

Bodies and Technoscience. Practices, Imaginaries and Materiality

Simone Arnaldi
Stefano Crabu
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In our contemporary technology-driven societies, every aspect of life connected to our bodies — such as birth, reproduction, sexuality, gender, and aging — is profoundly influenced by technoscientific advances. The body is no longer a fixed entity but a dynamic battleground, constantly reshaped by technologies.

This compelling book delves into the evolving interface between human bodies and technoscience, exploring themes like technoscientific imaginaries, the cyborg concept, bodily transformations through technologies, datification, and biomedicalization. Approaching these topics from a Science and Technology Studies (STS) perspective, the book poses essential questions about the relationship between technology and the body: What are the consequences of our increasingly mutable physicality? What analytical frameworks can we use to study this ever-changing, hybrid body? How does STS help us understand the material and discursive construction of corporeality through technoscience? And how do our bodies, in turn, help shape the very nature of technoscience?

This book is of interest for scholars and students in Science and Technology Studies (STS), Sociology of the Body, and Social Theory, offering fresh insights into the crucial interplay between scientific knowledge, technology, and bodily experience. It invites readers to reconsider the essential questions regarding the interplay between technoscience and corporeality.

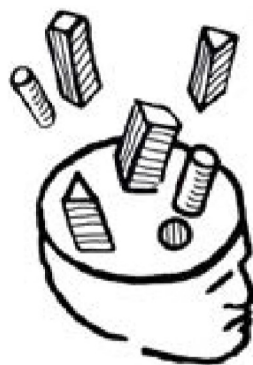
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Introduction

Exploring the Intersection of Bodies and Technologies in Social Theory and Science and Technology Studies: An Introduction

STEFANO CRABU, SIMONE ARNALDI, ASSUNTA VITERITTI

The examination of the interaction between bodies and technology is currently a pressing and relevant topic within academic circles, among policymakers and among practitioners. They are critically scrutinising the political, ethical and social challenges arising from the widespread incorporation of emerging scientific and technological advancements into human lives. These developments are altering identities, agency, behaviours and even augmenting human capacities to the extent that they are reshaping collective perceptions and blurring the boundaries between life and death.

In contemporary societies, no aspect of life related to the body and bodily experiences, such as birth, work, learning, reproduction, sexuality, gender and ageing, remains untouched by technological and scientific interventions. Examples of such interventions include deep brain stimulation, targeted drug delivery, augmented reality, sensory implants, brain-computer interfaces, DNA biosensors, prostheses, cosmetic surgery and diagnostic imaging. Research and innovation increasingly provide opportunities not only to explore the body but also to intervene and modify it at the very molecular level (Rose 2007). Consequently, the body is no longer a stable site of normalised biological functions but a mutable battleground open to diverse technologically mediated interventions.

When examining how the body has become a matter of concern in the field of social theory and how its relationship with technologies has been framed, it is valuable to commence by delving into the case of “healthy bodies”. Generally, for healthy individuals,

it is easy to overlook the body, much like a well-functioning metropolitan infrastructure that commuters take for granted as an embodied technology in the urban landscape. The body is similarly taken for granted as a part of the self, obviously for healthy people. Therefore, we agree with Turner (1996), who, in a foundational contribution to social studies of the body, argued:

We have bodies, but we are also, in a specific sense, bodies; our embodiment is a necessary requirement of our social identification so that it would be ludicrous to say, "I have arrived and I have brought my body with me." (p. 42)

This tendency to "forget" the (healthy) body is undoubtedly part of the mundane routines embedded in everyday practices for managing ordinary life. However, it should be acknowledged that until recently, this forgetfulness also affected social scientists. Mainstream social sciences traditionally placed great importance on social structures and individual subjectivity, giving little attention to the social and material dimensions of physical bodies (see Lupton 2013 for a critical review of this issue). One reason for hesitancy in addressing the body in its social, cultural and material settings of interaction may be attributed to the need to avoid the risk of accusations of biological determinism, which social scientists traditionally directed at their colleagues working in the field of natural and life sciences. For instance, (post-)structuralist social scientists, particularly sociologists, dedicated extensive volumes and substantial discussions to the structural, political and economic dimensions of society/of social processes, as well as the institutions of social control. This resulted in the construction of a conceptual and theoretical framework in which the physical body was essentially marginalised and overlooked. Conversely, social scientists rooted in phenomenological epistemology and those adhering to symbolic interactionist approaches focused on theorising the social construction of society and individual behaviours. In doing so, they substantially neglected the exploration of the embodiment of everyday decision-making practices and routines.

The long neglect of the body and embodiment within the prevailing traditional approaches in the social sciences for many decades has resulted in a lack of theoretical attention in this area. However, it is worth noting that this lack of attention to the social meaning and relevance of the physical body in the accomplishment of social reproduction and social order has been partially mitigated by some significant contributions that laid the groundwork for what would become the field of body studies in the late 20th century.

Discussing the foundational framework of body studies is beyond the scope of this chapter. However, it is useful for social theorists to briefly review the key conceptual milestones that have enabled the study of the body as an object of attention. In this regard, Mauss's (1934) influential essay titled "Les techniques du corps" (Techniques of the body) pioneers in shedding light on how the physical body is not merely a biological entity but an emergent outcome of social and cultural dynamics. Mauss argues that the body is not a

neutral or universal entity; instead, it is shaped by shared societal norms, beliefs, customs and rituals. He explores how different societies maintain distinct techniques for perceiving and mobilising the body, encompassing gestures, postures and bodily comportment. These techniques are learned through socialisation and play a crucial role in maintaining social order and identity. A central concept in Mauss's (1935) essay is "habitus", which refers to the ingrained, habitual bodily dispositions acquired through cultural practices. George Simmel, although not extensively focusing on the human body's relation to culture and society, provides a compelling account of how sensory perceptions mediated by the physical body – such as sight, hearing, touch and taste – influence human behaviour and social relationships. In his essay, aptly titled "The Sociology of the Senses", Simmel (1997 [1907]) argues that sensory experiences are not merely individual phenomena but are deeply intertwined with social and cultural contexts. For instance, he discusses how the visual aspect of clothing can serve as a form of social communication and how people use their senses to establish social boundaries and distinctions. In a similar vein, the phenomenologist philosopher Merleau-Ponty (1945) significantly contributes to the study of the body and perception. His work centres on the idea that our embodied experiences are fundamental to our perception of reality. By challenging the traditional dualistic view, which separates the mind and the body, he argues for an embodied perception and contends that our perception of the world is not solely the result of cognitive or mental processes or sensory input but is deeply intertwined with our bodily experiences. In other words, the body is not merely an instrument through which we perceive or interact with the world; it is an integral part of perception itself. He introduces the concept of the "lived body", which refers to our immediate, pre-reflective awareness of our own body. This lived body serves as the foundation for all our perceptual experiences. Merleau-Ponty emphasises that our body is not just an object in the world but the very means through which we engage with and understand the world. He also explores the idea of "motor intentionality", suggesting that our bodily movements and actions are not separate from our perceptions but are an integral part of the perceptual process. Our body's movements and gestures are meaningful expressions of our engagement with the world.

A dedicated reflection on the body in the context of power relations and knowledge emerged in the 1970s. In this regard, Foucault's (1975, 1976) work is paramount. He argues that throughout history, societies have exerted control and authority over individuals through dispositifs inscribed on and through the body. These dispositifs, which he refers to as "discourses" and "technologies of power", regulate and govern various aspects of the body, including health, sexuality and behaviour, effectively disciplining the body. One of Foucault's key insights is the concept of "biopower", which refers to how political and social institutions exercise control over populations by managing and regulating life itself. This includes controlling birth rates, managing disease and shaping societal norms related to the body. The French Author also emphasises the role of disciplinary institutions, such as prisons, hospitals and schools, in shaping the modern human body. These

institutions use surveillance, normalisation and discipline to mould individuals into compliant, docile and productive members of society. However, Foucault also recognises that the body can be a site of resistance. Individuals can resist and subvert oppressive power mechanisms by reclaiming control over their bodies, often through practices of self-care and self-discipline.

The role of the body as a crucial element in mediating social interactions is central to Goffman's (1956) work. Goffman's perspective on the human body in social interaction is rooted in the concept of "the presentation of self". He argues that individuals engage in social interactions as if they were «theatrical actors on a stage», using their bodies as instruments to convey specific impressions to others. In his influential work "The Presentation of Self in Everyday Life", Goffman (1956) highlights that individuals strategically manage their bodily gestures, expressions and appearances to project a desired self-image or identity to others. He introduces the notion of "impression management" to describe this process, emphasising how people carefully craft their public personas. According to Goffman, the human body serves as a vital tool for conveying information and maintaining social order.

While these contributions have aided social theorists in understanding how the body serves as a "right tool" for everyday life, they have primarily overlooked the relationship between the body itself and the material dimension surrounding social practices. This aspect gained prominence in the early '90s with the emergence of cyber-feminism, which specifically focuses on the intersection of feminism, technology and the body in the digital age. Cyber-feminist thinkers, including Donna Haraway and Sadie Plant, delve into how digital technologies have transformed our understanding of gender and the body. A central concept in cyber-feminism is the idea of the "cyborg". Donna Haraway's "A Cyborg Manifesto" posits that in a technologically mediated world, humans and machines are increasingly entangled, challenging traditional binary distinctions between humans and non-humans. The cyborg, as a hybrid entity, represents the merging of the organic body with technology, questioning conventional gender norms and highlighting the potential for liberation from essentialist identities.

These recent contributions have been highly influential in prompting science and technology studies (STS) to explore the physical body as an emerging entity functioning within heterogeneous assemblages: networks of machines, animals, infrastructures, knowledge and more. STS is an interdisciplinary field that investigates how scientific knowledge and technologies, or technoscience, are co-produced within the intricate web of social and political structures, as originally discussed in Latour's (1987) seminal work. STS, in its effort to unravel this complex interweaving between technoscience and society, has moved beyond the concept of human corporeality as a "biographical body" (Corbin and Strauss 1987) to embrace the notion of the body as a "cyborg entity" (Haraway 1992). The concept of the "biographical body" focuses on life trajectory and physical dimensions, explaining how individuals manage their lives and shape their subjectivity to

maintain a meaningful and consistent sense of self within a symbolic universe shaped by specific sociohistorical contingencies. In contrast, the idea of the “cyborg body”, while still considering biographical and physical dimensions, emphasises the role of technologically mediated interventions in constructing the human body and redefining its capabilities and agency. This implies a body enacted through the biomechanical expansion of natural potential.

As Haraway (1990) states:

We are all chimeras, theorised and fabricated hybrids of machines and organisms; in short, we are cyborgs. The cyborg is our ontology; it gives us our politics. The cyborg is a condensed image of both imagination and material reality, the two joined centres structuring any possibility of historical transformation. (p. 191)

Therefore, the human bodies and bodily experiences emerge as the result of complex assemblages of technologies, knowledge and power relations, as well as social and cultural elements. This prompts scholars to explore the intricate relationships between the body and (sometimes invisible) technological systems of innovation, experimentation, application, development, production, marketing, medical installation and monitoring. Technologies, due to their entanglement with physical bodies, can redirect or prescribe current bodily practices and behaviours and fuel future-oriented sociotechnical imaginaries (Crabu and Magaudda 2022). Moreover, technologies are often integrated into geographically dispersed and functionally differentiated sociomaterial networks of interdependence, which are essential for their functioning. Take, for example, digital health and postgenomic science. STS scholars who have explored these technoscientific domains have shown how digital infrastructures and platforms have transformed biomedicine from within (see Clarke et al. 2010). Patients can not only access increasing amounts of health-related information but also generate and share it (Oudshoorn and Somers 2006; Neresini et al. 2019; Tempini and Teira 2019). In this scenario, individuals are no longer passive consumers of medical knowledge and technologies; they are active and expert users who produce, distribute and consume biomedical data and knowledge. This makes the human body part of the broader biomedical sociomaterial landscape. For instance, precision medicine aims to develop therapeutic approaches based on genetic, environmental and lifestyle factors for individuals who are not necessarily sick and who can engage in intensive self-monitoring of their health status by collecting data on tablets and smartphones. This allows individuals to bridge the informational gap that can arise between one medical consultation and another. For example, individuals at risk of skin cancer can wear sensors (e.g., a patch) to detect thresholds of exposure to ultraviolet radiation, thus radically reshaping their everyday habits and identity as potential patients based on the feedback and predictive knowledge generated by this technology.

In general, from an STS perspective, several crucial research questions arise: what are the implications of such a mutable corporeality? What analytical approach can be

adopted to investigate this changeable, hybrid body? How can STS explore the entanglements among bodies, scientific knowledge, and technologies? How can STS shed light on the way in which corporeality is materially and discursively constructed through technoscience? How do corporeality and the body contribute to defining technoscience itself?

This volume seeks to address these questions through its 13 chapters. These chapters explore various aspects, including technoscientific imaginaries, the impact of technologies on bodies, the concept of the cyborg, bodily transformation through technology, datification and the biomedicalisation of bodies, which can also lead to controversies regarding biomedical expertise. While the chapters unfold in a rhizomatic manner, they invite readers to reconsider key issues concerning the interplay of scientific knowledge, technologies and human bodies.

One central thematic issue addressed by the first three chapters revolves around how technologies contribute to the generation of expert knowledge and public sociotechnical imaginaries concerning life and the human body. Technologies can render visible what is essentially invisible to the human eye, such as molecules and atoms, shaping how we perceive the world. This theme is a central focus in the STS literature related to technoscientific imaging, as extensively examined, for instance, in Perrotta (2012). The exploration of this theme has been ongoing since the groundbreaking works of Lynch (1985a, 1985b, 1998), also in collaboration with Woolgar (1990). Therefore, the book chapters that delve into this theme contribute to addressing one of the pivotal questions in STS literature concerning how technologies play a role in co-producing expert knowledge and how this involvement is influenced by the embodied experiences and corporeality of research scientists.

Expanding on this inquiry, the first chapter by Federico Neresini puts forth a conceptual framework designed to investigate how scientists, through the utilisation of various technological tools, venture into the imperceptible realm of the material world. For instance, they employ a scanning tunnelling microscope to create images of the otherwise invisible “nanoworld”. They create “literary inscriptions” (see Latour and Woolgar 1986), including numbers, tables, graphs, charts and images, which construct and naturalise scientific facts and theories that shape reality itself. In the second chapter, authored by Manuela Perrotta, the focus is on technoscientific imaginaries. This chapter delves into the incorporation of algorithmic technologies into the creation and utilisation of images of embryos in the context of fertility treatment. The case of embryo imaging serves as a notable example of how the progress in imaging technologies for in vitro fertilisation not only alters the way embryos are observed but also reshapes the overall processes of knowledge generation in the field of embryology. In this manner, the chapter. It sheds light on the factors that influence when and how images come to be regarded as “true” representations of the world, taking into account the specific contextual conditions in which this perception is shaped. Chapter Three by Barbara Pentimalli delves into the role of metaphors and aesthetic judgments used by scientific practitioners when visually

exploring biological phenomena for diagnostic purposes. It highlights how metaphors, originating from anatomy books or daily work contexts, guide novices to observe relevant details and identify pathological signs.

The second thematic issue explored in Chapters Four, Five and Six concerns how the body in contemporary society is considered an object of technoscientific intervention. These interventions can reshape, discipline, exclude and standardise individuals and collectives through diverse technologies. Chapter Four, co-authored by Valeria Cappellato and Valentina Moiso, reflects on the biomedicalisation of bodies in breast cancer therapies and post-mastectomy breast reconstruction. The authors, by emphasising the significance of medical technologies in healthcare, both within hospital environments and in the daily lives of patients who use them, investigate how the concept of “good functioning” and the ideals surrounding a “healthy woman’s body” materialise in the female body. The subsequent chapter by Mariia Kiseleva and Andrey Kuznetsov explores the bodily dimension of practitioners engaged in technological innovation, focusing on the Russian-based startup Trali, which developed self-driving trucks and advanced driver-assistance systems software. It argues that the body plays a fundamental role in constituting technoscience, a process labelled the “bodilisation of technoscience”. Chris Hesselbein and Paolo Volonté’s chapter investigates how technology and mass production normalise the female body within the fashion system and exclude bodies or body parts that do not conform due to seemingly “objective constraints”. Through two case studies related to clothing production that result in the normalisation of “other” categories of bodies, the authors demonstrate how technologies can standardise the female body, restrict its diversity and consequently categorise many women as “others” based on “technical constraints”. Additionally, they explore how women seek to navigate or overcome these constraints and exclusions.

The third thematic issue addressed in Chapters Seven, Eight and Nine explores the concept of the cyborg and its potential for critically examining mainstream notions of the “natural” body as a sociotechnical and cultural construct. Bianca Rumore’s chapter, informed by STS and post-humanist literature, examines the material dimension of the processes that lead to becoming cyborgs. It analyses recent technologies for visual disabilities and introduces the concept of “cyborg communities” to understand the characteristics of the current cyborg scenario. In so doing, she examines how users and designers are engaging with ethical concerns and advocating for “cyborg rights”, specifically focusing on issues of accessibility and inclusiveness. The chapter prompts scholars to address ethical dilemmas that may arise when technologies (permanently) modify the human body. In Chapter Eight, Casartelli explores the dilemma of plastic surgery, which encompasses the choice between eliminating or embracing physical imperfections, as this choice serves as an illustration of the Science versus Nature divide. The concept of “uncanny technoaesthetics” is introduced to explore the technological, aesthetic and political implications of plastic surgery. This concept is influenced by Masahiro Mori’s well-known “uncanny valley” hypothesis and Simondon’s examination of “technics”. By integrating

these ideas with feminist science studies, the chapter engages in theoretical discussions about the distinctions between the “natural” and the “artificial”, promoting the idea that the uncanny can serve as a productive space for disruption. Therefore, the author argues that the uncanny valley emerges from the disconnect between our expectations and our actual experiences, providing a lens through which to investigate the construction of a “natural” appearance, ultimately challenging the fixed notion of humanity. Thus, the chapter by Stefan Nicolae draws on Gunther von Hagens’s “Body Worlds Exhibition”, which displays technically prepared organs, body parts and entire human bodies (commonly referred to as “plastinates”) to the wider public. It identifies and analyses different “normative repertoires” in which science, art and morals are addressed and reshaped in assessments of plastinates. This chapter underscores how these repertoires render intense processes of boundary drawing undertaken by social actors, fine-tuning the normative demands of these realms of social life.

The fourth thematic issue revolves around the concept of datification in everyday life. As is well known, datification involves the translation of various aspects of individuals’ daily experiences, behaviours and interactions into (digital) data. These datasets can then be collected, analysed and processed using digital technologies and media platforms. Elise Li Zheng’s chapter specifically focuses on the practice of self-tracking within the context of China’s tech sector, where an overworking culture prevails. This chapter explores the diverse practices and technological assemblages that help individuals articulate their health data within this social setting. Through interviews with users and their reflections on personal data, this chapter asserts that self-tracking practices are influenced by neoliberal languages, productivity culture and the intersection of workplace and personal life. Additionally, ideal user representations from the health tech market rise to a variety of self-tracking practices that often clash with one another. These practices aim to transform the body into a project for productivity while also perceiving it as a worked object, rendering it fragile and under stress in the process. The chapter establishes theoretical connections between health data and the broader social context, paving the way for further inquiries into how design features can address users’ varying agential capacities, empowering individuals under different modes of surveillance, stress and control. The subsequent chapter, authored by Jessica Pidoux and Pascale Kuntz, delves into the definition of variables used as input for algorithms operating in digital landscapes. They identify two types of variables: declarative and non-declarative. Declarative variables, such as weight, are filled in by users through specific interfaces when creating their profiles and are accessible to users to describe their bodies for profile formation. Non-declarative variables, on the other hand, include data such as the number of times an app has been opened and are derived from usage traces collected during users’ online activities on the platform or from external sources, such as social networks. The chapter particularly focuses on identifying declarative variables used in dating apps to describe “female” body morphology, drawing from fieldwork observations.

The fifth thematic issue primarily focuses on the formation and contestation of expert knowledge. Stefano Crabu and Barbara Morsello's chapter initially centres on how communities sceptical of institutional science attempt to challenge commonly used military metaphors in public and professional biomedicine discourse. These metaphors describe the human body and immune system as battlefields where health practitioners use therapeutic tools to combat diseases. The chapter highlights how these communities, in addressing prevailing biomedical discourses and related military metaphors, construct alternative interpretations of the human immune system and redefine the living body as a subject of self-management practices situated outside the boundaries of biomedicine. In doing so, the chapter illustrates that the critical examination of biomedical metaphors goes beyond a discursive critique and serves as a foundation for developing specific knowledge claims aimed at shaping a health and well-being model that diverges from biomedical interventions. The last chapter of this section, authored by Assunta Viteritti and Letizia Zampino, investigates processes related to knowledge design in the field of stem cell research. Stem cells are portrayed as a potent resource, akin to intelligent life, possessing the ability to take action, move, reproduce and replicate autonomously. The chapter views stem cells as adaptable entities that assume various forms depending on the environments they traverse, with ongoing inquiries about their interpretation and application consistently in focus. Throughout this transformation, the central inquiry revolves around how stem cells are interpreted and utilised, which is a constant consideration in their study. Drawing on the concept of interpretative flexibility (Pinch and Bijker 1984), the authors seek to examine some of the processes contributing to the increased stabilisation of stem cells as research objects.

The book is brought to a close with an afterword that includes a contribution by Guido Nicolosi, honouring the personal and intellectual heritage of Marina Mastrutti, whose work serves as the inspiration for this book. Indeed, after the sudden and unexpected passing of Marina on January 22, 2021, the initial motivation to publish this volume stemmed from the desire of the Italian Society for Science and Technology Studies (STS Italia) to honour her life and work by creating a book dedicated to her core research interests, which involved exploring how technologically advanced societies reshape and enact the human body, along with notions and practices of care, through a wide array of technologies. Just as Marina Mastrutti's work did, this edited collection illustrates how scholars in STS and, more broadly, social scientists can investigate the co-construction of the body as a result of interactions between human and non-human elements, materiality, knowledge and institutions.

A cherished and respected colleague, Marina served as vice president of STS Italia from 2016 to 2018. With a background in philosophy and anthropology of technology, she was affiliated with the University of Paris 1 Panthéon, where she conducted extensive research across various scientific and technological fields, including nanotechnology, robotics, biotechnological innovations, artificial intelligence and new medical devices and

techniques. The central theme of her work resonates with the enduring tradition in social theory and STS, that underpins the chapters in this book, as they delve into the evolving boundaries and characteristics of the human body. This exploration acknowledges that the body has progressively grown more reliant on advanced technologies emerging from various technoscientific domains.

In essence, much like Maestrutti's work, this edited compilation showcases how scholars can explore the co-creation of the body through interactions involving human and non-human elements, materiality, knowledge and institutional factors. Such a perspective challenges the essentialist view of the human body, which presumes fixed and "normal" physical and mental attributes. This viewpoint advocates for a more process-oriented understanding of living bodies, acknowledging that they manifest as relational phenomena emerging from complex sociomaterial configurations across time and space.

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