

**M. Airoidi**

*Machine Habitus: Toward a Sociology of Algorithms*, Cambridge, Polity Press, 2022, pp. 192

by *Guilherme Cavalcante Silva*

**A. A. Casilli**

*Schiavi del Clic. Perché Lavoriamo Tutti per il Nuovo Capitalismo? [Slaves of the Click. Why Do We All Work for the New Capitalism?]*, Milano, Feltrinelli, 2020, pp. 320 [Italian translation of *En Attendant les Robots: Enquête sur le Travail du Clic*, Paris, Seuil, 2019, pp. 400]

by *Attila Bruni*

**K. Crawford**

*Atlas of AI*, New Haven and London, Yale University Press, 2021, pp. 327

by *Federico Cugurullo*

**M. P. Diogo, C. Luis and M. L. Sousa (eds.)**

*Ciência, Tecnologia e Medicina na Construção de Portugal, Volume 4: Inovação e Contestação [Science Technology and Medicine in the Construction of Portugal, Volume 4: Innovation and Contestation]*, Lisboa, Tinta-da-China, 2021, pp. 704

by *Luis Junqueira*

**B. Mitchell**

*Engaging with Actor-Network Theory as a Methodology in Medical Education Research*, London and New York, Routledge, 2021, pp. 150

by *Roberto Lusardi*

**I. Picardi**

*Labirinti di Cristallo. Strutture di Genere nell'Accademia e nella Ricerca [Crystal Labyrinths. Gender Structures in Academia and Research]*, Milano, FrancoAngeli, 2020, pp. 124

by *Letizia Zampino*

\* \* \*

**Massimo Airoidi**

*Machine Habitus: Toward a Sociology of Algorithms*, Cambridge, Polity Press, 2022, pp. 192

**Guilherme Cavalcante Silva** *York University*

A lot has been written about algorithms over the past decade. The idea of algorithms as neutral and value-free is being challenged even at a mainstream level, as works like Safiya Noble's *Algorithms of Oppression* (2018) and Shoshana Zuboff's *Surveillance capitalism* (2019) became talking points in places like the White House. At the same time, productions like *The Social Dilemma* (a docudrama released by Netflix in 2020) reached millions of viewers around the world. So why another book on algorithms when critical approaches to digital technology, its potential negative social impact, and the business models of tech companies have flooded academic classrooms, conference hallways, and even pub night conversations? For Airoidi, it all comes down to the (lack of) understanding of both what machine learning systems and what things like social structures are. If all we have left is reproducing approaches to algorithms that keep splitting the world between the order "we" humans inhabit on one side and the technical order on the other, then there is, in fact, not much one could add to the mainstream critique of algorithms or to avoid the fight between *apocalittici* and *integrati*.

That is where Airoidi's *Machine Habitus: toward a sociology of algorithms* comes in handy. In Chapter 1 ("Why not a Sociology of Algorithms?"), Airoidi fully embraces a sociotechnical view of reality, aiming to comprehend "how culture enters the code of algorithmic systems, and how it is shaped by algorithms in turn" (p. 4). Moving away from debates around human-machine interaction centered on concepts like consciousness and intelligence, Airoidi highlights the importance of an agentic notion of sociality to account for machine systems as social agents inhabiting a techno-social structure, something especially true for machine learning systems. But is that all? Recognizing algorithms as social agents is all that is left as a research agenda? If that is the case, then Airoidi came too late to the party as critical algorithm studies contributions have for more than a decade now recognized algorithms as fully integrated within sociotechnical assemblages (e.g., Gillespie 2014). However, there is much more to the book than that. For Airoidi, it is not enough for STS scholars to address human-machine interactions in terms of "sampling bias," "collection methods," or subjective limitations on the part of the agents involved in the technological process (Symons and Alvarado 2016, 5). Sociological and political inquiries of machine systems should also not have to choose between focusing on some sort of soft "technological determinism" on one side and the resistance capabilities of agentic subjects, changing technology from

below, on the other. To understand machines as social agents, we need to consider how machines are socialized and how socialized machines participate in society. For that, Airoidi extends Bourdieu's concept of "habitus" to the study of algorithms and machine learning systems.

In Bourdieu's words, habitus are "systems of durable, transposable dispositions, *structured structures predisposed to function as structuring structures*" (Bourdieu 1977, 72, emphasis added). For Airoidi, the main insight from Bourdieu's theory of habitus is that it allows us to talk about agents and their actions not as a result of deterministic impulses from the "outside" or self-determined. Agents act within habitus in the sense that their actions are structured structures, that is, the result of embodied dispositions from one's environment and social setting, whilst being structuring structures, in the sense of ordering and changing the very social structure they inhabit. Airoidi uses the concept to complicate (in a good way) sociological studies of machine systems. For him, habitus is not just an attribute of humans as we can look at machines through the lenses of habitus. After all, he says, "the code is in the social world, but the social world is in the code" (p. 28). Cultural propensities and social structures are encoded in machine learning systems that, at the same time, shape what these social structures look like. Our techno-social environment is neither the effect of algorithmic oppression nor human achievements (or failures) but a result of the interactions between human habitus and machine habitus.

Airoidi devotes Chapter 2 and 3 to understand the dynamics of the culture in the code and the code in the culture, respectively. The most common answer in critical data studies and STS for the question "where does the culture in the code come from?" (p. 36) would probably be through the cultural biases that come to the machine through design or from the code's creators. An overwhelming amount of works over the past few years have focused on how to solve the problem of cultural biases in the design of technology and create a more inclusive and equal digital environment. That includes scrutinizing the definitions of what the algorithms are supposed to evaluate (e.g., "relevant," "high risk," "meaningful") and also databases, statistical postulates, and methods employed by companies or public agents for algorithms to function. However, for Airoidi, a sociology of algorithms cannot just be a sociology of algorithm creators (or of *deus in machina*), especially with the rise of unsupervised machine learning systems. The role of trainers, for instance, those who advertently or inadvertently "prepare" the data for machine learning systems, has been overlooked. There is more to the sociotechnical analysis of algorithms than looking at companies, economic models, or designers. Following Bourdieu's habitus, Airoidi invites us to look at the specific cultural contexts which give rise to machine habitus, starting with the local and global data contexts for and through which machines operate and make sense of the

world. Like with humans, machines' predispositions and affordances, inherited by design, would interact with the cultural structures through time, producing specific forms of socialization and internalizing culture in different ways. Those specificities would add more complexity to the study of algorithms in fields like STS, for example.

On the other hand, the very cultural structures in which machines are socialized are also shaped by the code. This symbiosis is never symmetric as the interactions always occur between different habitus and cultural propensities. Humans never respond to machinic input with the expected output and vice-versa. In his words, "interaction orders of humans and machines blend within the layered techno-social order of the Internet" (p. 89). Tracing causal relations between algorithms and social world changes will only produce technocratic and fatalist accounts.

Airoldi highlights that interactions between users and machines always occur in peculiar environments (platforms and their business models), which in their turn are always shaped by cultural and economic fields. Both users and machines learn from each other, as even the famous feedback systems, so commonly mentioned in relation to filter bubbles, work both ways. Finally, interactions between users and machines are always crossed by what he terms "informational asymmetry", the fact that the knowledge the user has of the machine functioning is not always the same a machine has of the user, and "cultural alignment," or whether the propensities of socialized machines "match" with the ones of the users (or whether there is a clash between habitus[es]). He proposes a typology of four types of user-machine interactions (which entails reinforcement, co-production, transformation, and disillusionment), a useful theoretical contribution for STS scholars to address the code's relations and influence on culture vice-versa.

In the final two chapters, "Theory of Machine Habitus" (Chapter 4) and "Techno-social reproduction" (Chapter 5), Airoldi seeks to answer the following questions: "what is the extent of machine habitus in comparison to the original "habitus" theorized by Bourdieu? How do different propensities "embodied as habitus and encoded as machine habitus" (p. 110) mediate human life in techno-social fields? What are the effects of the entangled relations between humans and socialized machines over time and what are the global (overall) effects of such relations? For the first one, to understand the differences between machine habitus and the original habitus, it is important to account for the limitations given to machine habitus by its digital infrastructure, namely platforms. As recent STS scholarship has demonstrated (e.g., Helmond 2015), platforms offer particular affordances to machine learning systems, from a variety of levels, including political-economical, that "modulate possibilities of action" (p. 117). Airoldi brings a concept very dear to STS for the second and fourth ques-

tions: that of *entanglements*. He warns scholars that there is never an interaction between autonomous me and an autonomous machine, but a relation between a set of cultural propensities mediated by an active environment (platform) and different habitus (what he mentioned when referring to cultural alignment). “There is nothing personal in automated music recommendation,” for instance, as “things like taste and behaviour are a product of shared social conditions” (p. 121). How the author relates the idea of entanglements and its ontological indistinguishability perspective with other terms he uses, like sociotechnical order or sociotechnical evolution, is nowhere to be found in the book, perhaps a shortcoming not only of the book but of certain STS approaches lacking theoretical rigor when using terms interchangeably.

For the third question, he highlights the importance of another concept dear to STS scholars: boundaries. For him, at least four processes of boundaries happen in techno-social fields over time: boundary differentiation (reinforcing the local culture of social subjects – e.g., filter bubbles), boundary fragmentation (nudging users towards certain behaviors or directions they are not familiar with), boundary mobilization (reinforcing the global scale, collective culture of social subjects – e.g., Google’s autocomplete algorithm), and boundary reconfiguration (transforming practices of users with a top-down approach – e.g., algorithmic ranking on Instagram).

The inclusion of these typologies and concepts showcases Airoidi’s main objective with the book: to amplify the scope of sociological analysis of machine systems beyond calls to “fix” biases. These strategies aim to “provide researchers interested in the social world with ways to include artificial agents in their analyses, and researchers studying artificial agents with ways to consider them as part of the social world” by means of “investigating machine learning systems as social agents culturally entangled with humans in the context of platformized fields” (p. 149).

All in all, Airoidi provides a powerful reimagination of the study of machine learning systems. Fields like STS and Critical Data Studies have been looking at particular instances of human-machine interaction, such as ethnographies of machine design or even of algorithms *per se* (e.g., Delfanti 2021), studies of user reception and interaction with algorithms, and platform studies investigating the political economy of digital platforms. Airoidi adds to these specific research strategies a solid theoretical background that brings together the most fundamental concerns at play in human-machine interaction. While not disregarding the contribution of critical approaches to algorithms that focus on issues of bias and “incorrect” databases, he offers researchers a chance to investigate such issues “in light of the socio-cultural data contexts behind its formation” (p. 156). However, I wonder how further researchers should take the concept of habitus to address those fundamental concerns. Airoidi himself recognizes limitations in Bourdieu’s original concept, even though he avoids spending too

much time addressing criticisms of Bourdieu's formulation, especially how habitus in Bourdieu appears as some sort of a "print" with little possibility of change over time. While machine habitus is a fascinating and useful insight, studying techno-social reproductions and machine socialization can move through different paths as the ones formulated by Bourdieu decades ago.

This book should be of interest to any STS scholar investigating human-machine interactions, in particular to early-career scholars and STS graduate students who want to not only study the impact of machine learning systems on society but also empirically understand the ways in which machines become part of society in the first place and in which users, designers, policymakers, and machines are entangled in techno-social structures.

## References

- Bourdieu, P. (1977) *Outline of a Theory of Practice*, Cambridge, Cambridge University Press.
- Delfanti, A. (2021) *The Warehouse: Workers and Robots at Amazon*, London, Pluto.
- Gillespie, T. (2014) *The relevance of algorithms*, in T. Gillespie, P.J. Boczkowski and K.A. Foot (eds.), *Media Technologies: Essays on Communication, Materiality and Society*, Cambridge, the MIT Press, pp. 167-194.
- Helmond, A. (2015) *The platformization of the web: Making web data platform ready*, in "Social Media + Society", 1 (2), pp. 1-11.
- Noble, S. (2018) *Algorithms of Oppression: How Search Engines Reinforce Racism*, New York, New York University Press.
- Symons, J. and Alvarado, R. (2016) *Can we trust Big Data? Applying philosophy of science to software*, in "Big Data & Society", 3 (2), pp. 1-17.
- Zuboff, S. (2019) *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*, New York, Public Affairs.

\* \* \*

**Antonio A. Casilli**

*Schiavi del Clic. Perché Lavoriamo Tutti per il Nuovo Capitalismo? [Slaves of the Click. Why Do We All Work for the New Capitalism?]*, Milano, Feltrinelli, 2020, pp. 320 [Italian translation of *En Attendant les Robots: Enquête sur le Travail du Clic*, Paris, Seuil, 2019, pp. 400]

**Attila Bruni** *University of Trento*

With the purpose to impress the Empress Maria Theresa of Austria, so the story goes, in 1770 the Hungarian inventor Wolfgang von Kempelen built a chess automaton known as “Mechanical Turk”. This device was capable of playing chess against a human opponent and it won most of the games played in demonstrations across Europe and the Americas over the course of nearly nine decades. But the Mechanical Turk was an illusion: a chess master was operating the machine by hiding inside of it.

In 2005, Amazon.com marketed its micropayment-based crowdsourcing platform under the same name. According to Ayhan Aytes (2012), Amazon’s initial motivation for building its own “Mechanical Turk” arose from the fact that its Artificial Intelligence (AI) programs could not identify duplicate product pages on its site. Following a series of futile and costly attempts, project engineers turned to people to work on computers within an optimized web system. The “Amazon Mechanical Turk” digital laboratory emulates AI systems by checking, evaluating, and correcting machine learning processes thanks to a remote, dispersed, and underpaid workforce of *clickworkers*. They are subjects employed in micro-tasks that can range from translating a three-line text, recognizing and deleting from the internet prohibited contents, composing a playlist, verifying the identity of users of a platform on a sample basis, training an artificial intelligence to distinguish pedestrian crossings from zebras, and so on. Precisely all the activities we now tend to take for granted are automated, as they are made more and more opaque by the pervasiveness of digital platforms, social media, and futuristic rhetoric on digital innovation and AI. This type of invisible and hidden work, outsourced and collectivized, hidden behind interfaces and camouflaged within algorithmic processes is now commonplace, and sometimes entirely unpaid. The case of Google’s reCAPTCHA is emblematic: to prove that we are not a robot, we have to train Google’s AI image recognition system for free, by checking the boxes containing buses, cars, or mountains.

Far from being at the gates of an era in which robots will “steal” jobs from humans, Antonio Casilli’s book aims at opening the black box of digital platforms by showing how contemporary forms of AI are not that much “artificial” after all. Consider for example the hard physical work of the miners and the repetitive work in the factory on the assembly line needed

to produce a smartphone or a tablet; cyber work in distribution centers and cognitive factories exploiting outsourced programmers around the world; the low-cost crowdsourcing work of the workers of the Mechanical Turk, or the intangible unpaid work of various social media and/or platforms users.

Casilli assembles different references and materials: mainly texts and researches from the broad spectrum of social sciences (and therefore not strictly Science and Technology Studies), but also newspaper articles, and reports published on the internet by companies (Google, Amazon, Facebook) or government agencies, as well as video documentaries. In this regard, I highly recommend watching *The moderators* (<https://fieldofvision.org/the-moderators>), a documentary that in twenty minutes shows in an extremely effective way the training, the job practices, and the working conditions of between fifty and one hundred million workers worldwide, mostly concentrated in India, in Southeast Asia, in Sub-Saharan Africa but also in Brazil, Venezuela, or in Romania. Countries where workers' rights and trade unions are easily ignored, where informal work represents a normal and direct option for a vast portion of the population, and where "micro-benefits can serve as a gateway to the labor market for a great variety of people with different levels of education, language skills and work culture" (p. 105, my translation).

Digital platforms and automation processes, the author argues, are in fact to be read in continuity with the macro phenomena that have characterized the last thirty years: dissemination of information and communication technologies; financialization of economy; globalization of markets, transport and goods; international financial crisis. Casilli shows how each of these phenomena played an "enabling" role in the establishment of platform capitalism, on a par with different forms of "invisible work" or "shadow work" that we have witnessed over the years: domestic and care work, cognitive and intangible work, as well as the work performed by users, consumers, or by an undefined "crowd" in processes of labour gamification (*playbour*) and/or in hybrid combinations of production and usage (*produsage*).

The text convincingly shows how in a scenario marked by the economics of surveillance, reputation, and emotion (as well as by the quantification and the commodification of trust and traces through cryptocurrencies), the horizon is set by the extraction of data and the reorganization of information through AI systems that combine human work with that of machines. And it is equally convincing in depicting how a handful of mega-corporations – the (un)famous GAFAM – Google, Apple, Facebook, Amazon, Microsoft – increasingly dominate territories and create new infrastructures and mechanisms for the accumulation of capital and the exploitation of human and planet resources.

Alongside texts such as *The Platform Society* (van Dijck et al. 2018),



*Ghost Work* (Gray and Suri 2019), *Surveillance Capitalism* (Zuboff 2019), or *Atlas of AI* (Crawford 2021), the book by Antonio Casilli aims at highlighting the various forms of digital labor on which digital platforms, algorithms, machine learning and AI are based. What is then the original contribution of this book and why should it be read by STS scholars?

First, it is extremely well-written and well-supported. Antonio Casilli constantly mixes theories, concepts, numbers and “exemplary cases”, calling into question the readers and stimulating them to build their own opinion, not necessarily convergent with that of the author. In this regard, it should be noted that Casilli’s book is not intended to be a canonical scientific monograph, but a text capable of dialoguing with different publics, not necessarily academics or social science experts. Not surprisingly, it has been granted in 2019 by the Colbert Foundation and by the École Nationale Supérieure de Sécurité Sociale (*Grand Prix de la Protection Sociale*), and in 2021 by the Association Régionale pour l’Institut de Formation en Travail Social (*Prix de l’Écrit Social*).

Secondly, it offers an interesting taxonomy of digital labor. As the author writes in the Introduction, originally the book was intended to have quite a different title (*Théorie générale du digital labor*; in English: “A General Theory of Digital Labor”), which was reframed by the Seuil publishing house (*En attendant les robots. Enquête sur le travail du clic* – in English: “Waiting for the Robots. Investigation into the Clickwork”) and further re-signified on the occasion of its Italian translation, with the appearance of the word “slave” in the title (a translation and a word about which the author himself expresses some doubts in the Introduction to the Italian edition). After a first section focused on automation processes, the second of the three sections, in which the book is divided, is dedicated to presenting what Casilli frames as three main forms of digital labor (the third section is then titled “The Horizons of Digital Labor”). The first type of digital labor is characterized by the request for a service (Uber or Deliveroo, for example). In doing so, it composes an economy of odd jobs (the so-called “gig economy”) which, beyond the service provided (transport, delivery, personal assistance, etc.), produces a variety of data (on customers and their satisfaction, on the timing of the service, etc.) which in their turn, will be re-exploited by the company/platform at stake. In other words, hidden additional work runs through the service provided contractually. “Microwork” is the second type of digital labor described by the author. It is carried out by a crowd of “microtaskers” who perform what machines cannot do or what would be unprofitable to make them do. The microtasks thus performed, most often consisting of a few simple but essential “clicks”, invisibly supports the proper functioning of apps and/or websites, turning clickworkers into the “human-based computation” of digital platforms and AI systems. The third type of digital labor identified in the book relates to “networking”, the activity of “producers” and the

establishment of an “economy of ties”. It refers to what we all do when we participate in the production or the correction of contents and/or data via social media (Instagram, Facebook, etc.) or dedicated websites. Again, fragmented contributions (more or less complex, but sometimes very time-consuming) are mobilized to improve platforms’ performance. But this time the idea of “work” seems even more evanishing, since many producers will be satisfied with symbolic, reputational, or even simply narcissistic gratifications. We find here the old debate on the understanding of what we could designate as “free work”, which takes to my third point regarding why it is worth reading this book.

Contrary to a deterministic and dichotomic view in which platform workers (and users, at large) are seen as squeezed between proclamations of independence and material conditions that expose them to low or non-existent remuneration and to externally imposed rhythms and purposes, Casilli calls for a reappropriation of work. Unveiling the opaque logic of algorithms and artificial intelligence, digital labor may act as an engine of change, enacting new collective subjects and novel forms of workers’ organization. In this call we find the last pillar of the theoretical approach proposed by Casilli, which dates back to the Italian operaist and post-operaist thinking: “a galaxy of authors [such as Sergio Bologna, Silvia Federici, Maurizio Lazzarato, Christian Marazzi, Cristina Morini, Antonio Negri], who have managed to conceptualize the processes of externalization and socialization of work, but also the effects of absorption of life itself in the sphere of work” (p. 31, my translation). In my view, mingling this theoretical tradition with an STS stance represents one of the main theoretical contributions of the book, in that it allows to revise the “excessive faith in the Marxist prophecy on the general intellect, which led to underestimate the material conditions of work in the age of digital technologies” (p. 31, my translation). At the same time, it allows recalling the attention on the inherently political dimension of some concepts commonly used in STS (such as those of “black-box” or “invisible work”) and on how a processual stance toward work and digital technologies – that is, a stance oriented to underline the organizational side of digital processes – can enrich the debate on digital labor.

Finally, I particularly appreciated Casilli’s ability to re-frame some words while offering a sort of updated vocabulary of some of the dynamics related to digitization processes. For example: “automation” = invisible human work; “gratuity” = pricing logic and incentive architecture of social platforms; “financing” = decline of the corporate paradigm; “platformization” = virtual circulation of labor; “Clickworker” = foreigners at work; “Fragmentation” = prerequisite for automation; “Sharing economy” = work on demand.

Having opened the black box of digital platforms, Casilli concludes with an ambitious proposal, which invites us to recover the meaning and

political dimension of the term “platform”, which I will certainly not reveal in this review, hoping in this way to further intrigue readers reading this book and the dynamics related to digital work.

## References

- Aytes, A. (2012) *Return of the Crowds: Mechanical Turk and Neoliberal States of Exception*, in T. Scholz (ed.), *Digital Labor: The Internet as Playground and Factory*, New York, Routledge, pp. 79-97.
- Crawford, K. (2021) *Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence*, New Haven and London, Yale University Press.
- Gray, M.L. and Suri, S. (2019) *Ghost Work: How to Stop Silicon Valley from Building a New Global Underclass*, Boston, Houghton Mifflin Harcourt.
- van Dijck, J., Poell, T. and de Waal, M. (2018), *The Platform Society: Public Values in a Connective World*, Oxford, Oxford University Press.
- Zuboff, S. (2019) *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*, New York, Public Affairs.

\* \* \*

## Kate Crawford

*Atlas of AI*, New Haven and London, Yale University Press, 2021, pp. 327

## Federico Cugurullo *Trinity College Dublin*

Artificial intelligence (AI) is an unknown territory. It is what Renaissance cartographers would have called *terra incognita*: a Latin expression signifying unknown lands that have been barely explored. And what is more mysterious and undocumented these days than AI? The concept of AI evokes a multitude of diverse non-biological intelligences capable of learning independently, thinking in a rudimentary manner and acting without being supervised, in a variety of urban spaces and domains, ranging from cheap restaurants to the highest levels of governance (Cugurullo 2021). Somehow paradoxically AI is everywhere, and yet its geography and politics remain largely uncharted.

It is precisely in this context, rich in cartographic and epistemological challenges, that Kate Crawford’s work, researcher at Microsoft Research and chair of AI and Justice at Paris École Normale Supérieure, is situated. Over years of empirical research, she has extensively explored what AI is made of, where AI is coming from, what it is impacting on and how. The results of her studies are now culminating in a fascinating book: an atlas of

artificially intelligent technologies, which is simultaneously science and art, a geographical inquiry and a political intervention.

Crawford's *Atlas of AI* is an unusual atlas, since the author adopts a prominent narrative approach and, rather than a mere collection of maps and analyses, the book offers a collection of stories. Crawford is a gifted storyteller, and her tales of AI are divided on the basis of six main themes that form the core chapters of the book: *Earth*, *Labor*, *Data*, *Classification*, *Affect* and *State*. In the first part of the book, *Earth*, the author takes us on a journey to Nevada where AI, as a material product, is made. AI is presented as an *extractive technology* whose creation requires many minerals and metals and whose life depends upon electrical energy. The line of inquiry is here very much in sync with the work of economic geologists and critical geographers who have unpacked the supply chains of the critical materials that are behind the provision of smart tech (Zhou et al. 2021). Not only is Crawford's critique sharp. Her voice speaks the language of multiple disciplines, and a key strength of this book is in the solid bridges that it creates to connect diverse fields of research which together can fully illuminate the nature of AI.

The second part of the book, *Labor*, convincingly shows the human aspects of AI, stressing that the industry of AI would not be possible without the physical and mental exertion of thousands of human beings. To explore this critical aspect, the journey continues in the US where Crawford lets us enter an Amazon's fulfilment center in New Jersey. The space is gigantic and the labor dynamics that we witness are a Marxian nightmare: those very humans who are working hard to create robotic technologies are themselves being treated like robots.

The third and fourth parts, *Data* and *Classification*, are deeply interconnected, since they deal with the production of the digital information that AIs are fed with, and how artificially intelligent entities categorize and metabolize these flows of information. Data is everything. It is everything in the sense that it is the most important resource for any company wishing to create and train an intelligent machine. Data is also everything because every piece of both the digital and physical world contains some form of information that AI companies can extract and then feed their machines with. Crawford exposes and denounces the culture of data extraction which seems to know no limit despite its many flaws in terms of privacy and ethics. Singing from the same hymnbook of critical data scholars like Kitchin (2022), she shows how data is not neutral and its metabolization inside AI tech reproduces power relations and biases. The datasets employed by AI contain human-made worldviews which often amplify social inequality under the banners of rationality and scientific objectivity.

The same leitmotif continues throughout the penultimate part of the book, *Affect*, which deals with one of the most controversial topics in AI research: emotions. Here the author, taking a stand unlike that of some

STS scholars (see Hillersdal et al. 2020), equates *affect* with *emotion* and asks the following critical question: can artificial intelligences recognize our emotions and then predict our behavior? In the AI industry, the answer to such questions would be an obvious *yes*, but Crawford does not take the mainstream discourses surrounding AI as articles of faith. Instead, she traces back and critically unpacks the roots of contemporary facial recognition systems, stressing for instance that many datasets are built upon the work of actors who are simulating emotions. Her conclusion is that what the AI is commonly learning from are thus faked emotions whose impact is however very real. AI hiring companies use these flawed systems to evaluate people's suitability for a job, and police officers rely on predictive systems to identify potential suspects. AI is becoming the lens through which society and its future are observed, but this lens is often cracked and even a tiny crack on the surface can generate a huge distortion.

In the final parts of the book, via two interconnected chapters, *State* and *Conclusion*, Crawford digs deep into questions of politics and power. These final chapters are in the tradition of Science and Technology Studies. The work of STS scholars such as Winner (1978) is employed to portray AI as an instrument of power which, far from being politically neutral, is frequently designed to punish rather than to support. This is because, as Crawford explains, most AI systems go back to military systems, which is a point that resonates with Suchman's (2020) recent studies. Their original logic was to find and eliminate threats, and now the same punitive logic is filtering down to schools, workplaces, hospitals and police stations. It is leaving the battlefield to enter our everyday life.

By reading *Atlas of AI*, the picture that emerges is that of a technology that, to paraphrase Winner (1978), has got out of control: an autonomous technology. Essentially, this has happened for two reasons. First, because while in the beginning AI technologies were instruments in the hands of the state, intentionally crafted for military purposes, they are now being increasingly privatized. States do not control AI anymore. The governance of AI is a complex mix of private and public forces and interests, which mirrors the classic neoliberal implementation of smart tech (Karvonen et al. 2019). Second, because we scarcely understand AI and its capabilities, and we will never be able to fully control what we do not fully understand.

*Atlas of AI* is the perfect medium to begin to understand AI. Crawford wisely avoids any form of jargon and her message comes across clear and loud. The book also contains a wide array of notes and references which the more experienced readers will find very useful to go deeper into the several themes that Crawford's atlas illustrates, but also to find new directions for future research. There are many more uncharted lands that await AI researchers, including emerging human-machine relations, thorny ethical dilemmas and questions of governance at a time when autonomous technologies are making decisions about our life (Stilgoe 2018). There is a

sense of urgency that social scientists in particular cannot help but feel. The reason is that AI is not simply *terra incognita*. It can also be *finis terrae*: the end of the world. The radicality of AI tech is such that it might cause the end of cities and societies as we know them (Cugurullo 2021). It is time to be brave, face our deepest fears and explore the unknown. We already have an excellent guide book and it is *Atlas of AI*.

## References

- Cugurullo, F. (2021) *Frankenstein Urbanism: Eco, Smart and Autonomous Cities, Artificial Intelligence and the End of the City*, Oxon and New York, Routledge.
- Hillersdal, L., Jespersen, A.P., Oxlund, B. and Bruun, B. (2020) *Affect and effect in interdisciplinary research collaboration*, in “Science & Technology Studies”, 33 (2), pp. 66-82.
- Karvonen, A., Cugurullo, F. and Caprotti, F. (eds.) (2019) *Inside Smart Cities: Place, Politics and Urban Innovation*, London and New York, Routledge.
- Kitchin, R. (2022) *The Data Revolution: A Critical Analysis of Big Data, Open Data and Data Infrastructures*, London, Sage.
- Stilgoe, J. (2018) *Machine learning, social learning and the governance of self-driving cars*, in “Social Studies of Science”, 48 (1), pp. 25-56.
- Suchman, L. (2020) *Algorithmic warfare and the reinvention of accuracy*, in “Critical Studies on Security”, 8 (2), pp. 175-187.
- Winner, L. (1978) *Autonomous Technology*, Cambridge, MA, the MIT Press.
- Zhou, L., Fan, H. and Ulrich, T. (2021) *Editorial for Special Issue “Critical Metals in Hydrothermal Ores: Resources, Recovery, and Challenges”*, in “Minerals”, 11 (2), p. 299.

\* \* \*

**Maria Paula Diogo, Cristina Luis and M. Luisa Sousa**

*Ciência, Tecnologia e Medicina na Construção de Portugal, Volume 4: Inovação e Contestação [Science Technology and Medicine in the Construction of Portugal, Volume 4: Innovation and Contestation]*, Lisboa, Tinta-da-China, 2021, pp. 704

**Luis Junqueira Iscte** – Instituto Universitário de Lisboa, Centro de Investigação e Estudos de Sociologia (CIES-Iscte)

*Ciência, Tecnologia e Medicina na Construção de Portugal, Volume 4: Inovação e Contestação [Science Technology and Medicine in the Construction of Portugal, Volume 4: Innovation and Contestation]* aims to use science, technology, and medicine as lenses to look over the 20<sup>th</sup> century of the Portuguese history and examine their role in building the 20<sup>th</sup> century of the Portuguese society.

The book broadly covers this period of time, going over the four regimes in the recent history of the country – the last decade of the Monarchy (1900-1910, with some chapters going back to the last quarter of the 19th century), the First Republic (1910-1926), the military dictatorship and the Estado Novo authoritarian regime (1928-1974) and, finally, the contemporary democracy started with 1974's Carnation Revolution and marked by the integration into the European Union (then European Economic Community) in 1986.

The book is an edited volume that brings together 25 chapters by leading scholars in History of Science and Science and Technology Studies in Portugal. It is the last book in a four-volume collection entitled *Science, Technology and Medicine in the construction of Portugal*, edited by Maria Paula Diogo and Ana Simões. These volumes are part of an effort by researchers from the CIUHCT (Centro Universitário de História das Ciências e da Tecnologia) to increase the public visibility of these disciplines and to highlight the role of science, medicine, and technology in the history of Portugal.

The chapters are independent and cover a broad diversity of topics such as the emergence of scientific disciplines in Portugal, the development of scientific and higher education institutions, the relationship between science and political regimes, the technological development of some economic sectors (for example concrete, uranium extraction), the relationship between Portuguese science and colonialism, and science communication.

The chapters are organised in chronological order and, although the division between the political regimes of this period widely influence some of the chapters, the lack of further organisation was a deliberate editorial choice as stated in the introduction. The book aims to highlight how using

science as a lens to scrutinize the 20<sup>th</sup> century can help to emphasise the continuities between different regimes. Some chapters do focus on one of these political regimes (e.g. Chapter 1, on higher education during the First Republic or Chapter 13, on the concrete industry during the Estado Novo). However, many span over several periods like Chapter 13 analysing the relationship between tropical medicine and colonialism and chapter 19's account of the history of racial anthropology: both range from the late monarchy (starting from mid 19<sup>th</sup> century), through the 1<sup>st</sup> Republic, and into the Estado Novo regime, highlighting some of the continuities between the three political regimes of the period.

Nevertheless, the chapters tend to cluster around some key themes for each period. The initial chapters, broadly covering the first quarter of the 20th century, mainly focus on the role of science in the construction and consolidation of the Republican regime (Chapters 1, 2, 3, 4) and the role of science in the Portuguese colonial project (Chapters 5, 6). The central section explores how key scientific institutions operated within the Estado Novo regime (Chapters 7, 8, 9, 10), the role of the regime in developing key industrial sectors like concrete, plastics, or road construction (Chapters 12, 13, 14, 16, 17), and colonial science during the same regime (Chapters 18, 19). The last chapters analyse the dynamics of the "opening" of the Portuguese scientific system to the new democratic regime, both towards greater integration at the international level (Chapters 20, 24, 25) and new forms of public engagement with science and technology (Chapters 21, 22, 23).

The chapters are diverse in how they approach these topics. Some focus on particular institutions in the national context (Chapters 2, 7), while others on the development of a scientific discipline (Chapters 3, 6, 15, 19) or economic sector (Chapters 5, 12, 13, 14, 16, 17). One chapter examines the career of a prominent scientist, Egas Moniz, the only Portuguese granted a Nobel Prize in Medicine (Chapter 10) and another the history of a Portuguese science periodical, *Brotéria* (Chapter 11). A few chapters explore science policy and its impacts (Chapters 1, 9, 18, 20, 24, 25), science communication (Chapters 4, 18, 21, 22), and one focuses on the sociotechnical conflict around nuclear energy (Chapter 23). The volume also covers a diversity of disciplines but some are clearly more represented. There are several chapters on engineering or different engineering specialities. Chapter 2 explores the history of engineering education in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, Chapter 15 analyses the impact of the Marshall Plan on Portuguese engineering and some other chapters explore different engineering specialities (Chapters 12, 13, 14). Some chapters are on topics related to medicine: the influence of medicine in 20<sup>th</sup> century republican ideology (Chapters 3), the history of tropical medicine during the colonial period (Chapter 6), the research of the neurosurgeon Egas Moniz (Chapter 10) and agricultural science (Chapter 5). The remaining



discipline-focused chapters are on biology (Chapter 11), nuclear physics and engineering (Chapter 16), and anthropology (Chapter 19).

The authors come from a range of disciplinary backgrounds: social history, history of science, sociology, anthropology, geography, museology, and science communication. With such a diversity, the volume's cohesion comes not from a particular theoretical framing but mainly from its dialogue with the sources and previous Portuguese historiography in an attempt to reframe and expand the understanding of the role of science and technology in the Portuguese history. The chapters often draw from the authors' previous research and while they address topics covered beforehand, their reframing for this volume is nonetheless a valuable contribution to the scholarship on science and technology in Portugal.

It is nevertheless possible to identify some broad themes that are present throughout the book and give it a conceptual cohesion. One is, as mentioned by the editors, the role of science and technology in Portugal throughout the 20<sup>th</sup> century, pushing against the narrative that these areas were not a relevant force in shaping Portuguese society for most of this historical period. The volume contributes to highlighting, instead, how the role of science and technology changed according to the objectives of different political regimes and along with the evolution of the international context. For example, the chapters (e.g. 15, 16) on the *Estado Novo* period show how rather than isolationist, the regime had a pragmatist and selective approach towards scientific and technical development, which benefited from increased international involvement of the regime starting from the post-war period. Another important theme is the persistence of the semi-peripheral status of Portugal in the global science system, explored in previous work by other authors (Delicado 2014; Nunes 2001). Even though it is not a novel framing, the volume emphasises how this semi-peripheral status expressed itself in different periods of the 20<sup>th</sup> century. For example, Chapter 19, on the history of Portuguese Racial Anthropology, highlights the ambivalent relationship in the post-WWII period between Portuguese anthropology, aligned with the national colonial project, and "foreign science", that is, the foreign practice of anthropology that increasingly reflected the anti-colonial sentiment of the period. Similarly, Chapter 24 explores how the shifting patterns of mobility of Portuguese scientists flowed with changes in national science policy.

The volume follows from previous efforts of other scholars to highlight research on science and technology in 20<sup>th</sup>-century Portugal (see Nunes and Roque 2008; Saraiva and Macedo 2019). Importantly, it adds to a more nuanced understanding of the role of science, technology, and medicine in Portugal, often only perceived by its pattern of fragmentation, weak investment, lack of innovation, and dependence on political power. The book also explores how science, technology and medicine were mobilised throughout the 20<sup>th</sup> century with variable political enthusiasm to address

some of the country's challenges: from the need to educate the elites of the emerging Republican regime, to the Estado Novo's selective endorsement of technological modernisation, to the impetus to democratise science and higher education towards the end of the century.

The development of STS and History of Science in Portugal was shaped by the same historical pattern of weak political investment that affected Portuguese academia in general, exacerbated by the constraining influence of a traditionalist political regime that lasted for most of the 20<sup>th</sup> century and had a selective approach to modernization and general distrust towards the social sciences. However, the emergence of both disciplines quickly followed the political commitment to develop the national science and technology system, especially from the decade of the 2000s (see Chapter 20, 24). The improved status and increased social presence of science in Portuguese society (see also Chapters 21, 22) attracted a new generation of scholars that saw them as relevant objects of social and historical inquiry. This volume is also a valuable addition to scholarship on science and technology for gathering and highlighting some of the more prominent research from what are still fairly young, but nonetheless relevant, national STS and History of Science communities.

## References

- Delicado, A. (2014) *At the (Semi) Periphery: The Development of Science and Technology Studies in Portugal*, in "Tecnoscienza: Italian Journal of Science and Technology Studies", 4 (2), pp. 125-148.
- Nunes, J.A. (ed.) (2001) *Enteados de Galileu?: A Semiperiferia no Sistema Mundial da Ciência*, Porto, Afrontamento.
- Nunes, J.A. and Roque, R. (eds.) (2008) *Objetos Impuros: Experiências em Estudos Sobre a Ciência*, Porto, Afrontamento.
- Saraiva, T. and Macedo, M. (eds.) (2019), *Capital Científica: Práticas da Ciência em Lisboa e a História Contemporânea*, Lisboa, Imprensa de Ciências Sociais.

\* \* \*

**Bethan Mitchell**

*Engaging with Actor-Network Theory as a Methodology in Medical Education Research*, London and New York, Routledge, 2021, pp. 150

**Roberto Lusardi** *University of Bergamo*

Actor-Network Theory (ANT) has proven to be particularly useful for analyzing and understanding technoscientific practices in health-care settings. From the study of laboratory practices by Bruno Latour and Steve Woolgar (1979) to the multiple ontologies identified by Anne Marie Mol (2002), researchers inspired by this approach highlighted how the heterogeneity of the phenomena involved in various ways in the practical of scientific products and care practices can be understood only considering their relational and dynamic dimensions. Technoscientific objects and practices, according to ANT, are not universally given entities, endowed with unique and immutable properties. On the contrary, they need of being analyzed in the environment of use and in their socio-material networks to identify their salient characteristics. How can this perspective also be useful for studying the production of knowledge in a medical educational program? This is the question Bethan Mitchell intends to answer with the book *Engaging with Actor-Network Theory as a Methodology in Medical Education Research*.

Analyzing two empirical case studies situated in UK, the author takes the socio-materiality position of ANT by considering knowledge and learning in its development through space and time, bringing together objects, people, knowledge, institutions, and relationships. Starting from this assumption, the author aims at bringing those who are not familiar (especially in the educational field) with ANT into this approach, and at producing new scientific arguments regarding the production of knowledge in medicine. The book tries to reconcile both communities in an argumentative path structured in successive steps that gradually provide the intellectual tools to understand when applying ANT to medical education research.

The volume consists of eight chapters, with a brief introduction acting as a prelude to the book. The first two chapters are mainly aimed at those who are not familiar with ANT to illustrate its main theoretical and methodological characteristics, by briefly retracing the salient stages of its historical development. Although these chapters do not provide those familiar with ANT with new content, they are relevant for them too for understanding the book's purpose and structure. The third chapter provides the historical and theoretical coordinates to frame the UK institutional system in medical education and pharmacy studies; it deals with the specific setting in which the research was carried out: a peculiar regulatory device that

falls within what is called “improvement science”. This label defines a systematic approach that identifies desirable improvements in the medical field (in terms of quality, efficiency, equity, and value), and validates their reliability and credibility so that such improvements can also be disseminated in contexts other than the medical one.

The author defines the two case studies as Student-Led Improvement Science Projects (SLISPs). These consist of two training courses, which represent an elective part of the formal curriculum in medicine and pharmacy, whose participants act as “change agents” to improve existing practices: the first case refers to medical students working on an improvement to the process of antimicrobial prescribing practice in two different wards; the second case regards an inter-disciplinary students group investigating insulin prescribing practices and how these could be improved. It is not always easy to understand the articulation of different levels the study refers to: educational, professional, organizational, and cognitive. All are filtered by the ANT reflective and socio-material perspective. Although the author makes considerable efforts to clarify the above-mentioned levels, at times the text is not so easy to follow, which may be problematic for readers not already accustomed to the multilevel complexity of ANT reporting.

The fourth chapter describes the methodology of the study and is significantly called “the research assemblage”, to show how the ANT approach permeates the entire research path and is not just a heuristic means to address the empirical field. The chapter consists of two parts: in the first, the methodology is outlined by describing socio-materiality and ANT as derived from the practice and professional education (network, symmetry, and multiple worlds are the key concepts); in the second part, the research design, the data gathering, and the analysis procedures are described by using the two SLISPs cases. The next chapter focuses on exploring SLISPs in the hospital setting. In the first case (about antimicrobial prescribing as part of a wider project in quality improvement), “the antibiotic story” comes out as a network of interconnecting materials (gentamycin form, roles, ward, etc.) which requires the alignment of humans and non-humans; the second case (about improving medical reconciliation for insulin-dependent patients) shows the effects of non-human actants on the learning process intended as socio-material assemblage. In the sixth chapter, the different enactments of SLISPs become explicit, with a focus on the pedagogies of improvement science and with professional and practice learning orientation. The chapter oscillates between the discussion of ethnographic data concerning the research paths pursued by students and the inclusion of these researches within improvement science. Here, the ANT perspective helps to grasp how improvements are enacted between two main elements: the clinical staff of the ward, who need to be convinced that the SLISPs will improve practices, and the students, who require the time and the commitment to developing the improvement. This analysis also shows

that there is no single, predictable, a priori outcome of improvement science interventions. Mitchell uses the expression “multiple worlds of SLISPs” (p. 111) to emphasize how different realities coexist at different stages of students’ research until an alignment is found and produces a stabilization in practice. The overlaps between different ontologies generate ambiguities and controversies that students are led to resolve by moving through material assemblage (lockers and electronic equipment) and organizational spaces (rooms and areas for group work). Exposure to the indefinite, and to the areas of possibility that this uncertainty produces, is seen as a primary source of learning for students. Learning itself, as improvement science, is not predefined, unique, and immutable in practice: Mitchell’s work shows how it is “distributed through space and through assemblage of objects” (p. 115).

The last two chapters address the key points of Mitchell’s investigation. The network perspective applied to educational practices shows that learning is not just a heroic, benevolent individual act, as it is usually conceived in medical education (Bleakley 2012), and makes it possible to grasp the disruptive force that accompanies the intrusiveness of improvement processes in daily practice. The assumption that learning and improvement are positive in themselves is only an ideal: in their development they can bring disruption and uncertainty to organizational routines and professional procedures, forcing their stability and legitimacy. Objects also move changes in preexisting practice. They “invite” practice through colors, shapes, dispositions, accessibility, and degree of visibility. These characteristics are partly inherent to the objects themselves and, at the same time, are the result of interactions within the network in which they are situated. The ANT perspective applied to medical education opens the “black box” of learning and reveals the ambivalences that inhabit it: expectations and impossibilities, commitments and resistances, convergences and divergences. The main merit of Bethan Mitchell’s book lies in this disenchanting look at learning processes within the boundaries of improvement science. From the analysis of the practices, one understands the transformative scope inherent in these processes but, at the same time, the complex articulation they require and the challenges they can bring.

In conclusion, the answer to the question that opened this review (How can this perspective also be useful for studying the production of knowledge in a medical educational program?) is definitely positive, even though the book does somewhat suffer the same fate typical of publications that intend to reach different targets and audiences. It is difficult to maintain the right balance in the dual register of argumentation throughout the text. However, Bethan Mitchell succeeds quite well in this task, ensuring an appreciable readability and an adequate degree of scientific depth of the content, thus managing to satisfy ANT scholars looking for new stimuli

and a new scientific contribution, and those who are interested in the production of knowledge in medicine for professional or educational purposes.

## References

- Bleakley, A. (2012) *The Proof Is in the Pudding: Putting Actor-Network-Theory to Work in Medical Education*, in “Medical Teacher”, 34 (6), pp. 462-467.
- Latour, B. and Woolgar, S. (1979) *Laboratory Life: The Construction of Scientific Facts*, Princeton, Princeton University Press.
- Mol, A. (2002) *The Body Multiple: Ontology in Medical Practice*, Durham, Duke University Press.

\* \* \*

## Ilenia Picardi

*Labirinti di Cristallo. Strutture di Genere nell'Accademia e nella Ricerca [Crystal Labyrinths. Gender Structures in Academia and Research]*, Milano, FrancoAngeli, 2020, pp. 124

## Letizia Zampino Sapienza University of Rome

The book *Labirinti di cristallo. Strutture di genere nell'accademia e nella ricerca [Crystal Labyrinths. Gender structures in academia and research]* by Ilenia Picardi outlines a framework aiming at unravelling gendered practices in academic and scientific institutions.

The author adopts the theoretical perspective provided by feminist studies in the field of Science and Technology Studies (STS) as a toolkit capable of discussing the complexity of the metaphorical and iconographic representations of “crystal ceiling” and the “leaky pipeline” and of observing how gendered practices construct academic paths similar to “crystal labyrinths”. With the labyrinth’s metaphor, Picardi shows how women *do science* by oscillating between innovative disciplinary mobility and hybridisation dynamics practices (Sciannambo and Viteritti 2021) and the reproduction of male-dominated career models. *Crystal labyrinths* expose the rhetoric of merit as a system designed to justify the low presence of women in high positions because they are supposedly less competent than men in fields such as science, politics, and business. Indeed, Picardi’s book highlights that the current systems of evaluation of competence and consequently of career progression in academic and research work are underpinned by gendered processes.

The volume is articulated in six chapters, and it is grounded on empirical evidence coming out from both quantitative and qualitative analysis techniques.

In Chapter One the statistical analysis describes the gender dynamics in recruitment processes as a consequence of the latest reform – dated 2010 – of the Italian academic system. The data provided by Picardi show the substantial precariousness of academic careers. Such precariousness becomes structural when the sex variable is introduced. The author introduces what she calls the Glass Door Index (GDI), with the aim of operationalising the gender gap that occurs in the transition from low-waged positions to permanent positions. The GDI has the potential to show how evaluation policies and reforms, which have introduced important transformations in the selection of academic staff and in career regulation, make Italian women more exposed to the risk of precariousness than their male colleagues. The reform acts as an invisible door limiting access to academic career progression, reinforcing the gender gap in those disciplinary fields – for example in scientific-technological disciplines – where the presence of women is already inherently lower due to historical and cultural factors. In Italy, the extension of the precarious status causes delays in the time needed for career stabilisation, affecting especially the recruitment of women in the 25-40 age group. There is an invisible door that limits the access to scientific careers, reinforced by evaluation systems that have a differential impact by gender, especially in an age range when women, as the author points out, may be faced with the choice between career and pregnancy.

Chapter Two focuses on the issue of gender equity in feminist literature. In feminist STS studies the issue of equity unveils gender segregation and discrimination as factors that prevent women from accessing the technoscientific education. Such studies have also questioned social, political, and cultural dynamics, whereby informal discrimination is maintained even when women enter scientific careers (Harding 1986). Picardi, introducing the issue of gender equity, observes the dynamics of scientific production as influenced by practices, values, assumptions, and power relations dominated by a model of scientist, who is generally male, white, and Western.

The concept of gender equity sets the ground for the theoretical framework outlined in Chapter Three, which underpins the analytical reading and shapes the qualitative analysis of Chapter Four. Chapter Three features the dialogue between feminist STS and the gender approach of the “practice turn” in organisation studies, launched by Silvia Gherardi (2019). Like Gherardi, Picardi turns the analysis to the gender structures and processes that disclose the role of sociomaterial practices in the production and reproduction of power asymmetries in organisations. The concept of practice allows looking at gender as a process that, running through

the academic institution and research groups, reproduces patriarchal models of recruitment and career assessment. Practice-based literature and feminist STS studies accompany the reader to look at gender in *its doing* through the enactment of *gendered practices* that perform the production of institutional and academic structures understood as *gendered organizations*.

Chapter Four provides the results of an empirical research consisting of semi-structured interviews and three focus groups involving 26 women researchers in STEM and 18 women researchers in Social Sciences and Humanities (SSH), by using a qualitative analysis carried out through the NVivo software. The collected experiences have been codified and aggregated to capture the different dimensions of the examined phenomenon. This chapter aims to provide an interpretative scheme to disentangle the gendering processes that create and reproduce gender inequities in academic and scientific institutions. Picardi identifies three levels of gendering processes, acting and producing academic and research environments dominated by patriarchal logics, which enact gendered practices. For Picardi, the gendering processes are embedded in 1) academic and research institutional structures; 2) the organisation of academic and research work; 3) academic and research culture. These processes, while encapsulating the phenomena in which gender becomes a practice, also structure the practices that reproduce gender discrimination in the institutional contexts of academic research. Gendering processes are portrayed as “crystal labyrinths” that reproduce male-dominated top positions. According to the author, there is not just one invisible obstacle at the top of women’s careers, as the metaphor of the “glass ceiling” suggests, but multiple obstacles situated along their – often fragmented – career trajectories. However, the crystal labyrinth metaphor theorised by Picardi risks excluding the socio-material density of emancipatory practices against the homologation to male models.

In Chapter Five, the author presents an analytical exploration of the mechanisms that underpin gender practices. The mechanisms are embedded in the scientific-reputation system based on the concepts of merit and excellence: women’s careers are, therefore, mainly evaluated by groups of men according to spatial and temporal mechanisms built on a patriarchal model of science. The concepts of “merit” and “excellence” reinforce, in certain ways, the biases linked to evaluation criteria, which, even if proclaimed as objective and neutral, contribute to reiterating gender discrimination. Women’s careers are assessed using evaluative and quantitative criteria which, on the contrary, tend to favour linear paths and work rhythms congenial to the model of work historically and culturally free from caring roles. Women must work twice as hard to be considered at the same level as their male colleagues: a phenomenon known in literature as the double standard of excellence. The chapter ends with an interesting



discussion about the temporal dimension in the Italian academic context. The author captures how the dimension of time is plural and multidimensional. Time, entwined with politics, power, knowledge and control, imposes constraints and rhythms, generating gender asynchronies that, in turn, produce tensions between personal time and work time, especially in the 30-40 age class, in which women define intimate relationships and future projects, even those of motherhood. Tensions between private and professional life can cause a loss of planning for the future, and in some cases, as some of the stories point out, a “forgetting to choose to face the choice of motherhood” (p. 68, my translation).

The book ends (Chapter Six) with a critique of the supposed objectivity of scientific career evaluation methods. The author notes that gender discrimination in academic environments can only be investigated by acknowledging the social character of science. Analysing the constitutive and normative elements of science means observing the systematic operation of social mechanisms – male-dominated leadership and network patterns, gender asymmetries in the distribution of research funding – that sustain the processes of recruitment, reputation building, and promotion in academic careers.

In writing this review I adhered to a feminist epistemology – which underpins the entire structure of the book – by situating myself as a young post-doctoral researcher. The reading of this book is striking for its criticism of equity and temporal mechanisms of research, which are reflected in the homologation to the male scientist model and in certain “non-choices”, such as the renunciation to have children narrated by some of the women who have been interviewed. It is an intrinsically political book that shows how the rhetoric of merit translates into “replacing the *future* category with that of the *extended present*” (p. 95, my translation, original emphasis). This volume contributes to disentangling the labyrinths of gender mechanisms in order to rethink the structures of the organisation of scientific work – and the production of knowledge – claiming the right to choose and plan the future.

## References

- Sciannamblo, M. and Viteritti, A. (eds.) (2021) *Fare la Differenza: Stereotipi di Genere e Nuove Pratiche di Affermazione nei Campi Scientifici*, Roma, Centro Stampa Sapienza.
- Gherardi, S. (2019) *How to Conduct a Practice-based Study: Problems and Methods*, Cheltenham, Edward Elgar.
- Harding, S.G. (1986) *The Science Question in Feminism*, Ithaca, NY, Cornell University Press.

