# Technoscience in the Remaking of Human Bodies: Knowledge, Identities and Discourses

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**Abstract**
This contribution aims to introduce the topic under investigation in this special section and highlight the connections between the three essays contained in it. Taken as a whole, the special section explores the relationships between the human body, science and technology by focusing both on present material interactions and interventions and on futuristic visions of bodily enhancements. It shows how science and technology studies scholars can explore the co-construction of the body as the result of the interaction between human and nonhuman agency, materiality, knowledge and institutions. From this perspective, the body and its subjectivity emerge as relational phenomena from multiple entangled sociomaterial configurations spanning space and time. Hence, this special section reinforces the call for a processual understanding of living bodies as emerging from the intertwining of human and nonhuman entities.

**Keywords**
living bodies; cyborg; prostheses; neurotechnologies; digital identification.

## 1. Introduction

In the context of contemporary technologically dense societies, human bodies are deeply intertwined with technoscientific developments. No sphere of life related to bodies and bodily experience – birth, reproduction, work, learning, sexuality, gender, ageing and so on – is alien to technoscientific intervention (Clarke et al. 2003; Cohen 2009; Oudshoorn 1994). In this regard, the field of science and technology studies (STS) has been traditionally highly concerned with showing how human bodies and their boundaries are constantly being reshaped by technoscience, including biotechnology, nanotechnology and robotics (e.g., targeted drug delivery, sensory implants, prostheses and diagnostic imaging). It is worth highlighting that STS, in its effort to disentangle the mutual interplay between technologies, knowledge and bodies, has moved beyond rejecting biological reductionism and technological determinism and has instead conceptualised the human body as both the "object" and "subject" of technoscientific interventions (Mol and Law 2007). Following Mol and Law (2007), the living

body can be enacted as an object in multiple ways. When the body is (self-)scrutinised via medical imaging devices, self-tracking apps or surveillance techniques, it becomes the object of a specific (disciplinary) practice that may also modify and transform it, as in the case of biomedical implants. But the living body is also a subject, in the sense that humans are deeply embedded in specific bodily experiences (e.g., the fear or pain related to an illness or the feeling of satisfaction and pleasure arising from a physical activity). These experiences are inherently "fleshy" and can be the driver of subjectification processes as well as the co-definition of the subjective identities involved.

This article introduces the special section "Technoscience in the Remaking of Human Bodies", which is devoted to investigating the intricate relationships between the body, science and technology by focusing both on present material interactions and interventions and on futuristic visions of bodily enhancements. To describe these intricacies, STS and technology assessment scholars have pointed to the notion of intimacy between humans and technologies (see van Est et al. 2014). New and emerging technologies are intimate because they are *in us* in the form of drugs, implants, prostheses and more. They are also *among us* because they mediate and transform human interactions via online platforms, communication devices, and (self-)tracking and (self-)measurement tools. They are *about us* since our bodies and behaviours are digitised and datafied for a vast array of purposes. Finally, they are *just like us* because, for example, computer programs (e.g., chatbots) and robots increasingly mimic human behaviours and capacities.

The human body is fully part of these entanglements. It emerges as the outcome of complex assemblage processes that involve material, social and cultural elements. Because they are intimate, technologies are tightly linked to the human body; they reorient or prescribe present bodily practices and behaviours and fuel future-oriented sociotechnical imaginaries (Crabu and Magaudda 2022). Moreover, technologies are often nested in geographically dispersed and functionally differentiated sociomaterial networks of interdependence, which are necessary for their functioning, thus making the human body part of the broader sociomaterial context.

Let us take the example of digital health and post-genomic science. STS scholars who have explored these technoscientific domains have shown how the internet and digital platforms have changed biomedicine by allowing patients not only to access an increasing amount of health-related information but also to generate and share it (Oudshoorn and Somers 2006; Tempini and Teira 2019). In this domain, individuals are no longer passive consumers; rather, they are active users who produce, distribute and consume biomedical data and knowledge. 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. In this way, these individuals can bridge the informational gap that can arise between medical consultations. For example, those at risk of skin cancer can wear sensors (e.g., a patch) to detect thresholds of exposure to ultraviolet radiation, thus radically redefining their everyday habits and identity as potential patient based on the feedback and predictive knowledge generated by this technology.

The metaphor of the cyborg (Haraway 1991) is well suited to analytically grasp the multifaceted configuration of human bodies; it describes a body that has become pliable by virtue

of technological interventions and additions, thus overcoming the traditional distinction between "nature" and "culture" (Pellizzoni 2012). Hence, science- and/or technology-based interventions can modify the body beyond what might be described as "normal" functioning (Lock 2007; Wolbring 2008). This expanded role of technology has appeared beyond what Alan Roulstone (1998) defined as the "deficit model". This new role is not just about correcting the "deficits emerging from impairments [so that] technology stands as a correction mechanism that advances the individual body, enhances educational deficits, and normalises the disabled subject" (Galis 2019, 404). Increasingly, new technologies are able to reconfigure and modify the human body "not merely in their effort to represent and cure pathology but with intent to enhance what nature has endowed" (Lock 2007, 875). At the same time, the mobilisation of technologies "to modify the appearance of the human body and its functioning beyond existing norms and species-typical boundaries allows for a redefinition of what it means to be non-impaired", which also opens the space for unintended consequences and ethical dilemmas, such as new forms of ableism that see all bodies and minds "as limited, defective and in need of constant improvement beyond species-typical boundaries" (Wolbring 2008, 254), including those related to cognitive capacities. This new ableism may "fetishises certain cognitive faculties and conceives of disabled people in much the same way as the old eugenicists did with regard to the so-called 'feebleminded'" (Coenen 2014, 758). Furthermore, the emergence of pervasive wearable devices and digital applications, as well as the "invisible" infrastructures that allow their functioning, can translate human bodies and their performance into data through self-monitoring and self-surveillance practices that promote and enhance the experience-based knowledge that people have of their (self-objectified) bodies. This experience-based knowledge is imbued with prevailing normative biomedical discourses in which individuality is translated into numbers, thus fuelling the idea that the improvement and optimisation of the human body can be achieved by measuring it. This frames the body in a logic of display, performance and consumption (Thomas and Lupton 2016) and enables end users to intervene on their bodies through "technologies of the self" (i.e., self-tracking apps; see Lupton 2016) alongside health professionals.

Overall, the body appears no longer to be a stable site of normalised biological functions but a mutable ground in constant transformation, where materiality and subjectivities are being shaped. What are the implications of such a mutable corporeality? Which analytic stance can be adopted to investigate this changeable, hybrid body? The three papers in this special section examine the entanglement of technology and the human body and offer valuable insights into these questions.

The paper by Lucie Dalibert, Valentine Gourinat and Paul-Fabien Groud presents the results of ethnographic fieldwork conducted with amputees and healthcare professionals in France. This study aimed to investigate amputees' daily experiences and, in this way, understand the sociomaterial relations between their bodies and their prostheses. The authors highlight the material and discursive ambiguity of prostheses, which are both absent and present in the lives of amputees. According to an ableist representation of the body that is dominant in the medical discourse, prostheses are already present and intimately tied to the body in the discourses and practices of amputation and rehabilitation. However, their status is more ambiguous when their use becomes natural in daily life and when they are viewed by ampu-

tees as "parts" of their bodies, which makes them simultaneously absent and present. Finally, prostheses are also absent because they are often unused in the privacy of the home or when alone and because they are hidden when the amputee is in a social context to avoid what is perceived as stigma. The authors conclude that the relationship between the body and prostheses is better understood as something that is enacted and re-articulated in situated settings of interaction rather than as something that is defined once and for all.

The paper by Roberto Favalli analyses the discourse surrounding brain-computer interfaces (BCIs), a cutting-edge neurotechnology that allows direct interaction between the human neural system and external electronic systems. From the vantage point of the future-oriented representation of BCIs, Favalli examines the visions of the merging of humans and machines engineered by BCIs as they are presented in the scholarly literature. His article shows two distinct views of the cyborgisation of the body. The first one echoes the view of a strong human agency that characterises most of the transhumanist rhetoric; from this perspective, the human being is an agent capable of steering human-machine interactions towards his/her desired goals in a controlled fashion. The second view of cyborgisation reflects a less voluntaristic approach to the encounter between BCIs and the human body; it emphasises the autonomous adaptation of technologies to the changing realities of humans, even beyond the intentionality of the subject.

The paper by Stefan Strauß investigates the global spread of biometric technology as well as the ever-increasing accuracy and specificity of digital identification practices. Strauß notes that, while the use of biometrics is frequently justified as a security improvement, the expansion of this technology in daily life and for purposes not strictly related to security issues entails a significant growth in identifiability and surveillance mechanisms. According to the author, the increased use of biometrics poses various risks. As individuals cannot simply opt out of their bodies or change their corporeal characteristics, in the long run, they may be partially reduced to enduring machine-readable informational patterns as physical and digital environments conflate.

Three broad conclusions can be drawn from these papers.

First, the relationship between technology and the body is "spatially ambivalent" as it involves both proximity and distance. At the material level, technologies can be within the body or close to the body; however, at the same time, their embodiment depends on the dispersed infrastructures required by proximal devices for their functioning, such as in the case of biometrics or, more generally, the (self-)monitoring of the body (see the article by Strauß). On the discursive level, current technologies are shaped and enacted through the association with different knowledge and imaginative repertoires; these mediate particular sociotechnical futures that anticipate distant (and hypothetical) possibilities (see the paper by Favalli). Finally, in terms of perception, absence and presence as well as proximity and distance may coexist as different modalities of relations between the body and technology. This primarily depends on the context rather than on a general configuration of these relations (see the article by Dalibert, Gourinat and Groud).

Second, these three articles deal with identity and agency. The enmeshed relationships between the human body and technology challenge the idea of a stable and powerful human agency that directs technologies purposefully. As Favalli notes, the experts and researchers working on BCIs oscillate between a view of technology development as oriented by human agents and a view that sees humans as passive beings who adapt to said development. From a

different point of view, Dalibert et al. show the complex work entailed by trying to manage the blurring of the boundaries between human bodies and prostheses. The latter are a presence that is difficult to manage according to the desires and preferences of the amputees, and this shapes patients' daily lives as well as medical practices in both surgery and rehabilitation.

Third, the entangled relations between technology and the human body do not depend on the novelty of the technologies in question. The intimacy referred to above is not limited to new and emerging technologies. The example of prostheses is telling in this sense. The cases explored by Dalibert et al. show that the boundary between the human body and technology is not blurred only in the case of cutting-edge devices. Prostheses establish complex relations of embodiment with amputees.

Overall, this special section shows how STS scholars can explore the co-construction of the body as the result of the interaction between human and nonhuman agency, materiality, knowledge and institutions. From this perspective, the body and its subjectivity emerge as relational phenomena from multiple entangled sociomaterial configurations that span space and time. The resulting view challenges an essentialist conception of the human body as characterised by allegedly specific and "normal" physical and mental attributes. It strengthens the call for a processual understanding of living bodies as emerging from the intertwining of human and nonhuman entities.

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