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Manufacturing Life, What Life? Ethical Debates around Biobanks and Social Robots

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Abstract

In this paper we explore how the definition of life takes on an essential character in the ethical debates around health technologies, with life thus being manufactured in the tensions and conflicts around the use of such artifacts and devices. We introduce concepts from science and technology studies (STS) to approach bioethics, overcoming the dualistic conception that separates the natural and the technological, and questioning the dominant rationality that divides life into dualities. Drawing on two research projects in which we have been involved in recent years, one regarding biobanks and the other social care robots, we explore how the ethical discussions about biobanks and robots imply particular notions of life. We argue that the contemporary epistemic category of life is a manufactured life in which various rationalities coexist: one rationality based on a separation between the technological and the human, focused on pragmatism and functionalities that tend towards a dualized notion of life divided into qualified and non-qualified life, and another rationality based on a non-essentialist ontology, focused on the mediating role of health technologies, that entails a distributed life appearing as a precarious effect of a network. Each of these rationalities allows the emergence of different issues and ethical concerns, thus enriching the bioethical debate.

Key words: dualization of life, mediation, science and technology studies, biobanks, social care robots

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1. Introduction

The heavy impact of human activity on terrestrial ecosystems characterizes the period in which we live as a new era that is called the Anthropocene. It is paradoxical that, while discussing whether this impact can erase life from the face of the earth, we are witnessing, in parallel, intense human activity aimed at the manufacture of life, to the point that it seems that the research programme that Jacques Loeb years ago assigned to biology has become a general endeavour for technoscience [1]. While he was carrying out this assignment for biology, Loeb also came to demand an evolution of ethical thinking that would be in line with the scientific advances made and, above all, with those to come: “Our present economic and political ethics is still on the whole that of the classical period or the renaissance, because the knowledge of science among the masses and statesmen is still on that level, but the natural sciences will ultimately bring about as thorough a revolution in ethics as they have brought about in our material life” [1]. These words undoubtedly resonate with those of Rosi Braidotti, who said that one of the most acute paradoxes of our day consists in the tension between the urgency of finding new alternative models of ethical and political responsibility for our technologically modified world and the inertia of consolidated mental habits [2].

In our view, the demand for alternative ethical debates regarding the processes of manufacturing life seems, therefore, not only reasonable, but imperative. As Sophie Roosth has observed, life has become an epistemic category, examined and understood through its manufacture [3]. Following Roosth’s argument, this simply means that, as synthetic biologists seem to suggest, life is “what we make it”. Taking the argument to its limit, Roosth suggests that “manufactured life, more than simply blurring distinctions between nature and artifice, incarnates accumulated biological theories of life”, and says that the only way to understand it is a retroactive exercise to examine the techniques used to make it. However, without denying this dimension of the issue, our thesis is that the place where the definition of life takes on an essential character is in the ethical debates on the use of those manufacturing techniques about which Roosth talks. In other words, these technical processes produce a great deal of ethical debate, and it is important to pay attention to what is being said in these debates as well as to the analysis of the effects of these techniques on our conception of life. These debates and controversies occur, in short, because there is a struggle over the definition of what life is. It is in this same debate that life is manufactured as well.

The analytical tool we are going to use to address these bioethical debates relates to the traditional western distinction between *bios* and *zoé*. We use some of Giorgio Agamben’s insights about the

dualization of life [4]. The philosopher goes back to the Greek comprehension of life, in which two semantic and morphological terms are distinguished: *zoé* and *bios*. *Zoé* expressed the simple fact of living, which is common to all living beings (animals, human beings and gods), and *bios* meant the way of living particular to an individual or group. Agamben emphasized that when Plato and Aristotle theorized about life, they did not use the term *zoé*. This terminological decision was because what was at issue was not simply natural life but only qualified life, that is, a particular way of life [4]. We explore how bioethical debates around biobanks and social care robots understand life on the basis of this traditional western dualization between *bios* and *zoé*, politically articulable life and bare life, qualified life and non-qualified life.

In addition, theoretical and conceptual insights developed during recent decades from the alignment between science and technology studies (STS) and engineering ethics will be incorporated in our analysis [5]. One of the recurrent ideas in this alignment is the heterogeneous nature of technoscientific artifacts, composed as assemblages of practices, relations, values and materials [6]. In this vein, the ethical debates have to be considered in relation to this assemblage of which they are also part. We show in our analysis how life is conceptualized in different ways in the various bioethical discussions, moving between, on the one side, a dominant rationality that entails a debate focused on a dualistic approach to relationships (doctor–patient or human–artifact) and that also implies a dual conception of life, and, on the other side, another rationality focused on the mediating role of technologies, which entails a conception of life as a precarious effect that appears from particular assemblages.

To illustrate our approach, we will focus on two technoscientific realms in which practices regarding the manufacture of life are particularly salient: biobanks and social care robots. Research biobanks manufacture life from human-based biospecimens and associated data, and their manufacturing processes entail, among other practices, the collection, processing, conservation and distribution of the manufactured bioresources, and the development of drugs. By contrast, social care robots manufacture social life from mechanical and artificial raw materials, from the metals and plastics used to build their shells, and their baseboards or cabling, and so they encapsulate forms of social interaction in logarithmic formulations.

2. Symbiosis of theory and practice

We are basing our methodological approach on the symbiotic empirical ethics of Lucy Frith, who proposes a conception of ethical theory in which practice informs theory just as theory informs practice [7].

In other words, this is an approach that relates theory and practice in a symbiotic way. Inspired by this commitment to the symbiosis between theory and practice, we have recovered some of the empirical work done in recent years on biobanks and social robotics, and confront it with some theoretical reflections formulated from an ethical standpoint. In this sense we have found to be particularly relevant the information we collected from biobank researchers and roboticists about how they approach ethical issues in their daily practice, using ethical theory as a tool of analysis. In this paper we show the results of this confrontation, a new theoretical reflection about the ethical concerns related to the practices of biobank researchers and roboticists in manufacturing life.

The first example to be analysed focuses on biobanks. Biorepositories are present in various fields within the life sciences, storing and registering data from a diverse range of samples: seeds, animals, microbes, bacteria, plasma, saliva, brains, etc. Since the late 1990s, in the context of the so-called postgenomic era and other -omics, the term “biobank” came to be predominantly used to refer to human-based repositories of different kinds. The classifications of biobanks follow different criteria: purpose, type of specimen, group of donors, or institutional custodianship [8]. Biobanks for research collect, store, process, and distribute biospecimens and associated data for a diverse range of biomedical research projects. In our project on biobanks, we developed a scoping review of publications on Ethical, Legal and Social Implications (ELSI), and carried out qualitative research with biobankers (administrative staff, science directors, lab technicians, security guards, researchers, etc.) [9]. This research included an ethnographical study on cell banking for immunotherapy, exploring “science and banking in the making”, and multi-sited fieldwork with biobankers exploring their concerns and the ways in which their practices are being transformed. Lastly, we carried out a documentary analysis to delve into the lags between scientific policies and projections and situated infrastructural complications [10].

The second example deals with a new generation of robots that has appeared during recent decades in what is known as the New Era of Robotics: robots characterized by the capacity to collaborate with humans in their daily environments. Specifically aimed at vulnerable groups, such as the elderly, children or people with some kind of disability, in recent years there has been an exponential growth in research and pilot projects that seek to develop what are known as social care robots [11]. Social care robots are robots designed for use in the home, hospital or other environments to interact with people and to support, assist and provide care for children and sick, disabled, elderly and vulnerable people [12]. During the last few years we have conducted research on social and ethical controversies that arise from social care robots,

using empirical qualitative research methods for gathering information (participatory observations, interviews and focus groups), exploring participatory methodologies for designing the appearance and functionalities of robots [11], and carrying out case studies on the fears and hopes of different groups concerned with healthcare and robotics (nurses, physicians, elderly people, roboticists, relatives of hospitalized children, etc.) [13, 14].

3. Manufacturing life in biobanks and social robotics

In the various debates about biobanks and social robotics, different issues are identified that require reflection and ethical discussion. These different controversies also imply different ways of understanding life. In the following sections we reflect on these debates and on how different conceptions of life emerge, which is the same as saying that we are reflecting on the ethical debates in the fields of biobanks and social robotics about how life is manufactured.

3.1. Ethical concerns about biobanks

The ethics of human-based biorepositories, as “life libraries”, have not always drawn as much attention as they do nowadays, and neither has an understanding of what they store remained fixed over time and across contexts. To explain how biobanks became “ethical problems” requires us to track back to at least two key events that entailed a shift, before the end of the twentieth century, in understanding biological life, and therefore of donated human biospecimens [15]. On the one hand, Polymerase Chain Reaction techniques allowed fast in vitro amplification of small samples of DNA. On the other hand, the Human Genome Project was one of the first large-scale scientific projects to incorporate a programme on ELSI [16]. These two events generated a shift in scale and in the way in which biobanks and human samples were framed, filling biobanking with the anxieties and concerns derived from the contested genetic goldrush and genomics. For instance, the 2009 OECD Guidelines merge Human Biobanks and Genetic Research Databases under the abbreviation “HBGRD” [17].

The interweaving of informatics and biology has led to multiple metaphors and a call to produce so-called bioresources for biomedical research. How “the biological” might be understood is co-produced by such innovations and informational metaphors, with donated samples being considered as double-selves, potential books of life, or cloning material. However, these events cannot be summarized as a substitution

of “life as organic unity” by “life as information” [18], but as much more complex entanglements that engender the current reference to what biobanks store and manufacture as “samples and associated data”.

The ELSI framework is the umbrella under which ethics discussions on biobanks tend to be held. Even though the reflections gathered under ELSI approaches are heterogeneous, the framing evokes an artificial division between technoscientific issues and ethical, legal, and social ones, which is mainly on the basis of the promotion of normative ethics.¹ These questions have led to scholarly discussions on the transformations within the framework and the possibility of expanding the ELSI approach to strengthen plurality and collaboration [19, 20]. The discussions recognize that ethics reasoning is limited if it aims to purify domains and relationships, relying on dualizations and saying that these domains and relationships belong to the technoscientific realm or the ELSI one (biological or social life). In what follows, we present salient ethics debates in biobanking around the collection, storage and circulation of biospecimens and associated data, and explain how these activities fall outside such divisions, but also outside a dualization of life as qualified or non-qualified, that is, spilling over and into the division between *zoé* and *bios*.

Literature reviews show that the ethical theme that has gathered the most attention in biobanking is informed consent [21, 22]. Different types of consent have been analysed and proposed for biobanks [23] (specific consent, dynamic consent, and meta-consent), as well as participatory initiatives on the design of the document [24]. In biobanking, a broad consent for biomedical research, which would allow the transfer of samples and associated data “for biomedical purposes” in general, seems to have gained general agreement [25]. This type of consent aims to avoid excessive bureaucratization and practical handicaps on re-consenting. However, informed consent in research biobanking has been contested in ethics discussions, with questions about its purpose. These discussions reflect the weaknesses of relying on the duality of “consent” or “no consent” to deem particular practices acceptable, instead of carrying out further scrutiny on the content of such informed consent forms or the way in which such consent is configured in specific sites and procedures. Therefore, informed consent is cornering the articulation of ethical discussions, rather than recognizing that informed consent is only one way to approach biobanking diversity and complex

¹ The report *Taking European Knowledge Society Seriously* (2007) explores the “politics of ethics” in the European Union. This report indicates how, until the mid-2000s, ethics and legislation in science and technology were coupled to such an extent that the differentiation between ethical reasoning and law-making was blurred.

challenges. In this kind of document, consent is becoming increasingly empty of the meaning it presupposes, unable to retain the unknown, the unexpected, or the collective nature of biobanks [26].

Besides informed consent, other ethical discussions cover questions such as the commercialization of biobanks [27], the ownership or custodianship of biospecimens and data [28, 29], intellectual property [30], benefit-sharing [31, 32], trust [33], the sustainability of research infrastructures [34], data concerns [35] and the ethics of postcolonial science or so-called vulnerable groups [36, 37]. Debates of these types recognize biobanks as actors in the current bioeconomies [38], and, for this reason, see them as rearticulating the relationships between biological life and political life [39]. For instance, political life issues are present in some social sciences research into how biobanks as national projects engage the construction and branding of populations [40, 41].

There is an interplay between ethical discussions regarding the commercialization of biobanks and a classic anthropological question regarding the fragmentation and commodification of the human body [42]. These debates deal with the manufacture of life and vitality qualified as “human” or “human-based.” This qualification forms the backbone of the ethical principles and of bio-rights in biobanking, as the Helsinki Declaration or the Best Practices of the International Society for Biological and Environmental Repositories (ISBER) illustrate. Ethical concerns arise in relation to the manufacture of human biological life; we also include the manufacture of meta-data from samples or associated data of different kinds (clinical, demographic, sociodemographic, or lifestyle data). Do human samples not matter if we are talking about isolated white cells or saliva: is this qualified life, or mere *zoé*? Is it the manufacture of data along with those samples that qualifies such life as *bios*? These are the kind of questions that lie underneath some of the central ethics discussions and regulations on biobanking. Still, any efforts to decouple *bios* and *zoé* to arbitrate ethics discussions will barely grasp the complications that are engaged in the manufacture of life, which is what we aim to reflect upon in this paper.

If we take a look at the salient discussions on commercialization in biobanking, what is at stake is the eligibility of donated biospecimens and data to become a direct part of commercial activities, and the tensions arising from benefit distribution, human dignity or concerns about public trust and participation. These discussions mainly consider the possible paths that biospecimens can take through buoyant biomedical industry assemblages and, to a lesser extent, what might happen to stored bodily materials and data when a biobank declares bankruptcy [27] or donated samples are dismissed for financial or commercial reasons. In any case, these discussions revolve around when samples are oscillating closer to a qualified or

non-qualified form of life under a particular legal framework and around which information the informed consent should then include rather than considering which relationship is establishing or avoiding with the bioresource contributor. These discussions tend to incorporate the issue of material continuity between donors and biospecimens under a particular type of relationship, that of ownership, through the retention of rights over donated samples and data. Humans cannot be owned, and yet human-based biospecimens are sufficiently unqualified to be eligible for manufacture, but are not mere *zoé* that can be commercialized without any ethical problematization.

Informed consent discussions include a range of themes regarding the way to address this continuity between the donor and the sample, and the way in which this continuity is unable to deal with the collective features of biobanking. Some relevant questions in these debates involve how much information should be included on the form, the possibility of re-contacting the individual, the right to withdraw consent fully or partially (a full withdrawal could be considered only a fictional possibility as a result of the networking practised by biobanks and the distributed access to and use of samples and data), the possibility of including restrictions on the use of the samples, the right to know and not to know, the disclosure of incidental findings, the secondary uses of samples and data, the withdrawal of monetary benefits, and so on. These aspects indicate the limitations of an individual's informed consent as it is understood nowadays, and the impossibility of binding samples and data within the realm of unqualified life while also neglecting their yet unknown social lives.

Treating isolated biospecimens² as “raw biological life” ignores not only their vitality and plasticity [43] but also the relevance of the medium in which they live and the conditions under which this life is suspended throughout different techniques such as cryopreservation [44]. Moreover, biospecimens are a matter not only of biological life but also of “biographical life” [45]. This biographical life accounts for a situated relational life between particular biospecimens and different people and objects, requiring caution with respect to some assumptions: not all human-based materials are given a preferred status or subjecthood over materials that are not human-based, as Klaus Hoeyer's work has shown in the case of

² What constitutes a product of nature is a question that has been asked throughout the history of intellectual property [86]. Historical accounts provide relevant insights regarding the understanding of isolated biological materials, and the product of nature doctrine. The Supreme Court decision in *Ex Parte Latimer and Parke-Davis v. Mulford* gathers together valuable content exploring discussions on gene patentability, and biotechnology in general.

titanium hips [46]. Clear cut limits, dualisms and assumptions about what biological life is made of are unable to grasp the complexity of biobanks' assemblages. A vague approach to human biospecimens as raw and homogenous ignores the different types of biospecimens (urine, tumours, whole blood, mouth swabs, brain samples), and the plurality of procedures and contexts in which they are extracted. Similarly, there are privacy or data-sharing ethical concerns, and we should note that there is no such thing as raw data; as Geoffrey C. Bowker stated, "raw data is both an oxymoron and a bad idea; to the contrary, data should be cooked with care" [47].

Much of the tagged ethical literature on biobanking unfolds as "organizational decision-making rather than ethical reasoning" [15], and this approach can be traced in the way in which ethical discussions revolve around a necessary but limited procedure for biomedical research, the obtaining of informed consent. An organizational approach might be pragmatic to get things running, but it is unable to grasp and address many ethical concerns. We argue that ethics should not be reduced to enacting a patchwork to keep biobanks working, or an additive to legislative enforcement. Ethical reasoning is needed to reflect on the limitations of some ethical principles applied to biomedical research on "human subjects" that might be unsuitable for current and ongoing transformations in research biobanking, such as autonomy or subject-individual based approaches.

Overall, biobanks' ethical discussions stem from their mediation between "the givers", the biospecimens and data, and the uses of such manufactured life. Biobanks are entrusted with the position of a mediator, whose practices interweave and generate heterogeneous relationships, which in turn vary over time and across context. The dynamics and complexity of the relationships in which biobanks mediate have led to reflections on what to call "the givers": donors, participants, contributors, sources, or subject sources. This creativity in naming call our attention back to the questions that spill out from informed consent models and ethics discussions and cannot be bounded by dualisms (researcher/donor, cell/drug, etc.). An ethics approach that recognizes biobanks as mediators would consider their ongoing contribution to the making and renegotiating of particular relationships and asymmetries in technoscience. The issue at stake is the co-production of these relationships and how these relationships modify the way in which human health, medicine, or a fuzzy concept such as life, are understood. Indeed, the ethics debates that arise from research into biobanking account for a "worrying world" [48] that cannot be reduced to life dualizations, Cartesian divides, or science and society bifurcations.

3.2. Ethical concerns about social robotics

Over the last decade, the range of debate on the ethical and social implications of introducing social care robots into everyday healthcare environments has grown considerably [49]. Three interrelated trends are gaining relevance in the articulation of this debate: speculation regarding future robot development; an ethical controversy focused on the discussion of the functionalities of robots; and the growing relevance of diverse forms of responsible design.

In ethical debates around robotics, as is the case for other technological innovations, there is a certain premonitory tendency to speculate about the hypothetical development of social care robots and their role in society. The debate that follows this type of a priori approach is characterized by speculative ethics in technological innovation [50–52]. From a utopian and very positive vision of the development of robotics and AI, some authors have advocated the designing of moral machines capable of making ethical decisions, providing robots with ethical principles that guide their behaviour and select the best action at each moment [53]. Adopting a less enthusiastic approach, other scholars focus on the ethical debate that warns us of the risks and dangers linked to the development of robots in healthcare.

The premonitory identification of risks and the establishment of regulations are the ethical studies that have been most extensively developed, particularly focusing on the discussion of robots' functionalities. This trend is represented by what is called "*roboethics*" [54]. Supposedly facing what is regarded as a near-future scenario in healthcare, ethical reflection has worried about what would happen if we introduced intelligent and autonomous humanoid robots with certain functions into the area of care for the elderly, the children or other vulnerable groups. The concerns guiding the debate on the uses and functions of robots revolve around the following: the possibility that the most vulnerable groups could be deceived by robots because they are unable to understand their artificial nature [55]; the substitution of humans by robots and the dangers that the reduction of human contact could entail [56], as it could interfere with people's learning about human relations or with their cognitive and linguistic development [57]; privacy and data protection, due to the ability of robots to gather sensitive information when performing monitoring tasks [58]; and the difficulty of discerning how to settle responsibilities in the case that a robot's actions caused any type of damage or harm [59].

Widening this debate, other perspectives have pointed to the need to introduce the opinions and concerns of stakeholders beyond those of experts in ethics and robotics, such as roboticists, medical and healthcare personnel, and patients. In relation to this, the methodological proposal of Care Centered Value-

Sensitive Design by Aimee van Wynsberghe [60], or the idea of guaranteeing responsible research and innovation (RRI) criteria throughout the development of robotics, have had a major impact [49]. These approaches broaden the ethical debates around robots beyond the identification of the risks related to a hypothetical development of functionalities. In this way, the discussion is no longer focused on the human–robot interaction (HRI) paradigm, which dominates robotics and is based on the relationship between two individual and separate entities, a robot and a person. In a similar way to what happens with biobanks, when ethical debates introduce stakeholders into the robot design process, heterogeneous relationships situated in particular contexts and uses are generated. Proposals for the participation of stakeholders represent a more recent ethical discussion on robotics that introduce complexity on how the dualization of life is entangled in ethical debates around social care robots. In the following paragraphs we will show how different ways of dealing with the dualization between qualified and non-qualified life coexist in ethical debates. While some of the speculative and technocratic ethical debates on social care robots tend to a more dualistic approach towards life, discussions that strengthen the need to include users' fears and hopes from the first stages of design represent a more integrated approach to life, one in which the distinction between qualified and non-qualified life is no longer usable, and at the same time the traditional separation between human and machine is questioned.

One of the concerns driving the speculative debates around functionalities has to do with the substitution of humans by robots [61]. Robots are quite acceptable when presented as a complement, but there is the constant fear that robots will be an alternative to human care [62]. Obviously, the replacement of humans with technological devices poses different problems. In the case of social care robots, the importance of human contact for people, particularly children and vulnerable people, is stressed, together with the negative effects of a continued deprivation of this contact if care for people were to be carried out exclusively by robots [55]. This kind of debate tries to establish criteria for discerning what type of care can be delegated to the robot, with this delegation not being a threat to “the human”. The point is to know what is considered to be “human substitution”, so that bioethical criteria can be established to ensure that care robots are not used for such highly human activity. The problem is basically formulated around two interrelated problems: the type of care tasks that could be done by a social care robot [63], and the type of tasks that should be maintained in the hands of humans. Both problems, which in the end are the same problem, are addressed in the application of a logic of care fragmentation. In dualistic thinking, posing the

problem in these terms means that life is broken into two “fragments”, one that contains those care tasks that could be delegated to a robot, and the other the care tasks that are exclusive to humans.

The care of life as *bios* should be maintained in human hands, while all the care surrounding *zoé* could be delegated to a robot. This is one of the core parts of the debate around social care robots. In this view, normative regulations and public and academic debates are quite often focused on the study of how to guarantee the non-substitution of these “valuable” or “exclusive” human care tasks [64]. In this vein, care is conceptualized as a set of tasks that can be separated into pieces of activity that have different “natures”. This is the core of roboticists’ image of healthcare assemblages with robots [14]. This way of understanding care and care relations presupposes that care could be isolated into different parts, and that there are some actions related to care that are more valuable than others. In this dualization, care tasks are organized around two opposite value poles [51]: the unvalued pole of tedious and heavy tasks, and the valued pole of emotional and affective tasks. Indeed, the most valued tasks are those that have to do with emotions and affectivity, and this most valuable part of care must be kept in the hands of humans. In this imaginary separation, daily performance tasks can be delegated to robots and detached from the more valuable affective and emotional tasks. These daily performance tasks include all activities that require physical effort – such as lifting a patient to change their bed, holding people with mobility problems during a shower, etc. – and daily repetitive activities, such as feeding, conducting social learning tasks for children with autism, making conversation with elderly people with dementia, distributing medication among the rooms of a hospital or taking vital signs in diseased people. By contrast, affective or relational tasks are considered to be those related to establishing conversation, making eye contact, interacting with love, taking charge of someone, or assuming the planning or organization of care. Thus, the ethical debate about the substitution of humans by robots is based on the assumption that care tasks are organized according to a dual system of exclusionary categories, namely: emotional or physical; valuable or non-valuable; delegable to a robot or exclusively human. This binary notion of care assumes the traditional western dualistic distinction between, on the one hand, emotional and moral sensibilities and, on the other, the physical work of caring [65]. It is only on the basis of this assumption that the fear or the debate around the “substitution” of humans by robots can be envisaged. The debate is not about whether the human will be substituted, but about whether some task that is considered exclusively human will be substituted. The very formulation of the problem expresses the dichotomy of life entangled in ethical robotics debate: how can the *bios* be maintain with the participation of the robot?

By regulating and discussing which care tasks can be delegated to the robot and which are exclusively human, the bioethical debate around social care robots articulates life from the dualization of care. Thus, there is a qualified life that refers to valuable care tasks related to the affective and relational aspects of life, and there is a non-qualified life that refers to physical, daily, repetitive human caring activities, which are considered to be delegated. By defining which non-valuable tasks can be performed by a robot and guaranteeing which valuable care tasks should be maintained in the hands of humans, it is thought that the dangers around replacing humans are limited. Such a dualist conception of life, which configures these non-valuable tasks as the non-qualified part of life, has relevant repercussions once we extend it to other care issues: how are different socially and economically valuable care tasks performed by formal or informal care-givers, what is the human consideration of those people who need to be fed and bathed, and how are care tasks organized in hospitals, hospices, or residences?

As explained, the majority of the work in the field of risk identification around functionalities takes as its starting point a dyadic interaction between a human and a robot [66]. The HRI paradigm and its ethical analyses show that this dyadic nature, organized around the distinction between the human and the machine, is inadequate for addressing the complexity of ethical issues when social care robots are to be used in healthcare contexts. Some other approaches centre on a more nuanced understanding of robot interactions, highlighting the need to introduce the complex network of patients, doctors, nurses, etc. and the logic of the healthcare system into the ethical reflection about the robot [11, 67–69]. The underlying idea of these approaches is the conceptualization of the robot as interacting in an assemblage, and not only in a one-to-one relationship. Technologies do not only help in daily life: they are also powerful forces that act to reshape human activities and their meanings. However, technological artifacts are not neutral intermediaries. Rather, they actively participate in the construction of the way people are in the world: their perceptions and actions, experiences and existences. This technologically mediated character of our daily lives has important ethical implications [70]; social care robots not only help us in certain care tasks, but they also transform the way in which all stakeholders understand and practise the processes of care [13].

If the locus of the ethical discussion is the assemblage of care relations between patients, physicians, volunteers, family members, hospitals, etc., the HRI paradigm loses its prominence. The assemblage in which the robot participates is not organized into the dual exclusionary categories of a human and a machine, qualified and non-qualified life, *bios* and *zoé*.

4. Widening the bioethical debate

At its inception, bioethics claimed to be a project of reflecting on the moral issues raised by new technologies [71]. From its origins, there has been an hegemonic paradigm in bioethics systematized by four principles: autonomy, beneficence, non-malevolence and fairness [72]. These ethical principles are grounded on individual autonomy, and draw out a moral discussion based on the interaction between individuals, establishing the priority of reflecting on the doctor–patient or researcher–subject relationships [73]. This approach, known as principlism theory, has been the prominent one, although since the 1990s new theories have emerged and have begun to pose questions regarding the hegemony of the principlism theory [74]. The questions raised point to the need to contemplate public health policies, social inequalities, philosophical critiques of a rational-decision model [75], economic globalization, problems of social exclusion, and lack of access to scientific-technological development [76]. These other bioethical theories and questions proposed by researchers engaged in bioethics aim to broaden the reflections and approaches.

The rationality beyond conceptions of life entangled in ethical debates around health technologies is not a universal one. As Andrew Feenberg explains, diverse rationalities reflect the relative power, interpretation, and definitions of the different actors, contexts, and preoccupations [77]. In our analysis, we show how life is conceptualized differently in the various bioethical discussions. It oscillates in a tension between a dualistic approach to life and a precarious conception of life that appears to be an assemblage effect. Using a constructivist approach to the technological ethical debate, the development of any technology involves a multiplicity of actors and concerns, with conflicting interpretations of the nature of the problems to be solved [6]. Ethical debates around biobanks and social care robots are not external to their technological development; in other words, the way in which biobanks or social care robots manufacture life is not independent of the conflicts about how life is understood in bioethical debates about them. The context and concepts of these debates pervade the rationality of healthcare technologies, emphasizing some ethical and social concerns, but not others, in their development [77].

4.1. Different rationalities entail different notions of life

The dominant rationality seems to be grounded in a comprehension that life is divided into qualified and non-qualified life, or *bios* and *zoé*. This dominant rationality unfolds in the biobanks ethics debate as a reasoning about organizational decision-making [18], and in the social care robots debate as a reasoning focusing on functionalities [78]. This dualization of life is accompanied or accompanies an

ontology of dualization between the technological and the social. It is clearly represented in the dominant ELSI framework in the debates about biobanks – based on a germinal division between technoscientific issues and ethical, legal and social ones – or in the speculative technocratic debate in roboethics that assumes that a set of hypothetical technical functionalities will be developed autonomously, and that society should adapt to them.

These rationality programmes have also their “anti-programmes”: other ways, beyond a dualistic comprehension, of understanding what a life is. Bruno Latour introduces the term “anti-programme” to express the conflictual aspects of networks in technoscientific assemblages [79]. Further, Feenberg proposes the symmetry of programme and anti-programme in order to avoid any bias in favour of the dominant actor [80]. When actors, values, practices, etc. are in conflict, different programmes may highlight different elements [77]. The same robot that appears to hospital managers as a symbol of innovation may appear to psychologists who give therapy to autistic children as a nuisance and a source of new forms of health bureaucratization. Both hospital managers and psychologists belong to the network in which the robot is entangled, but their different relationships to it are manifested in different programmes – for example, an innovation business plan and an assessment of the benefits to autistic children of working with robots.

In our interpretation, we propose the symmetrical logic of the programme and the anti-programme as an approach to explore different conceptions of life. This proposal is founded on the analysis of the bioethical debate as one of the many nodes of the network of the assemblage, a network crossed by multiple conflicts around which the notion of life is articulated. As happens with technologies themselves, ethical debates about biobanks and social care robots have an apparent inevitability [77]. As “rational” reflection or analysis, bioethical debate appears to be inevitable, but, as critical constructivism argues, rationality is not universal and ethical concerns are not determined by purely technoscientific considerations, and thus the influence of social criteria causes bias [6]. This rationality implies a pragmatic approach towards the ethical concerns about biobanks, or an efficiency approach to care tasks in discussions about social care robots. However, the role of rationality is not limited to the dominant programme – there is also a role for it in the anti-programme. There are other logics and other ways to interpret life that respond to different ways of creating meaningful biobanks and social care robots.

In ethics discussions about research biobanks, the debates on commercialization and informed consent illustrate that a dualization which presupposes that there is such a thing as “raw tissue” or “raw

data” also falls short in accounting for some ethical challenges and questions. A dualistic approach to life in biobanking research is incapable of addressing the issues generated by fuzzy boundaries between biological material, data, and personhood, and between research and care practices [48]. In debates about social care robots, dualistic thinking about life is paradigmatically exemplified by the debate about the substitution of humans and the fragmentation of care. In such a dualistic approach, non-qualified care can be delegated to the robot, and qualified care is exclusive to humans [51]. This dualistic conception has a correspondence in a dyadic interaction between a human and a robot, stabilized in the paradigm of HRI [11, 66]. The dualizing notion of life in bioethical debates promotes necessary normative frameworks [81], and it is quite useful for establishing limits to avoid risks and some of the undesirable consequences of health technology applications. However, these types of debate are unable to address many of the other ethical concerns and challenges that are raised by new health technologies. For example, concerns about the role of biobanks in current bioeconomies [38] or the way in which care is organized and valued when introducing social care robots [60] are non-existent and cannot be reached from the dominant rationality of the dualization of life.

4.2. The mediating role of technologies and a precarious notion of life

In our analysis of the conceptions of life, we identify other meaningful interpretations of biobanks or social care robots that imply a different rationality from the dominant programme. Bioethical anti-programme rationality revolves around an understanding of the mediating role of devices or systems [82]. Technologies enable certain relationships between humans and the world that would not otherwise have been possible. In their mediating role, technologies are not neutral intermediaries, but are actors, actively influencing the formation of human perceptions and human interpretations of the world. From this approach, developed from the Actor Network Theory and the social constructivist approach to technology, some of the dichotomies that have traditionally populated bioethical analysis, such as nature–society, subject–object or human–technological, are questioned. The abandonment of dichotomic notions also implies the appearance of new actors that are a hybrid between subject and object – the quasi-subjects or quasi-objects that come from Michel Serres’ philosophy [83]. These entities are neither subjects nor objects, but they are not simply nothing: they are something. Their action has effects: they mark things, determine relationships, and configure networks of connections [84]. The focus is not on subjects or objects, but on the movement, the mediation, as something that happens but is not entirely cause or entirely consequence,

something that occurs without fully having a means or an end, which leads to different meanings. The notion of life acquires meaning in the network of the heterogeneous relationships. If we focus on the movements of the entities that form the network, in which the ethical debate is also assembled, the notion of life is a precarious effect that appears and acquires meaning in that network.

Considering biobanks as mediators necessarily means stepping aside from a dual understanding of life as qualified or non-qualified, and engaging in a much more multidirectional and relational approach. After all, ethics debates in biobanking revolve around their position as a mediator and the making of multiple and heterogeneous relationships between donors, biospecimens and manufactured data, but also between biobanks and other actors, such the state, family members, patient associations, biotech companies, international biomedical infrastructures and medical counsellors. We observe how ethics debates produce and renegotiate the material continuity between the donor as a subject and the donated samples and associated data as quasi-objects [85], that is, as less than subjects and more than objects. In this context, human-based biospecimens in ethics discussions enact an ongoing and heterogeneous oscillation between *bios* and *zoé*, and a dual understanding of life as qualified or non-qualified is unable to account for the diversity of such material-semiotic continuities and discontinuities.

In its mediating role, a social care robot, thought of as a mechanical arm to spoon-feed a person with a severe disability, is accompanied by specific forms of use – for example, a certain way of organizing the dining room, its tables or chairs – and is conceived to generate certain forms of life on the part of its users; caregivers and care-receivers will have different interactions and relations at mealtimes depending on whether or not we introduce the robot for feeding. Thus, if robots are understood as embedded in an assemblage of care relationships, the ethical debate will not only be focused on the artifact, because the artifact configures relations and shapes human lives and experiences. On this basis, and beyond an idea of technologies as something merely functional, new discussions on the conception of caring relationships and the value placed on care tasks appear. These discussions could not emerge from a dualistic interpretation of qualified or non-qualified care, nor from a dyadic relation among a subject (a human) and an object (a robot) entangled in the HRI paradigm.

The notion of life entangled in an ethical debate that is focused on the mediating rationality of technologies and technosystems is a notion of a precarious life, one that does not have an essentialist meaning but is an effect that appears from particular assemblages, engendered as part of the in-betweenness. In this regard, life appears in the continuities and discontinuities between donors, biospecimens, data, and

prospective users, as it does in the caring relationships sustained by patients, robots, care-givers and context–use procedures. In this sense, it is possible to go beyond the dominant dualistic interpretation and to find a multiplicity of manufactured lives. Such a conception also addresses challenges and ethical concerns that are not incorporated in the dominant bioethical debates, widening their scope.

5. Conclusions

We use the western dualistic notion of life, of *bios* and *zoé*, as an interpretative tool to approach the ethical discussions around biobanks and social robotics. In addition, we confront this dualistic tradition with the notion of mediation developed from STS. This perspective makes it possible for us to practise a context-sensitive form of ethics, in which normative questions are intrinsically connected to the rationalities out of which they emerge [5]. We show how contemporary sociotechnical processes manufacture life in different ways when different rationalities about artifacts and their relation to the world are in discussion in ethical debates. Our analysis shows how life is conceptualized differently, moving between a dominant rationality that entails a debate focused on a dualistic approach to relationships (doctor–patient or human–artifact) and that also implies a fragmented conception of life, and another rationality focused on the mediating role of technologies, that entails a distributed notion of life as a precarious effect that appears from particular assemblages.

Life is defined through the ethical debates around the use of particular health technologies. Thus, the notion of life is being manufactured in such debates. Paraphrasing Roosth [3], the tensions and conflicts of ethical controversies around artifacts and devices incarnate the accumulation of different conceptions of life mobilized in the practices of manufacturing life. Simultaneously, exploring these debates from diverse rationalities allows us to broaden the bioethical debate around healthcare and biomedical technologies. From this model, life could emerge in multiple forms, being the process of manufacturing life a conditioned but not determined process. Bioethical reflection becomes an action, entangled in the process of manufacturing life in technoscience, that assumes its ethical and political responsibility.

Declarations

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References

1. Loeb J (1904) The Recent Development of Biology. *Science* (80-) 20:777–786
2. Braidotti R (2013) *Lo Posthumano*, 2015th ed. Gedisa, Barcelona
3. Roosth S (2013) Biobricks and crocheted coral: Dispatches from the life sciences in the age of fabrication. *Sci Context* 26:153–171.
4. Agamben G (2004) *El uso de los cuerpos*. Homo Sacer, IV, 2. Pre-Textos, Valencia
5. Van De Poel I, Verbeek PP (2006) Ethics and engineering design. *Sci Technol Hum Values* 31:223–236.
6. Pinch TJ, Bijker WE (1984) The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology might Benefit Each Other. *Soc Stud Sci* 14:399–441.
7. Frith L (2012) Symbiotic Empirical Ethics: A Practical Methodology. *Bioethics* 26:198–206.
8. Arampatzis A, Papagiouvanni I, Anestakis D, Tsolaki M (2016) A Classification and Comparative Study of European Biobanks: an Analysis of Biobanking Activity and its

Contribution to Scientific Progress. Arch Med 8:1–10

9. Argudo-Portal V, Domènech M (2020) Publicaciones sobre los aspectos éticos, legales y sociales de los biobancos entre 2011-2018. Una revisión panorámica.[Ethical, Legal and Social Issues Publications on Biobanks 2011-2018. A Scoping Review]. Rev Esp Salud Pública 94:e1-e18.
10. Argudo-Portal V, Domènech M (2020) The reconfiguration of biobanks in Europe under the BBMRI-ERIC framework: towards global sharing nodes?. Life Sci Soc Policy 16:1-15.
11. Vallès-Peris N, Domènech M (2021) Two Turtles: Children and Autonomy in Participatory Technological Design.” In Delicado A, Crettaz von Roten F, Prpić K (eds) Communicating Science and Technology in Society. Springer Cham, pp 179–195.
12. Van Wynsberghe A (2015) Healthcare Robots. Ethics, Design and Implementation. Routledge, London and New York
13. Vallès-Peris N, Domènech M (2020) Roboticians’ Imaginaries of Robots for Care: The Radical Imaginary as a Tool for an Ethical Discussion. Eng Stud 12:157–176.
14. Vallès-Peris N, Angulo C, Domènech M (2018) Children’s Imaginaries of Human-Robot Interaction in Healthcare. Int J Environ Res Public Health 15:970–988.
15. Hoeyer K (2008) The ethics of research biobanking: A critical review of the literature. Biotechnol Genet Eng Rev 25:429–452.
16. Hilgartner S, Prainsack B, Hurlbut JB (2017) Ethics as Governance in Genomics and Beyond. In: The Handbook of Science and Technology Studies. The Handbook of Science and Technology Studies, pp 823–851
17. OECD (2009) OECD Guidelines on Human Biobanks and Genetic Research Databases. Paris
18. Rose N (2007) The Politics of Life Itself. Biomedicine, Power, and Subjectivity in the Twenty-First Century. Princeton University Press, Princeton and Oxford
19. Myskja BK, Nydal R, Myhr AI (2014) We have never been ELSI researchers – there is no need for a post-ELSI shift. Life Sci Soc Policy 10:1–17.
20. Balmer AS, Calvert J, Marris C, et al (2015) Taking Roles in Interdisciplinary Collaborations: Reflections on working in Post-ELSI Spaces. Sci Technol Stud 28:3–25
21. Argudo-Portal V, Domènech Mi (2020) Publicaciones sobre los aspectos éticos, legales y sociales de los biobancos entre 2011-2018. Una revisión panorámica.[Ethical, legal and social issues publications on biobanks 2011-2018. A scoping review]. Rev Esp Salud Publica 94:

22. Budimir D, Polašek O, Marušić A, et al (2011) Ethical aspects of human biobanks: A systematic review. *Croat Med J* 52:262–279.
23. Kaye J, Briceño Moraia L, Curren L, et al (2016) Consent for Biobanking: The Legal Frameworks of Countries in the BioSHaRE-EU Project. *Biopreserv Biobank* 14:195–200.
24. Bossert S, Kahrass H, Heinemeyer U, et al (2017) Participatory improvement of a template for informed consent documents in biobank research - Study results and methodological reflections. *BMC Med Ethics* 18:1–12.
25. Helgesson G (2012) In defense of broad consent. *Cambridge Q Healthc Ethics* 21:40–50.
26. Hofmann B, Solbak JHH, Holm S (2009) Consent to Biobank Research: One Size Fits All? In: Solbakk JH, Holm S, Hofmann B (eds) *The Ethics of Research Biobanking*. Springer US, Boston, MA
27. Caulfield T, Burningham S, Joly Y, et al (2014) A review of the key issues associated with the commercialization of biobanks. *J Law Biosci* 1:94–110.
28. Tutton R (2010) Biobanking: Social, Political and Ethical Aspects. In: *Encyclopedia of Life Sciences*. John Wiley & Sons, Ltd, Chichester, UK, pp 1–7
29. Verlinden M, Nys H, Ectors N, Huys I (2016) Qualitative study on custodianship of human biological material and data stored in biobanks. *BMC Med Ethics* 17:1–10.
30. Hawkins N (2015) Intellectual Property and Biobanks. In: Mascialzoni D (ed) *Ethics, Law, and Governance of Biobanking : National, European and International Approaches*. Springer, London, pp 39–52
31. Hayden C (2007) Taking as Giving : Bioscience , Exchange , and the Politics of Benefit-sharing. *Soc Stud Sci* 37:729–758.
32. Nicol D, Critchley C (2012) Benefit sharing and biobanking in Australia. *Public Underst Sci*.
33. Goldenberg A, Brothers K (2018) Misplaced Trust: Building Research Relationships in the Age of Biorepository Networks. *Am J Bioeth* 18:21–23.
34. Chalmers D, Nicol D, Kaye J, et al (2016) Has the biobank bubble burst? Withstanding the challenges for sustainable biobanking in the digital era. *BMC Med Ethics* 17:39.
35. Prainsack B (2019) Data Donation: How to Resist the iLevia. In: *The Ethics of Medical Data Donation*
36. Radin J (2013) Latent life: Concepts and practices of human tissue preservation in the

- International Biological Program. *Soc Stud Sci* 43:484–508.
37. International Society for Biological and Environmental Repositories (2018) Best Practices: Recommendations for Repositories
38. Pavone V, Goven J (2017) *Bioeconomies: Life, Technology, and Capital in the 21st Century*. Palgrave Macmillan, London
39. Waldby C (2009) Singapore Biopolis: Bare life in the city-state. *East Asian Sci Technol Soc* 3:367–383.
40. Tupasela A (2017) Populations as brands in medical research: placing genes on the global genetic atlas. *Biosocieties* 12:47–65.
41. Mitchell R, Waldby C (2010) National Biobanks: Clinical Labor, Risk Production, and the Creation of Biovalue. *Sci Technol Hum Values* 35:330–355.
42. Sharp LA (2000) THE COMMODIFICATION OF THE BODY AND ITS PARTS. *Annu Rev Anthr* 29:287–328
43. Landecker H (2007) *Culturing life: How cells became technologies*. Harvard University Press, Cambridge, MA
44. Hoeyer K (2017) Suspense: Reflections on the Cryopolitics of the Body. In: Radin J, Kowal E (eds) *Cryopolitics: Frozen Life in a Melting World*. The MIT Press, Cambridge, MA, pp 205–2014
45. Svendsen MN (2011) Articulating potentiality: Notes on the delineation of the blank figure in human embryonic stem cell research. *Cult Anthropol* 26:414–437.
46. Hoeyer K (2013) *Exchanging Human Bodily Material: Rethinking Bodies and Markets*. Springer, London
47. Bowker G (2005) *Memory practices in the Sciences*. The MIT Press, Cambridge
48. Puig de la Bellacasa M (2011) Matters of care in technoscience: assembling neglected things. *Soc Stud Sci* 41:85–106.
49. Stahl BC, Coeckelbergh M (2016) Ethics of healthcare robotics: Towards responsible research and innovation. *Rob Auton Syst* 86:152–161.
50. Nordmann A, Rip A (2009) Mind the gap revisited. *Nat Nanotechnol* 4:273–274.
51. van der Plas A, Smits M, Wehrmann C (2010) *Beyond Speculative Robot Ethics: A Vision Assessment Study on the Future of the Robotic Caretaker*. *Account Res* 17:299–315.

52. Grunwald A (2010) From Speculative Nanoethics to Explorative Philosophy of Nanotechnology. *Nanoethics* 4:91–101.
53. Leigh Anderson S, Anderson M (2015) Towards a Principle-Based Healthcare Agent. In: van Rysewyk SP, Pontier M (eds) *Machine Medical Ethics*. pp 67–78
54. Veruggio G (2005) The Birth of Roboethics. In: *IEEE International Conference on Robotics and Automation, Workshop on Roboethics*. pp 1–4
55. Sharkey A, Sharkey N (2011) Children, the elderly, and interactive robots: Anthropomorphism and deception in robot care and companionship. *IEEE Robot Autom Mag* 18:32–38.
56. Sparrow R, Sparrow L (2006) In the hands of machines? The future of aged care. *Minds Mach* 16:141–161.
57. Coeckelbergh M, Pop C, Simut R, et al (2016) A Survey of Expectations About the Role of Robots in Robot-Assisted Therapy for Children with ASD: Ethical Acceptability, Trust, Sociability, Appearance, and Attachment. *Sci Eng Ethics* 22:47–65.
58. Feil-Seifer BD, Matari MJ (2011) Socially Assistive Robotics. Ethical Issues Related to Technology. *Robot Autom Mag* 18:24–31.
59. Iosa M, Morone G, Cherubini A, Paolucci S (2016) The three laws of neurorobotics: A review on what neurorehabilitation robots should do for patients and clinicians. *J Med Biol Eng* 36:1–11.
60. van Wynsberghe A (2013) Designing Robots for Care: Care Centered Value-Sensitive Design. *Sci Eng Ethics* 19:407–433.
61. Coeckelbergh M (2009) Personal robots, appearance, and human good: A methodological reflection on roboethics. *Int J Soc Robot* 1:217–221.
62. Coeckelbergh M (2015) Artificial agents, good care, and modernity. *Theor Med Bioeth* 36:265–277.
63. Borenstein J, Pearson Y (2010) Robot caregivers: Harbingers of expanded freedom for all? *Ethics Inf Technol* 12:277–288.
64. European Commission (2018) Statement on Artificial Intelligence , Robotics and ‘ Autonomous ’ Systems. Publications Office of the European Union, Luxembourg
65. Fisher B, Tronto J (1990) Toward a Feminist Theory fo Caring. In: Abel EK, Nelson MK (eds) *Circles of Care: Work and Identity in Women’s Lives*. SUNY Press, Albany, pp 35–62
66. van Wynsberghe A, Li S (2019) <p>A paradigm shift for robot ethics: from HRI to human–

- robot–system interaction (HRSI)</p>. *Medicolegal Bioeth* Volume 9:11–21.
67. Belpaeme T, Baxter P, Greeff J De, et al (2013) Child-Robot Interaction : Perspectives and Challenges. In: *Lecture Notes in Artificial Intelligence*. Springer-Verlag Berlin, Berlin, pp 452–459
 68. Arnold T, Scheutz M (2017) The tactile ethics of soft robotics: Designing wisely for human-robot interaction. *Soft Robot* 4:81–87.
 69. Riek LD, Howard D (2014) A Code of Ethics for the Human-Robot Interaction Profession. *We Robot Conf* 1–10
 70. Bijker WE (2009) How is technology made?-That is the question! *Cambridge J Econ* 34:63–76.
 71. Bishop J, Jotterand F (2006) Bioethics as biopolitics. *J Med Philos* 31:205–212.
 72. Childress J, Beauchamp T (2001) *Principles of biomedical ethics*. Oxford University Press, New York
 73. Mol A (2008) *The logic of care. Health and the problem of Patient Choice*. Routledge, London and New York
 74. Rán M, Peixoto Júnior CA (2007) Vulnerability and bare life: Bioethics and biopolitics today. *Rev Saude Publica* 41:849–857.
 75. Trotter G (2006) Bioethics and deliberative democracy: Five warnings from hobbes. *J Med Philos* 31:235–250.
 76. Garrafa V, Porto D (2003) Intervention bioethics: A proposal for peripheral countries in a context of power and injustice. *Bioethics* 17:399–416.
 77. Feenberg A (2017) *Technosystem. The Social Life of Reason*. Harvard University Press, Cambridge, MA and London
 78. Verbeek P-P (2009) Let’s Make Things Better: A Reply to My Readers. *Hum Stud* 32:251–261.
 79. Latour B (1992) Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts. In: Bijker WE, Law J (eds) *Shaping Technology/Building Society: Studies in Sociotechnical Change*. MIT Press, Cambridge, pp 225–258
 80. Feenberg A (1999) *Questioning Technology*. Routledge, London and New York
 81. European Parliamentary Research Service (2019) *EU guidelines on ethics in artificial intelligence: Context and implementation*. 13
 82. Latour B (1999) *La esperanza de Pandora: ensayos sobre la realidad de los estudios de la ciencia*,

2010th ed. Gedisa, Barcelona

83. Serres M, Latour B (1995) *Conversations on Science, Culture, and Time*. University of Michigan Press
84. Tirado F, Domènech M (2005) Asociaciones heterogéneas y actantes: el giro postsocial de la Teoría del Actor-Red. *AIBR Rev Antropol Iberoam* 1–26
85. Serres M (1982) *The Parasite*. Johns Hopkins University Press, Baltimore
86. Kevles DJ (2015) Inventions, Yes; Nature, No: The Products-of-Nature Doctrine From the American Colonies to the U.S. Courts. *Perspect Sci* 23:13–34.

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