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Integrative Robo-Ethics: Uncovering Roboticists' Attitudes to Ethics and Moving Forward

Antonio Fleres[1] · **Louise Veling**[2] · **Frank Broz**[3] · **Luisa Damiano**[1]

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Abstract
This article proposes an integrative approach to robotics research, based on bringing interdisciplinarity into the lab. Such an approach will facilitate researchers across various fields in gaining a more nuanced understanding of technology, how it is developed, and its potential impacts. We describe how a philosopher spent time embedded in robotics labs in different European countries as part of an interdisciplinary team, gaining insights into their work and perspectives, including how robotics researchers view ethical issues related to robotics research. Focusing on issues raised by the EU Parliamentary Motion on Robotics, we developed a seminar and questionnaire that investigated questions of ethics, electronic personhood and the role of policy in research ethics. Our findings highlight that while robotics researchers care about the ethical implications of their work and support policy that addresses ethical concerns, they believe there to be significant misunderstandings in how policy makers view robotics and AI, as well as a lack of understanding of, and trust in, the role that experts outside of robotics can play in regulating robotics research effectively. We propose that an integrative approach can break down these misunderstandings by demystifying the way that knowledge is created across different fields.

Keywords Roboethics · Social robotics · Regulation

1 Introduction

The contemporary diffusion of robots in society is bringing issues related to robo-ethics from the margins to the center of the scientific debate, and is engaging a variety of disciplinary domains in ethical inquiries focused on the interaction between humans and robots, as well as wider societal concerns. The range of disciplines involved in these explorations is not limited to philosophy, usually considered as the disciplinary area to which ethics belongs. Increasingly, robotics and related fields of engineering have turned their attention to the ethical issues, to the extent that, it is to specialists in these areas that we owe the birth of robo-ethics, and the request for inter- and trans-disciplinary integration to support its development [1].

The importance of ethical issues related to robotics is amplified by the rapid development of areas such as human-robot interaction (HRI) and social robotics. The creation and commercialization of robots suitable for interaction with humans—an interaction that ranges from the operator-machine model to the social interaction model—is multiplying the roles that robotic artifacts can play in our social contexts. Alongside robotic tools, today there are robots built to be our 'social partners' [2,3]: robotic artifacts communicating with us through social signals compatible with our own, and designed to be integrated into our social spaces - both public and domestic environments—to perform socially meaningful tasks—e.g., training, coaching, educational and therapeutic mediation, assistance... [4]. The result is that contemporary robots can significantly impact a wide range of aspects of our life, extended from the way we think and

✉ Antonio Fleres
antoniopietrougo.fleres@studenti.iulm.it

Louise Veling
louise.veling@mu.ie

Frank Broz
f.broz@tudelft.nl

Luisa Damiano
luisa.damiano@iulm.it

[1] Logic and Philosophy of Science, International University of Languages and Media, Carlo Bo Street, Milan 20143, Italy

[2] Department of Anthropology, Maynooth University, Maynooth, County Kildare, Ireland

[3] Intelligent Systems, TU Delft, Van Mourik Broekmanweg 6, Delft 2628 XE, The Netherlands

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perform the production of goods and services to the way we conceive and conceptualize our sociality and our identity (e.g., [5–9].

This scenario calls for the intervention of ethical inquiry to ensure the "social sustainability" of robotics [10]. Additionally, it stimulates ethical inquiry into robots to engage in a process of reflection, aimed at overcoming limits and gaps characterizing its current expressions. Based on previous explorations (e.g., [9,11]), the primary insufficiencies affecting contemporary ethical investigation of robots can be schematically listed as follows.

1. *Lack of effective disciplinary integration.* On the one hand, researchers from disciplines that are traditionally concerned with ethical issues, from philosophy and other humanities to social science disciplines, are not necessarily well informed about robotics and HRI research. On the other hand, disciplines that, like robotics, have an in-depth knowledge of machines, design, and human-robot interaction, and attempt experimental investigations of their ethical dimensions, often lack expertise in ethics.
2. *Lack of an interdisciplinary body of knowledge about the innovation and transformation that robots generate at the societal level.* Currently the body of knowledge available on robots tends to focus on technical aspects. Explorations of the processes of production, integration, and social impact of robots that consider their multiple dimensions (e.g., anthropological, psychological, socio-cultural, political, ontological, epistemological dimensions), as well as their interconnections, are still in their infancy and as yet there is no agreed approach to carrying out ethical inquiry.
3. *"Technological determinism"*. As pointed out by [12], often the ethical debate tends to consider our social contexts as passive objects of transformative actions exercised by robots, and does not detect the dynamics of "mutual determination between society and robotics" in which the development of robots is inscribed [9,13].
4. *A resistance to the creation of ethical novelties.* There is a diffused tendency to address the emergent issues of robo-ethics, certainly novel, with pre-existing ethical approaches, developed to tackle completely different ethical issues. Indicative of this is the extensive use of ethical frameworks developed in the field of bioethics to address ethical issues related to robotics.
5. *The stagnation of the ethical debate*, which often appears polarized in the sterile alternative between "techno-enthusiasm" and "technophobia" - "technological utopianism and dystopian presentiment " [6].
6. On the side of specialized ethical research on robots, there is a *lack of engagement in the definition of guidelines for a viable development of robotics*. Many voices of specialized ethical research on robots—especially in areas of particular interest for ethical research, such as social robotics—opt for a general condemnation of this technology. They produce an ethical reflection which intervenes a posteriori to condemn a priori all the production of the target research in robotics, and which, hence, is destined to remain unheard [8,11].

Despite much research of interest, these limits and gaps imply that currently robo-ethic research appears still unprepared to fully meet the challenges imposed on our society and our future by the ongoing transformations related to the development and diffusion of robots.

By introducing artificial agents in our world, some of which are social agents, robotics is transforming our social contexts and ourselves in ways that we cannot predict and do not yet understand, since these transformations will partly cause and constitute the very process by which we will come to have a better understanding of our social world and its interdependencies with robotic technology [7]. Expanding our inquiry into the different aspects of the processes of ideation, creation, introduction, and acceptance of robots in our society; considering and interconnecting the points of view of all the actors involved in these processes; creating synergies among different research approaches and disciplines to enrich and broaden the perspective(s): all of this appears crucial to best address the issue of advancing our ethical understanding of, and our ethical engagement with, the impacts that the spread of robots is having and will have on us and our social world.

2 Background and Related Work

From within the domain of robotics, the ethics of robotics as well as its regulation has been addressed by Gianmarco Veruggio through the establishment of the field called "roboethics" [1]. All subsequent developments related to ethics and regulation of robotics, including the EU motion at the center of our study, can be seen as transformative re-elaborations of the original robo-ethic approach. Hence, to offer a general overview of these developments and the best framing of our study on the Delvaux' motion to the EU Parliament and its implications, we begin with the institution and first developments of robo-ethics 2.1. Subsequently, we briefly present the EU Draft Report (seen as a transformative development of robo-ethics) 2.2, the reception of the EU Draft Report 2.3, and current research approaches to ethics and regulation of robotics 2.4.

2.1 Robo-Ethics and Its Evolution

The root of the ethical debate on robotics is grounded in the First International Symposium of Roboethics, orga-

nized in Sanremo by the roboticist Gianmarco Veruggio in 2004 [14]. The aim of this symposium was to activate a debate among scholars and experts in robotics in order to address the specific ethical concerns raised by the development of robotics. Reflecting the multidisciplinary approach that Veruggio intended to adopt, the experts who joined the symposium came from different research areas, including engineering, law, sociology, anthropology, psychology, and philosophy, among others. The main results of the first International Symposium can be found in (1) the first public use of the term "roboethics" to address the branch of ethics which deal with ethical concerns related to robotics, and (2) the creation of a multidisciplinary community laying the foundation of the ethics of design, development and deployment of robots. This is the basis for subsequent research into ethics and the regulation of robotics.

In 2006 the first Roboethics Roadmap [15] was published. This document collected all the achievements reached within the Roboethics Atelier Project founded by EURON [15], among which: (a) a definition of robo-ethics that emphasizes the difference between robot-ethics—namely, a branch of ethics focusing on robots as ethical agents—and roboethics—i.e., a branch of ethics focusing on humans as ethical agents building and using robots; (b) the transdisciplinary nature of robo-ethics and a list of all the involved disciplines; (c) a set of ethical principles relevant for robo-ethics, based on ethical principles from bioethics and fundamental human rights; (d) the individuation of the main ethical concerns related to the different domains of robotics. In 2014, a further step in the development of roboethics was marked by the guidelines on regulating robotics [16], which were published in the context of the European project Robolaw. This European project was specifically dedicated to the emerging new technologies in robotics and their impact on ethics and the legal system, with an aim to provide both ethical and legal guidance for European national regulators. The Guidelines on Regulating Robotics are grounded in the scientific debate on robo-ethics begun by Veruggio, and develop it at a theoretical and legal/regulatory level, defining recommendations for policymakers. The core idea is that, due to the multitude of applications of robotics and their diversified impacts on the legal system, it is not possible to adopt a single strategy. While in certain cases it is possible and suitable to modify the existing legal framework, in other cases there may be the need to create a new regulation, tailored to the specific robotic application under consideration.

2.2 Delvaux' Motion to the EU Parliament

An attempt to further develop the ethical and regulative reflection on robotics introduced by Robolaw was realized by the European Committee on Legal Affairs, which, starting in 2016, produced several proposals to regulate robotics in the EU. They were presented in the form of a motion, submitted to the European Parliament on the 31th of May 2016, by Mady Delvaux [17]. Delvaux's motion to the European Parliament is called the *Draft Report on Civil Law Rules on Robotics*. Its goal was to establish regulations for the civil robotics sector for the whole European Union, and to provide an ethical framework valid in all member countries. The motion, which will be referred to in this article as the Draft Report, focuses on widespread problems within civil robotics and advances related solutions. The proposals from the Draft Report, which are particularly relevant for the purposes of this article, can be summarized as follows.

A *Creation of a New Legal status for robots, called Electronic Person.* This is one of the most relevant, controversial and discussed proposals from Delvaux's motion. Essentially, according to the motion, the new legal status of Electronic Person should be applied to the most sophisticated autonomous robots and bestow on them "rights and obligations." These robots should be autonomous enough to interact independently with third parties. According to the Committee on Legal Affairs, the Electronic Person would solve the problem of liability, because it would ascribe to robots the responsibility for their own actions, and an obligation to repay any damages they cause.

B *Creation of an EU Agency for Robotics and Artificial Intelligence.* The main aim of this agency will be to provide technical, ethical and regulatory expertise to support the relevant public actors in order to ensure a correct and well-informed response to the technological development in robotics. According to the proposal, The Agency for Robotics will be equipped with a proper budget and a staff of experts from different sectors related to robotics covering technical, ethical and legal aspects.

C *Definition of Smart Robots.* The Draft Report proposes a definition of "Smart Robot" based on four distinctive characteristics: (i) the ability to acquire autonomy through sensors and/or by exchanging data with its environment and analyzing those data; (ii) the ability to learn through experience and interaction; (iii) a robotic physical support; (iv) the ability to adapt its behaviors and actions to its environment. The last version of the Draft report introduced a fifth definitory feature: (v) the lack of biological life.

D *Registration of "Smart Robots".* The Draft Report proposes to register any "Smart Robot" in the EU, with the goal of tracing any smart robot in any of the EU countries, and facilitating the implementation of any future recommendation. The proposed registration would be based on the above mentioned definition of "Smart Robot."

E *Charter on Robotics.* This is the ethical core of the Draft Report, which proposes a common ethical framework for

all the EU countries. The Charter is composed of four parts: a Code of Conduct for robotics engineers, a Code for research Ethics Committees, a Licence for Designers, and a Licence for Users. The preamble of the Code of Conduct for robotics engineers proposes four high ethical principles, taken from bioethics, i.e., Beneficence, Non-maleficence, Autonomy and Justice [18], and a second series of principles specific for research in robotics. Schematically, these are: the respect for Fundamental rights, Precaution, Inclusiveness, Privacy, Accountability, Safety, Reversibility, and Maximization of benefits and Minimization of harm.

F *General Basic Income.* The Draft Report proposes a General Basic Income to contrast the effects that the developments of robotics and AI might have on the labor markets and employment in the EU markets.

The European Parliament voted on the proposals of the Draft Report on the 16th of February 2017. One of the most important outcomes of this vote was the approval of the controversial proposal for the creation of the legal status of Electronic Person for the most sophisticated autonomous robots.

2.3 The Reception of the EU Draft Report Within the Academic Debate

Since its submission, the Draft Report has activated debate within not only the political, but also the academic context. Here, we briefly illustrate the academic studies on the Draft Report which highlight interesting aspects particularly relevant for our study.

In 2018, the Alan Turing Institute [19] published a study on how different international institutions are approaching the ethical challenge of AI and robotics in society. This article proposed a comparison between the EU Draft Report, the US Report from the White House Office of Science and Technology Policy, and the UK Report from the House of Commons' Science and Technology Committee on AI. The study highlights that all the three documents have in common values such as transparency, accountability, and the "positive impact" on economy and society. The authors compare the three documents and state that, while the UK and the US document are more focused on AI, the EU Draft Report is the only one which focuses more on robotics and considers robotics and AI not as two different stand-alone technologies. According to the study, a specificity distinguishing the EU Draft Report is also that it proposes innovative solutions, such as the new legal status of Electronic Person for the most sophisticated robots and the Code of Conduct for Robotics.

In 2017, Natalie Nevejans published a study proposing a detailed analysis of the European Draft Report [20]. Considering the most innovative aspects of the Draft Report, Nevejans highlights that there are weak points related to several of its proposals, in particular: the Charter on Robotics, the role of Asimov's Laws, and the status of Electronic Person for robots. Considering the Charter on Robotics, Nevejans points out that terms like "Charter" and "Code of Conduct" are not legal terms and thus they do not have binding legal value. In addition, the Draft Report characterizes its Code of Conduct as voluntary in such a way that no one is obliged to follow it. About the three Asimov's Laws, Nevejans focuses on the Draft report's affirmation, according to which "until such time, if ever, that robots become or are made self-aware, Asimov's Laws must be regarded as being directed at the designers, producers, and operators of robots, since those laws cannot be converted into machine code". Nevejans states that Asimov's Laws are too vague and general to be used as real laws, since they have been created not for legal purposes, but as a literary tool. Concerning the creation of the new legal status of Electronic Person, Nevejans highlights that this solution for the liability of robots could be harmful for the rights of people and that there are more effective ways to compensate victims - for instance an insurance scheme for autonomous robots.

In 2018, after the vote of the European Parliament in favor of the creation of this new legal status for the most sophisticated robots, Nevejans started a petition to stop this process. She wrote an open letter to the former EU Commission Jean-Claude Juncker, in which she illustrated the reasons and risks of introducing such new legal status [21]. The open letter was signed by more than 250 jurists and researchers in robotics, ethics and other fields.

In 2017, Aída Ponce Del Castillo published a study on the Draft Report [22] which points out a number of critical issues.

1. *Concept of Robot* Underlying the importance of basing legislation and regulations on clear and neat terminology, Del Castillo suggests the European commission use in its proposal a more inclusive term than "robot", namely "artificial agent". According to Del Castillo, this new definition permits treatment of a wider range of problems related to robotics, because it includes other kinds of agents which operate together with, or are embedded in, robots, such as algorithms and various forms of AI.
2. *Attribution of Electronic Personhood to more sophisticated autonomous robots.* As Del Castillo points out, according to current legal theory, artificial agents can not have a legal personality. In general, a legal person has rights and obligations and the capacity to express moral values and be politically oriented. Del Castillo argues that currently there is no robot sophisticated enough to match these kinds of characteristics and thus attributing to contemporary robots the Electronic Person status is pointless.

Additionally, Del Castillo joins Nevejans in criticizing the Charter on Robotics on its voluntary character, since this implies that the Charter can not be used as a tool for governance.

2.4 Current Approaches to Ethics and Regulation of Robotics

Current approaches to ethics and regulation of robotics can be divided into two branches, respectively developed by 2.4.1 practitioners in robotics and by 2.4.2 interdisciplinary teams.

2.4.1 Current Approaches within Robotics

Among current approaches to roboethics from the field of robotics, we converge with current literature in considering particularly influential, and particularly relevant for our study, works by Sullins, Winfield, Bryson, and Riek and Howards.

In his scientific production dedicated to robo-ethics, Sullins [23,24] argues that roboticists are, in general, reluctant to deal with the ethics of robotics, despite the fact that robotics and engineering have a direct impact on society and on ethics as well. According to Sullins, ethics is relevant for engineers in robotics because it confronts them with intriguing problems, and provides them with the opportunity to have an active role in shaping the future of mankind. On this basis, he promotes the active contribution of engineers and specialists in robotics to issues related to robo-ethcs.

Winfield's work on ethics of robotics underlines that an ethical governance is required to build trust in robotics for the public, and that the voluntary character is a recurring problem in ethics standards and code of conducts [25,26]. According to Winfield, this issue is made relevant also by the fact that practitioners in robotics and AI pay increasing attention to the ethical aspects of their job, in the sense that, increasingly often, employees in AI companies demand their employers to adopt ethical standards. In a study developed with Bryson [27], Winfield has questioned whether standards can have a role in the promotion process of ethics in AI and robotics. One of the key issues discussed is the IEEE's standard P7001 on transparency, which analyzes the problem of transparency and identifies relevant stakeholders. Proactively, Bryson and Winfield propose a strategy to provide the right level of transparency for each category of stakeholders, and, on this basis, are optimistic about the path undertaken by IEEE towards AI and robotics for being beneficial for our human society.

Particularly interesting is the work from Riek and Howard, which proposes a code of ethics for human-robot interaction (HRI) practitioners [28]. The two researchers point out that the ethical issues related to robots are relevant for roboticists, and emphasize that HRI practitioners should take ownership of robot-ethics. In their work, the authors illustrate several ethical challenges in the HRI research field (e.g., the deployment of therapeutic robotics for vulnerable people, assistive robotics for helping disabled people, as well as the gender stereotyping of robots' traits and roles) and, to address them, they propose "Guiding principles" for a Core of Ethics in HRI, focusing on human dignity, legal and social aspects, and design.

2.4.2 Current Interdisciplinary Approaches

Even though engineers and researchers in robotics increasingly work on ethics of robotics, a number of contemporary analyses denounce a decoupling between robotics and ethics. On the basis of the detection of weak points in the approaches to roboethics developed by specialists in engineering and roboticists, they propose interdisciplinary approaches.

In a recent study, Zawieska [29] refers the decoupling between ethics and robotics to two main factors: the fact that the majority of the engineers consider ethical concerns not relevant enough in robotics research, and the lack in these specialists' educational background of training in ethics. According to Zawieska, on these grounds engineers tend to look at ethics as a field unrelated to theirs, which risks devaluing humans.

In one of their studies, Forch-Villaronga and colleagues have dealt with the EU Draft report and other regulatory standards for robotics, proposing their approach to ethical, legal and social (ELS) issues [30]. The proposed approach is based on a series of multiple workshops with a number of objectives such as collecting different opinions from different stakeholders; identifying ELS concerns about social robotics; enabling discussion on ELS issues; and providing a comprehensive roadmap of issues in robotics research. During the course of those workshops, organizers and participants discussed and identified at least five challenges and several sub-challenges. The main five challenges are (a) privacy and security; (b) legal uncertainty; (c) autonomy and agency of robot technologies; (d) lack of employment of humans; (e) replacement of human interactions. Furthermore, Forch-Villaronga and colleagues state that those five challenges are linked together by two overarching challenges, defined as meta-challenges. They are respectively Uncertainty and Responsibility. This study's main contribution is identifying and addressing the main areas of ELS issues in social robotics. In addition, the scholars point out the limitations of their approach. They identify three main limits: first, they have approached those issues broadly instead of deeply; second, their workshops were explanatory and the comparison between them was problematic; last, due to the rapid development of robotics new ELS issues can arise constantly.

In Seibt's article dedicated to "Integrative social robotics" [31], the decoupling between ethics and robotics is analyzed with regard to social robotics and traced back to a series of

factors: (a) engineers do not have a proper academic training on ethical norms; (b) researchers in the Humanities that would be able to provide information on ethical and social norms are not informed on HRI and (c) the current capabilities of social robots; (d) the normatively relevant facts of HRI are not available until the description problem is solved; (e) the temporally relevant facts are missing; (f) the speed of the technological development in relation to the empirical research dissemination; (g) the arising new responsibilities cannot just be blamed on roboticists. In addition, Seibt states that the current paradigm of research, production, design, and development of social robotics is mostly independent from cultural research. On one hand, there are engineers and roboticists who have no specific education on ethics and cultural values of a society. On the other hand, decisions on social robotics are taken by legislators and policy makers, usually supported by ethics councils, which have no specific knowledge of robotics and emerging new technologies. The expertise of those councils come from fields such as philosophy, ethics, religion, and the political sciences. In order to address some of these concerns, Seibt has proposed an "Integrative Social Robotics" [31], or ISR, an interdisciplinary research approach to participatory and ethically-focused design. ISR is aimed at the development of "culturally-sustaining" or "value-enhancing" robots [32]. Her ISR approach to social robotics is proposed as an alternative paradigm to the current one, capable of passing from mere multidisciplinarity and collaboration to interdisciplinarity. In this sense social robotics will turn into a transdisciplinary area of research, resolving the problems stated above. However, there is little guidance on how to approach such an interdisciplinary or transdisciplinary approach to research.

3 Research Approach

In this paper, we describe an approach to interdisciplinary research in the ethics of robotics based on an emergent, immersive and collaborative study in which a philosophy researcher was embedded in the robotics research community in multiple labs within Europe. During this process, reflection on these experiences informed the design of an interactive seminar used to share the researcher's discipline-specific knowledge and collect data from participants through a structured questionnaire. In this section, we focus on (3.1) the overall research approach, (3.2) the fieldwork locations, and (3.3) the questionnaire and data collection.

3.1 An Embedded Approach

The embedded approach adopted in our study aimed at integrating an expert from the fields of philosophy and ethics into robotics research communities, and thus activating positive exchanges of knowledge about the robo-ethic issues raised by the EU Draft Report. An important feature of this approach is that it was immersive, allowing knowledge exchange outside of formal training activities or academic seminars and enabling the main researcher to gain insight into the practices of robotics research through prolonged interaction with practitioners. We argue that this experience of the environments where and how research is conducted in other fields is crucial in building understanding across disciplines.

3.1.1 Robo-Ethics in the Lab

The main researcher of this study has a background in Philosophy and Human Science, with a focus on Contemporary Philosophy. At the time of the data collection, he was writing a thesis on the European Draft Report focusing on the ethical impacts of robotics. As well as ongoing immersion and observation within the participating labs, different methods were used by the main investigator to exchange knowledge and collect data about the practices and attitudes of researchers in robotics during his embedding. The first method was training activities and research-related conversations with an interdisciplinary supervision team of local hosts and remote supervisors. The second method was engaging in informal conversations with researchers who were working at the labs. Those conversations were spontaneously born during daily life activities in the lab. The third method consisted in participation in daily research activities, such as taking part in experiments, conference volunteering, attending talks, and taking part in various stages of the design process. These various methods of interaction all contributed to the development of the format and content of the final method, an interactive seminar using a questionnaire for data collection (to be described in Sects. 3.3 and 3.4).

3.1.2 Fieldwork

Here, we briefly illustrate how fieldwork at the participating laboratories was structured. Basically two types of visit were carried out:

Traineeships During a long-term immersion in a lab, the main investigator took part in regular lab activities as a trainee, such as weekly group meetings, individual meetings with researchers, and presence inside the lab for a period of three-four months. He was embedded as part of the researching team, sharing the same working space and attending to the same activities. During these long-term visits, the researcher was able to experience the practical work of robotics, how researchers from different research fields cooperate, how experiments in social robotics are designed and conducted, and what are the ethical issues during experimental phases.

Table 1 Schedule and type of fieldwork

Laboratory	Period	Type
British Lab	01-03-2017 to 31-05-2017	Traineeship
French Lab	01-04-2018 to 13-07-2018	Traineeship
Italian Lab 1	1-10-2019	Site visit
Italian Lab 2	26-02-2019	Site visit

In addition, the main investigator took part as participant in experiments in social robotics.

Site Visits During the single-day site visits to a lab, the main investigator gave the interactive seminar, introducing the Draft Report to the audience. Subsequently a discussion on the seminar's topic took place. Following this, the participants filled out their questionnaires for data collection. Finally, the hosting researcher led the main investigator for a tour of the lab. During the tours, the main investigator was able to interact with robotics researchers about their personal research topics and practice. Generally, the site visits were primarily focused on gathering additional data from the robotics community through the seminar and questionnaire.

3.2 Locations

In this section, we briefly summarize all the visited labs and which activities were conducted in each location, as well as insights gained. See Table 1 for the visit timings.

British Lab The first field site visited was a robotics lab in the UK for a traineeship period of three months (see Table 1). This lab specialized in social robotics. During this time, the researcher was able to experience the practical work of robotics, which contrasted strongly with the more fantastical discourses that are often presented by media and informed by science fiction but also present in many academic papers. This period of time spent at the lab helped the investigator to develop a deep experience of robotics and robots. In addition, the researcher took part in experiments in HRI and social robotics. This gave the researcher insights into how HRI research works.

Additionally, the researcher gained insight into how the robotics reseach community engages with topics on ethics and regulation of robotics. Knowledge gaps, particularly in relation to the Draft Report and its contents, highlighted the need for knowledge exchange in order to enable the topics raised by the report to be discussed in detail. This led to the development of the interactive seminar and questionnaire format for data collection.

French Lab The second traineeship was a four month period in a research department in France which specializes in research on design of social robotics (see Table 1). The researcher administered the interactive seminar and questionnaire to employees of a local social robotics company as well as researchers within the department during this visit. The reseacher also was involved in educational activities on ethics and the design of robotics within the department on topics related to his thesis research.

Italian Labs The main investigator made one day site visits to two different robotics laboratories in Italy (see Table 1). At these labs, the researcher interacted with roboticists, and delivered the seminar.

Italian Lab 1 During this visit, the researcher had the chance to interact with lab members who were researching humanoid robotics. The main method of interaction was the interactive seminar and data collection by questionnaire. All the attendees were part of the lab. When the data collection was completed, the investigator toured various labs of the hosting institution. During the tour, the researcher had the chance to have informal conversations with researchers from the labs and gather more information.

Italian Lab 2 The visit at the "Italian Lab 2" was a one day visit in the midst of February 2019. The investigator was hosted by the head professor of the lab. The main area of investigation of the lab was robotics and IT engineering. The researcher interacted mainly with MSc and PhD Students. The seminar was presented to all participants, and questionnaire data was collected after the seminar discussion. The attendees were a mix of students from the courses held by the host professor and some researchers of the lab. No informal conversations followed the data collection by questionnaire

3.3 Seminars

The fourth method of interaction was giving an interactive seminar involving a presentation by the researcher followed by a discussion and collection of data by questionnaire. The main topic of the seminar was the EU Draft Report on Civil Robotics, which was central to this study for a number of reasons. Firstly, it allowed investigation of the level of engagement of robotics researchers with the policy-making process, and between robotics and roboethics. Secondly, it provided a forum for knowledge exchange between the investigator and roboticists in terms of relevant ethical concerns in robotics. This facilitated reflection on the draft and enabled better understanding of the point of view of the roboticist community.

Informal discussions at the initial traineeship highlighted the necessity of knowledge exchange prior to discussion of the ethical issues related to the Draft report. Many experts in robotics were not aware of the report or well-informed about its contents. The presentation gave information about the background of the Draft Report and specific information on the Draft itself, with special regard for the Electronic Person and Code of Conduct. In addition, the presentation raised some weak points of the Draft Report from a philo-

sophical perspective. Presentation of the Charter On Robotics appendix triggered relevant feedback from the roboticist community about the research in social robotics which can be used to improve the regulation or to strengthen some positions about robo-ethics. This information was presented as an interactive seminar to ensure that the same information about the Draft report was provided to all of the study participants prior to completing the questionnaire. The questionnaire's format allowed for information to be collected in a standardized manner across sites while also capturing open-ended reflection on the topics covered. A detailed description of the questionnaire and the collected data will be treated further in our paper.

3.4 Questionnaire

This section gives more detailed information about the creation process and the contents of the questionnaire, the analysis of the answers, and participants.

3.4.1 Creation

Here, we briefly illustrate the creation of the questionnaire. The visit to the UK robotics lab is particularly relevant because it was the first visit of the project and the one where the questionnaire was conceived and written. The experience of being embedded in a robotics lab and gaining first-hand experience of social robotics research provided the base level of knowledge for the subsequent questionnaire design on the role of researchers in robotics and their ethical concerns on their activities. The team who conceived the questionnaire was composed by the main investigator plus a computer scientist and a philosopher of science. The questions were developed based on the Draft Report, robo-ethics and the research activities in the lab.

3.4.2 Structure

The questionnaire gathered both qualitative and quantitative data, using open-end and multiple-choice questions. The questionnaire is composed of four different parts, as well as an initial section gathering demographic information:

A The first part focuses on the Motion to the European parliament, and its goal is to collect information about what the practitioners in robotics know about the political aspects of robotics. This section aimed to investigate the extent to which roboticists pay attention to what is going on in this field.
B The second part concerns the proposed code of conduct. This part focuses on the ethical aspect of the Draft Report. The aim of this section is to gather criticism and new ideas about the proposed Code based on the direct experience from practitioners as well as to involve these professionals in the creation process of their own code of conduct.
C The third part is focused on robo-ethics. This aimed to gather information about the general idea that practitioners in robotics have about this new branch of ethics.
D The fourth and last section of the questionnaire is based on the temporal aspects of robotics, in particular the future of robotics and its implications for human society.

The full text of the questionnaire is available at the appendix.

3.4.3 Participants

The selected groups of participants were drawn from robotics laboratories connected to universities and institutions selected across the European continent. Each group was composed of an average of 15 people (with 57 participants in total). Almost all participants described themselves as "researchers in robotics", and most are researchers in a STEM field, with a strong majority of people educated in robotics, engineering and computer science. The rest of the participants described themselves as educated in the fields of: design, cognitive sciences, communications, and neurology. Demographic information collected includes: the level of education, the field of study, and whether they consider themselves researchers in robotics. No information about age, gender, or ethnic background was collected from the participants.

3.4.4 Data Collection and Analysis

The data collection was done using paper questionnaires. Once the questionnaires were completed, answers were archived for subsequent analysis. Data was fully anonymized and each participant was assigned a pseudonym. Qualitative data was collated and manually coded to identify themes and patterns. A 'grounded' approach was taken to the analysis of the qualitative data, in which the research question emerges inductively from the empirical data [2]. All the answers were categorized into specific themes and sub-themes. Themes were developed through an iterative, collaborative coding process. The resulting insights were identified and developed through discussion. Direct quotations later in the article are presented with psuedonyms.

The closed answer questions were treated as quantitative, categorical data. These results serve to show the general opinions of the participants, which can give additional context to the discussion of identified themes. Key results will be presented in the following section as supplements to the qualitative analysis. We chose to combine participants at all sites into a single group because the relatively small number of

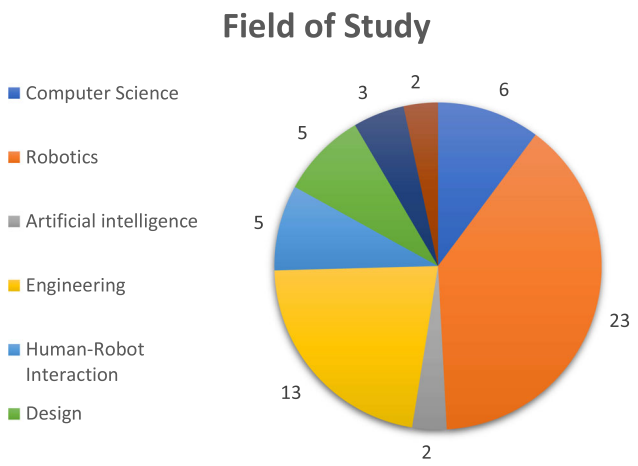

Fig. 1 The field of study of participants

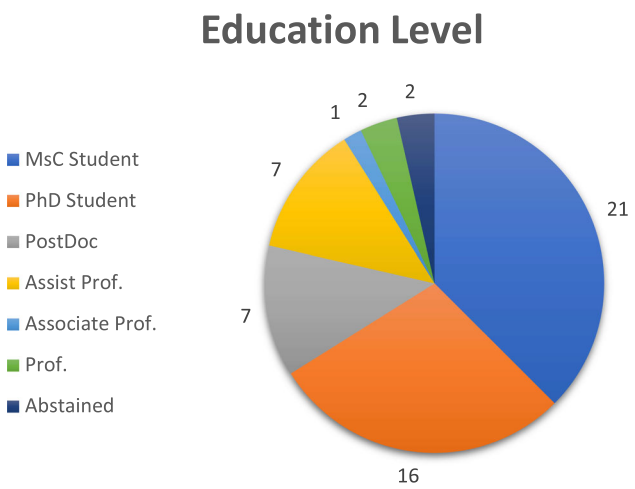

Fig. 2 The education level of participants

responses at each site makes it difficult to draw reliable conclusions about differences among them.

4 Results

4.1 Demographics

The opening section focused on the background of the participant, in order to collect demographic information, such as level and field of study. The self-identified fields of study were simplified for the sake of visualization (combining "industrial design" into the category "design", for example). The resulting distribution across all sites highlights that robotics is a field that contains multiple disciplines (see Fig 1). 75 percent of the participants responded "yes" to the question, "Do you consider yourself a robotics researcher?"

The full range of academic levels were present among our participants, ranging from MSc students up to full professors (see Fig 2). The distribution of the levels is a good representation of the academic structure.

4.2 Quantitative Results

Prior knowledge about the Draft Report was mixed (see Fig 3). The pie chart depicts that the majority of experts in robotics had no knowledge of the Draft report prior our seminar. 56 percent of attendees have answered they have no heard about the Draft Report. only the 42 percent have heard before about the topic of our seminar.

To the question who has liability for the behavior of a robot, 62 percent of researchers answered that it is a mix of co-responsibilities. Only 15 percent answered that it was their responsibility more than the responsibility of other parties involved (see Fig 4).

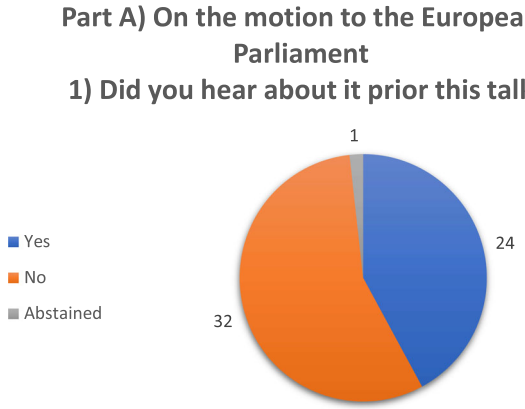

Fig. 3 Responses as to whether researchers were familiar with the draft report prior to the seminar

Concerning whether they have, during their career, run into ethical dilemmas related to the development of robots, most roboticists' answered no. Only approximately one third of the participants answered yes (see Fig 5).

The results of the question of whether social robots could pose a real risk to humans was answered negatively by the majority of the participants, however a large number of them affirmed that this could be a possibility (Fig 6). We found that 39 percent of the roboticists we interviewed seemed not to recognise the risks in social robotics. 47 percent of participants agree that social robots represent a real risk for humans. 14 percent of them abstained from expressing themselves on this topic.

4.3 Qualitative Results

4.3.1 Electronic Personhood

In this study, we take an integrative approach to the problem of robo-ethics, paying particular attention to the proposal

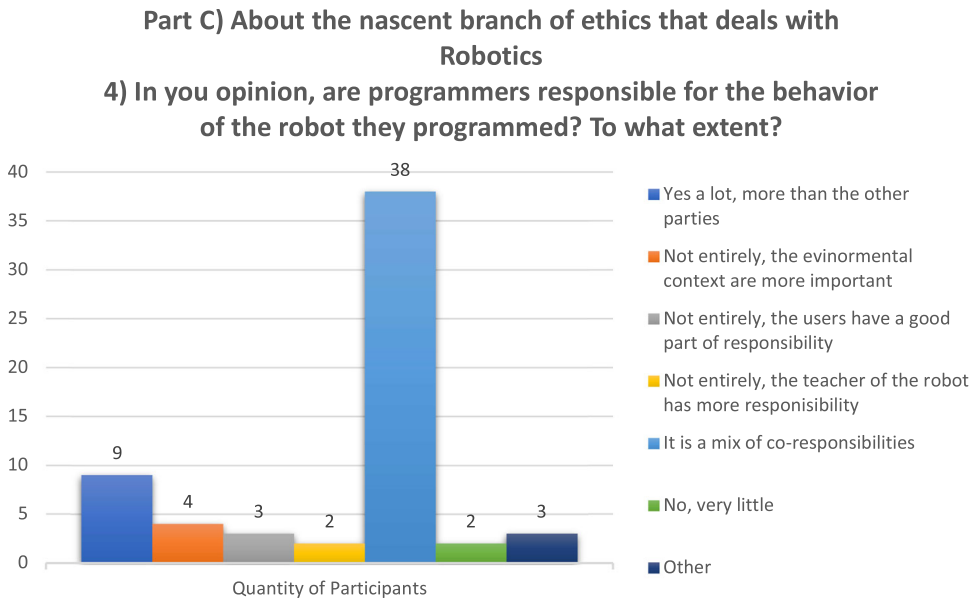

Fig. 4 Closed form responses about the level of responsibility programmers have for robot behavior

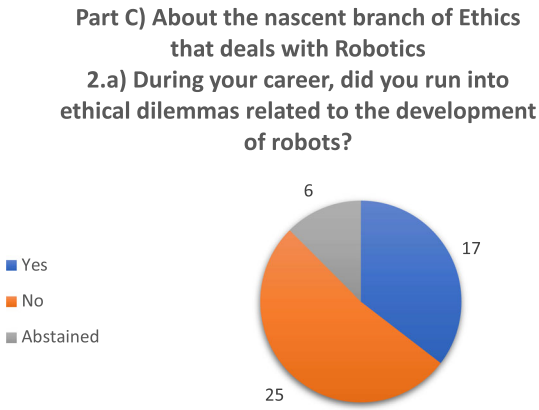

Fig. 5 Yes/no responses to whether participants have encountered ethical dilemmas during their research

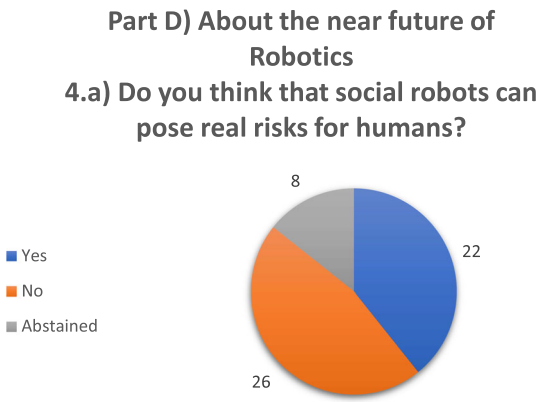

Fig. 6 Responses as to whether social robots pose a risk to humans

for 'electronic personhood' in the Draft Report. In the questionnaire, the overwhelming majority of respondents were strongly opposed to the creation of the legal status of the Electronic Person, yet few gave a specific explanation as to why.

For some, it was deemed simply unnecessary. For others, the topic of electronic personhood might one day be appropriate, but only if their capabilities were improved. Even the minority of participants who express some support for the concept believe that it is not a priority:

> "I support the initiative but I believe the charters are too general and the definition of an electronic person raises a lot of questions." (John).

4.3.2 The Role of Ethics

Concerning the questions about the role of ethics in robotics research we categorized the corresponding responses into four distinct positions among roboticists concerning the relationship between the robotics field and ethics. These positions were (a) there is no real risk when integrating social robots into society and ethics is not relevant to robotics research, (b) ethical considerations need to be addressed in order for the robot to be accepted by users, (c) a consideration of ethics is essential to the field, and (d) ethical considerations should be taken into account because humans should in general behave ethically. Each of these positions will be illustrated with concrete exemplary responses below.

A **There are no real risks and ethics are not relevant**
In the perception of these roboticists, robotics research poses few risks and ethics is not required. There are several different reasons why some roboticists believe that

robots do not pose a real risk for humans. For some, this is because of the limitations of the current capability of robotics. They do, however, acknowledge that it might represent a risk in the future:

"At the moment this risk is unreal. In the near future, in my opinion, robotics couldn't create any real risks. I trust in the capability of robotics programmers and teachers." (Rita)
"Not in the near future, at least not more than any other object or computer. If robots will become "social" in an intentional sense, this may cause in principle issues and risks." (Tom)

Similarly, some respondents believe that robots will become a risk only when they leave the lab:

"If social robots will be developed by industries then their behaviors will be regulated by the law, if they will remain a research field then they could never be a real risk for humans." (Erik).

Many participants, while acknowledging that there are some ethical risks, argued that they are no different from other technologies. Some compared robots to other heavy machinery, such as cars and trucks:

"If robotics is carried out as a supporting discipline and not a substitute for human beings, there can be no risks other than the common ones deriving from the use of any machinery." (Henry)
"Compared to an automated 36-tons truck? A trading bot on the internet that manages the money of millions of people? A physical robot that can only talk to people could pose a risk compared to that?"(Yvonne)
"There are risks everywhere, so social robots can be dangerous, such as using knives or cars. The problem is what are the risks and how to avoid them without rejecting social robotics. It is also outwork to help people understand risks and accept them. (Marc).
"Yes, just as any complex machine can be dangerous. I think that the potential dangers due to hacking and invasion of privacy are both immediate and under acknowledged." (Rachel)

Others respondents, also likening social robots to other technologies, compared the risks of robots to that of a computer or a smartphone:

"It's not really the robots themselves that would pose a real problem but the use that can be made of it. I believe people will be tempted to share their intimacy with robots like they've already doing with their smartphones, because they don't realize they are not talking to a close friend but with a machine that possibly could share this data with its computers or anyone else." (Ryan)
"We are already in an era in which we constantly interact with all kinds of software devices, are part of our daily lives and their use and production must be regulated." (Henry)
"The user has to be opportunely trained, and they should know the potential risks and the behavior to take in specific situations. Without training, each artificial product exposes humans to risks. The smartphones, for example, induce dependency; the users must be always educated to a conscious use of the artificial products." (Christian)

For these respondents, smartphones represent a threat to users in terms of privacy, social isolation and dependency. According to these respondents, training for users is required in order to achieve an ethical and respectful use of robotics (and also other related technologies). Similarly, some respondents believe that the risks can be mitigated through good design:

"If carefully designed less. Any system comes with real risks. We should value the benefits VS the risks and see if social robotics worth it. ;)" (Mary)

B *Ethical considerations in order to increase user acceptance by the user*
The second position is represented by the idea that ethics is necessary to increase the acceptance of social robots. This reasoning looks at ethics and ethical considerations on risk and issues on social robotics only as a tool to attain the acceptance/approval by society. According to Oliver, "Ethical conclusions must be addressed to ensure user's acceptance of the technology and for the technology to be really useful..."

C *Ethical considerations are essential to the field*
Many researchers state that every human context needs a form of ethical regulation in order to protect people. For some, the inclusion of ethical considerations in the field is a matter of urgency:

'Ethics is looked upon as the key for a peaceful cohabitation between humans and robots and because the presence of robots increases radically over the last period of time the development of ethics of robotics is a discipline which needs to be boosted. (Mary)
"Because it's a brand new field and it consists in putting self-thinking objects in our daily life. So as we have reflection on human ethics, we need to have reflection on robot ethics." (David)

Others pointed out specific ethical implications of their work. A key concern with regard to social robots is their potential for increasing the social isolation of users. They reason that the pleasant and friendly social interaction

with social robots could be so satisfying that their users might prefer to interact with them instead with other humans:

"Social robotics destroy the need for us to socialize with each other and it destroys the curiosity we have towards people. With that, our social circle might just solely constitute the user and the robot. Robots should serve as a functional tool, not a replacement of mankind." (Victoria)
"Kids may accustom themselves to robotic friends and find human friends annoying! A bad program could make a robot harassing." (Ellie)
"If it's done the wrong way then it could be very harmful. For example leading to a completely lonely and individual society." (David)

However, other respondents point out that social robots might in fact help to connect people, rather than isolate them:

"As I often have to explain to people outside of our community, social robots are not there to replace humans but rather to connect them (such as with robots at home) help them to improve communication with others (such as in autism treatment) and give them additional support (such as with elderly who often feel lonely)." (John)

Another common concern voiced by respondents is that of both privacy and security, which are often considered together. Robotics and AI researchers seem to be very sensitive with regard to these topics. In terms of privacy, respondents expressed many times concerns about the illicit or illegal use of data:

"In my opinion, politics should regulate the development of robotics in order to manage ethical rules, indeed it will guarantee human's safety and privacy." (Rita);
"Because when robots interact with people, they are recording data from them. If it is not used with permission, it could violate people's privacy." (Martin)
"Considering the robots we have now and the proposals for the next future I believe that the highest risk comes from intentional measure of the robots by humans (eg. To gather private information)" (Paul)

Additionally, respondents had safety concerns related to modification:

"For safety reasons, if you modified something that did not work, and the robot, for example, causes injury for someone, it can be dangerous. As if you change some parts of your car and then drive in a public place." (Adam)

D *Ethics as "the right thing" to do*

Among these respondents who believe ethics should be a part of the robotics field are those for whom it is simply "the right thing" to do.

"In my personal opinion, each context in which humans are involved needs to have ethical rules and behaviors for protecting their rights." (Christian);
"Medical robots, social robots, robots in the factory all share an impact on the daily lives of people, therefore they should follow some ethical considerations." (Gillian);
"Because this is about ethics, they are not voluntary in other sectors, like social or biological science, so why should robotics research be allowed to be unethical?" (Jason);
"This is not law, this is some kind of deontology thingy. You won't get fined or arrested for not applying it! It is all common sense ethics, I don't see how you could disagree. If you do, there must be something wrong with you?" (Eleonore);
"Ethics is about how people and robots could live happily. As (robots) are more and more present in our lives and IA ethics should be top priority." (Mary).

4.3.3 Roboticists' Perceptions of Policymakers' Understandings

From the point of view of many roboticists, policymakers are not well informed about robotics and AI in particular, with regard to the technical aspects. The majority of the respondents think that a good knowledge of new technologies is necessary in order to create efficient regulation.

'Politics should be concerned because robots will probably be a "necessity" in the future. But to control it, it is necessary to understand/know the robotics field. I don't think politics has the knowledge to orient it for now." (Mark).
'They should know about the things they are funding. They could participate in orienting development in robotics.' (Daniel)
'They don't seem knowledgeable enough to make such decisions (Anne)
'Politics and society be aware of the actual possibilities and risks of any novel technology, as the introduction of new tools always affect society at large. The attempt of "orienting" cannot be efficacious without knowledge or driven by fear.' (Paul)

There are some participants whose responses revealed very negative attitudes toward policymakers, accusing them of being informed primarily by science fiction:

"Because they [...] don't understand anything. They base themselves on SCIENCE-FICTION to take deci-

sions that will have effects on real life. This will be, at best, useless, at worst dangerous'. (Yvonne)

This type of response reveals a distrust that many in the field of robotics have towards politicians. A number of respondents revealed a negative view of politics and policy-makers whether they are related to robotics or not, such as a perception that politicians inhibit innovation and progress:

"If politicians use this as an opportunity to regulate unethical use of robotics (drones in the military etc) then yes, since this would be a beneficial thing. Otherwise, if by attempting to police the use of any robots (with badly defined code of conducts) they just inhibit research, this is not progressive nor sustainable" (Vincent).
"Because political views should not influence scientific development." (Alan)
"I don't believe politics is the best place to orient a priori any kind of research. Ethical and Deontological committees should be independent + laws & regulations happen afterwards (= politics' role)." (Vincent)
"... as any research activities, the work should to be independent from each kind of influence for conducting to realistic and good result" (Chistian)
"The government can be involved in funding robotics research, but I think robotics should be regulated in the same way as any other technology or industry". (Charles)

Some participants argue that it would be more efficient if the regulation of robotics and deontological code for practitioners is produced independently by those in the field.

For many respondents, a lack of understanding by policy-makers is reflected in the Charter on Robotics. A common viewpoint is that the code is too vague to be efficient:

'I think that the actual code is just the root of what it should be. It deserves more details about what is the "best interest", for example for who? For what? Spreading capitalism and democracy?" (Greg)
'Who is going to make sure the code is respected? Who is going to interpret it? Does "mean no harm" include killing terrorist? It's too vague. Therefore it's probably just going to be interpreted as the best interest of the authority in charge, and be useless.' (Yvonne);
"The code is too general: what does the right of privacy comprise of what is the definition of transparency? It's a good start, but I believe especially the previous two points should be more addressed in discussion with the community of lawyers, researchers and engineers." (John)
"The definitions used in the code are very vague and open to interpretation. Instead of having proposals about introducing e-personality, the definition of what constitutes intelligent behavior in robots should be vastly improved and regulations concerning the responsible designers/owners of the robots should be introduces" (Sheila).

Yvonne raises good questions about the function of the code and the risk of being used for the interest of the current authority. However, these responses also reveal a misunderstanding on behalf of the roboticist participants of the process through which policy is developed, such as the role of ethical principles as they are used in the Charter of Robotics. The proposed Code of Conduct is using an approach based on ethical principles, which to the roboticists appears as 'vague' or 'too general' because the nature of ethical principles is theoretical. Thus, we find shortcomings on both sides: roboticists do not have an understanding of ethics to accurately interpret the code, while, on the other hand the code is missing relevant information in order to explain how principles should be applied in a real situation

Not all of the respondents expressed a negative attitude to the role of politics and policy makers in robotics research. Caroline and Matt acknowledge the role of protecting privacy, particularly for vulnerable groups, such as children and teenagers:

'Although some proper politics may restrict the development of robotics, it protects more humanity benefits from the research. For example, privacy and potential risk interacting with a smart robot, for example, for children or teenagers.' (Caroline)
"In my opinion, politics should regulate the development of robotics in order to manage ethical rules, indeed it allows to guarantee human's safety and privacy." (Matt).

Other respondents express their concern about the economic implication for society and politics is viewed as a possible solution. Some participants address the disruptive effects of technology on society and support the idea that politics has a role in solving these problems. It seems, for them, good technology is not enough, it should be followed by good regulation and laws:

"Robotics, and automation in general, has a significant social impact. Business' short term interest will tend to automate to vehicle costs, to the detriment of the population's [...]. At scale, this loss can be disastrous, and it is up to the politics to prevent that and protect the population." (Eleonore)
"Because it's modifying the complete economy and how humans behave to each other. As every technology, it can be used with good or bad intentions but

with robots the impact is really huge. So it has to be controlled by laws." (David).

Furthermore, what is also notable in some of the responses is a desire to cooperate with experts from other disciplines, such as 'the community of lawyers, researchers and engineers' mentioned by John, to address these problems. Similarly, other roboticists suggested that a close collaboration between robotics and policy might improve the way in which technology can be matched to societal needs:

'Research and policy should work together to share future technology to respond to social needs and concerns.' (Oliver)
'With "good" laws, I don't see why it could be impossible to integrate them. They will be excellent so we as humans will have more time to enjoy ourselves.' (Mark)

Mark is not addressing any moral dimension, instead he argues that laws should be created in a proper way, not in the interest of few but on the basis of what the society needs.

Jennifer proposes ways in which the perceived lack of knowledge of policymakers might be addressed, for example, by ensuring that a team of experts on robotics could be called on to support policy makers in developing policy to regulate a robot's usage and development. Many others agree with this idea:

"In order to make sure that any technology develops correctly and integrates into the world reality such as economy, social, ethics... It is necessary that politics pays attention to the development of robotics, to ensure it is going in the right way." (Denise)
'Politicians should, with the help of experts, regulate as far as ethical aspects are concerned.' (Francis)

These comments indicate that there is an appetite among roboticists to approach regulation in an integrative way.

5 Discussion

The intention of this paper was to shed light on the positions and attitudes of roboticists towards ethical questions and the integration of ethics into their work and to propose a more integrative approach to developing a deeper understanding between disciplines. The trigger for our research was the EU Parliamentary Motion on Robotics put forward by Mady Delvaux in 2016. One of the key points of this motion is the legal status of robots and whether social robots should be given an Electronic Personhood. This initiated strong debates in the ethical and philosophical research community and posed the question of how roboticists are affected by such ethical notions.

In order to answer this question, we applied an approach that allowed a researcher from the fields of the humanities to experience social robotics research first-hand and to integrate into robotics research groups over longer periods of time in different European robotics research labs. At the end of each of the research visits, we administered a questionnaire that consisted of questions concerning various aspects of the attitudes and points of view of the resident roboticists in the visited labs.

The collected demographic data of our sample illustrates that the field of social robotics is inherently interdisciplinary, albeit the majority of disciplines being firmly located in the fields of STEM education. Despite their interdisciplinary background, 75 percent of our participants identified themselves as roboticists. We also evaluated the academic level of our participants. This showed that we had the full range of academic levels present, ranging from Msc student to full professor. The distribution of the levels in our sample mirrors the academic structure and is therefore representative to the different academic levels that can be found in a university research lab.

The questionnaire contained both open and closed questions. The closed questions could be answered either with yes, no or abstained. The first question of our questionnaire is about whether the practitioners knew about the existence of the Draft Report prior to the seminar. Only 42 percent of participants heard about this document before our seminar. 56% of practitioners have never heard about it before and 2% abstained from answering. This shows that, in general, practitioners do not necessarily pay attention to what is happening in related fields to robotics, especially from a regulatory/ethics perspective. We have found that, in general, most practitioners in robotics pay attention solely to the technical aspects of robotics. On the question of whether they have ever encountered an ethical dilemma related to their work, only 33% answered positively, while 63% replied that they had never encountered ethical dilemmas, and 4% abstained. This reveals that, despite the majority reporting that they had not encountered moral dilemmas during their work or research activities, a third of the participants did say they encountered ethical dilemmas during their work or know about people in the field who have encountered them. Considering that moral dilemmas must be exceptions, we can state that the population of practitioners in robotics meets a high rate of ethical concerns on their professional path. These results can be supported by the data from the open-end questions which follow the same trend. We categorized the open-end questions into questions about the motion of electronic personhood, the role of ethics for the researchers, and the roboticists' perceptions of policy makers' understanding.

5.1 Electronic Personhood

The participants very clearly answered the question about the introduction of electronic personhood status. The vast majority of them are opposed to the idea and think it is unnecessary. This shows that the community of roboticists is aware that there does not exist, and will not exist in the near future, such a kind of robot that matches the description of the electronic person, thus this new legal status is pointless. Secondly, it shows that the community considers this kind of initiative strongly influenced by biases from non-scientific environments, for instance science-fiction. These kinds of biases can be led far away from the real problems of current robotics. Finally, due what illustrated above, the robotics community is aware that the current ethical problems in robotics are other than this. On a higher level, this can be a good demonstration of what ethicists and policy makers should avoid in the ethical debate or in the regulatory process of robotics.

5.2 The Four Positions on Ethics of Robots

The responses about the role of ethics can be categorized into: (a) no risk, (b) need only for acceptability for users, (c) real risk, and (d) ethics should be applied because humans should in general behave ethically. The no risk responses can be summarized as follows. Their arguments are:

1. Robots are not able enough to be a threat
2. Others will do the regulation
3. Robots are the same like any other technology (pose similar dangers)
   (a) cars can kill too
   (b) mobile phones pose threat to society
4. Lack of awareness of specific qualities of social robots

This shows that some practitioners in robotics do recognize the potential risks but they apply a "Normalization" strategy, thus the risks are viewed as something which occurs normally or it is unavoidable. In addition, it reveals their idea that the risks are more or less the same as other kinds of technologies, for instance any other kind of machinery. Lastly, it shows an attitude to postpone risks due to robotics in the future, thus these risks are irrelevant for our society and due to the stage of development of robotics nowadays. Consequently, ethical reflection on the risks of robotics is unnecessary.

Clearly this result shows a link to the question if social robots can bring risks for humans, if robots will become more "social" thus there will be risk. This reasoning has a weak point, in order to avoid risks for humans, social robots should remain in labs, isolated from users. In conclusion, it seems that this answer accepts the idea that there are some risks if social robots will interact socially with humans.

About the justification of the comparison between robots and other kinds of machinery considered "dangerous". This kind of reasoning considers robots completely harmless and not able to impact negatively on the user's life. This answer seems naive because it observes the question too superficially without considering many variables and it is in contrast with the majority of answers which have addressed several different categories of threat from social robotics. All these answers describe the position where robotic devices bring with them more or less the same risks than other kinds of devices, thus it seems that practitioners want to normalize the risks which came out from robots.

The practitioners highlight that if social robotics is not developed in the correct way it can contribute to increasing the level of isolation of the people. This means two different things: (a) practitioners are conscious about the impact on the sociability of the users; (b) it is possible to develop social robotics which pay attention to preserve the social skills of users.

This viewpoint underlines the good impact on society of social robotics, like being helpful for people with special needs. In detail, it depicts the example of the older person who can feel less lonely. The other side of the example is that the older person is alone anyway, also with the company of a social robot and her relatives can just rely on the social robot and so let the elder be isolated.

Practitioners underline that robotics is exposed to similar problems as other kinds of technologies. Hence there is an evident similarity with other kinds of devices like computers and smartphones, but, as we have illustrated before in this paper, robotics introduces the possibility that a device can have an automated body and move cameras and microphones in the human's environment.

The acceptability responses can be summarized as follows. Roboethics reflection can be considered useful in order to increase the acceptance of robots in human society. The main argument here is more about the utility which ethics of robotics can represent for the robotics field. This illustrates that the robotics community is aware that in general people look at robotics with suspicion and mistrust. Secondly, the roboethics is seen as something functional for the acceptance of robotics in society. According to them, ethics is not about some ethical concerns on risks for humans but is about the building process of trust in robotics. On the other hand, we have a position about the ethical risks which considers them relevant and worthy of discussion.

The real risk responses can be summarized as follows.

1. Isolation of individual from society;
2. Problems for privacy;
3. Risk due to user errors;

4. Unregulated military use.

According to our results, it can be assumed because they well address ethical concerns linked to robotics applications. In addition this illustrates that robo-ethics has an important role in the design process of social robots, and subsequently it plays a role in building a human society which keeps in account the integration of social robots in it. This re-evaluates the role of robo-ethics as a discipline and the relevance for our society. This addresses the willingness of a large part of the roboticist community to recognize the importance of cooperation with researchers from the ethics/philosophy field. Finally, it is worth mentioning that social robotics practitioners condemn the unregulated use of robots on the battlefield.

The ethics in general responses can be summed up as: ethics should apply because ethics should be applied because humans should in general behave ethically. This illustrates that a portion of the practitioners in the robotics community is aware about the importance of ethics in society nowadays. They recognize the importance of being ethically regulated and they make comparisons between their field and other professions already ethically regulated by codes of conducts. Finally, it shows that the practitioners in robotics do not think their profession is not properly ethically regulated. Therefore it seems that they think their profession, in some way, does not have enough dignity to be ethically regulated as the other professional categories.

In addition, these results about the four illustrated positions raised new questions; for example, why are there four different positions? This question highlights that we are still in a phase of the development of roboethics which experts do not have an holistic perspective on it, but it is still sectorial. Other considerations need to be made about the idea of a compulsory code of conduct for practitioners in robotics. As our results show, this idea is mostly shared among practitioners in robotics and seems that a compulsory Code of Conduct can be easily accepted by the majority of them.

5.3 Attitudes Toward Policy Making Process

Further we evaluated our participants' perception of the policy making process. They can be summarized in two different main perceptions: negative attitudes toward the process of policy making and positive attitudes toward the process of policy making. The first shows that practitioners in robotics perceived a deep disengagement between robotics and the policy making field. Their answers address some external influences on the policy making field, especially coming from Sci-Fi suggestions. In addition, they support the idea that the policy making process inhibits innovation and progression. The second illustrates that politics is viewed as a place where it is possible to solve the ethical and social issues which came from robotics.

This reveals there is the need for closer cooperation between robotics and the ethics/regulatory field and they recognize that as the place where it is possible to solve social issues generated by robotics. Finally, those two different perspectives show that the community of practitioners in robotics is not homogeneous but fragmented. This is a sign that the robotics community is composed of a population with various ideas on ethical and political backgrounds. This could be considered an enrichment of the ethical perspective on robotics but at the same time ethicists have to take into account the differences between different social environments in order to develop a roboethics able to fit perfectly the specific ethical needs of every background.

While many roboticists feel that policy-makers do not understand robotics, it is clear that on the contrary there are misunderstandings by roboticists about the role of ethics, policy-makers and regulation. Practitioners in robotics are not trained enough on regulation and ethics, thus they have some difficulties to understand and interpret information from those sectors. Some background in ethics would be helpful for their education.

Although many roboticists view politics as potentially stifling innovation, it is clear that they have a realistic and nuanced understanding of potential risks, and a desire to mitigate them.

5.4 Limits and Potential

The embedded approach taken in this study to issues in roboethics has both potential and limits. Its potential consists in: creating interdisciplinary and transdisciplinary research environments, avoiding the stagnation of the debate on ethics of robotics, boosting knowledge sharing between fields of research that are not directly linked, avoiding the disengagement between robotics and ethical reflection, sensitizing the engineering community to ethical and social concerns regarding emerging technologies, spreading the acceptance of robotics (and more in general new technology) among people who work in both the humanities or regulatory fields, as well as helping ethicists to rid themselves of biases from cultural/sci-fi environments. Last but not least, the embedded approach gives the chance to practitioners in robotics to express their opinions and join the debate on their professional ethics. On a higher level, the embedded approach to roboethics can be useful to fulfill the need for cooperation and collaboration. In fact, during the visiting experience practitioners in robotics had the chance to deepen their knowledge on ethics and helped the ethicist to have a practical understanding how robots operate. From this perspective, the embedded approach seems to boost the sharing of knowledge and to increase the interdisciplinarity of research on robots.

On the other hand, the embedded approach has several limitations. It can be difficult for researchers from the humanities to gain access to robotics laboratories. Some roboticists may be reluctant or unprepared to interact with researchers from non-technical fields of research. There is also still much disengagement between ethics in research and the regulatory and policy processes, with an assumption that the communication is unidirectional from ethics and philosophy to Robotics.

6 Conclusion

This study highlights attitudes of the community of robotics researchers towards ethics and regulation, including problems in how they are communicated about across disciplines. It shows that the current approach to ethical regulation of robotics in the EU is disengaged from the research field. The majority of practitioners in robotics are not aware of those processes and when they are made aware, they often disagree with the proposals. Despite this, it is clear that experts in robotics are willing to be engaged with a compulsory code of conduct for their profession, as in other recognized professions. While there are various different positions espoused by robotics researchers, many practitioners in robotics are open to an ethical regulation of their activities and also express a need for more ethics in their field.

On a methodological level, this study reveals that an embedded approach to ethical issues in robotics can be fruitful in multiple senses. Firstly, it helps both ethicists and philosophers to be bonded with the object of their questioning. Many of them are reluctant or biased about new technologies. On the other hand, practitioners in robotics can have the chance to increase their knowledge outside of the STEM field. In addition they can deepen their awareness of the impacts of robots on society. Therefore our approach can be a solution to several issues in roboethics:

1. Lack of effective disciplinary integration - this approach requires physical and active presence in the lab, thus it boosts the chance of being integrated and to cooperate more deeply
2. The stagnation of the ethical debate on robotics - as we affirmed before, the debate on ethics of robots is polarized, this approach can give the right perspective on robots to ethicists, helping them to not fall in technophobic or techno-enthusiastic perspectives.
3. Lack of an interdisciplinary body of knowledge about the innovation and transformation that robots generate at the societal level—the embedded approach can help to study the human-robot interactions under a non-technical aspect because it embeds in labs researchers from the humanities field.
4. Lack of engagement in the definition of guidelines for a viable development of robotics—our approach allows researchers in philosophy to deal directly with robotics research, this helps to invert the trend from a posteriori to a priori reflection or robotics.
5. 'Technological determinism'—the embedded approach leads us out of this form of determinism because this helps in understanding the dynamism of the social interaction between humans and robots.

An embedded approach to roboethics can be a new solution to several criticalities which affect the roboethics debate. In our opinion, this embedded approach can lead to a deeper consideration of the ethical dimension of social robotics. This can be considered a first step toward a new way to think about the role of the ethical reflection and the ethicist, regarding robotics, and more in general other emerging technologies.

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Data Availibility Statement Data is not available upon request as consent to make the dataset publicly available was not obtained from participants.

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

Ethics Approval Ethics approval for this study was granted by the Ethics Committee of Heriot-Watt Unversity.

Consent All participants in this study provided informed consent for their responses to be used in publications resulting from this research.

Appendix

Questionnaire

- Field of study:.....
- Level: (msc student, phd student, postdoc, assist prof, associate prof, prof) *add a checkbox next to
- each of these options*
- Do you consider yourself a robotics researcher? yes/no

Part A: About the Motion to European Parliament

1. Did you hear about it prior to this talk?

2. In your opinion, is this motion useful?
3.a Should politics be concerned with the development of robotics and try to orient it?
3.b Why?

Part B: About the Code of Conduct

1. Do you feel the need for a Code of Conduct?
2. Do you think that a code of conduct could slow down the development of robotics?
3. Do you think that the code proposed by the motion can be improved?
4. What would you add to or remove from it?

5.a The Code of Conduct should be voluntary. Do you agree with this decision or not?
5.b Why?

Part C: About the Nascent Branch of Ethics that Deals with Robotics

1.a Do you consider ethical reflection on robotics to be useful?
1.b Why?
2.a During your career, did you run into ethical dilemmas related to the development of robots?
2.b If yes, what ethical dilemmas did you meet?
3. In your opinion, is the ethical issue of liability an important problem?
4. In your opinion, are programmers responsible for the behaviour of the robot they programmed? To what extent?

Part D: About the Near Future of Robotics

1.a Probably in the future, the users of robots will be able to modify their robots. Is this possibility suitable from the point of view of roboticists?
1.b What are possible advantages and/or disadvantages of user modification?
2. What is your point of view on the possibility of creating a human society that integrates robots?
3. How do you imagine the evolution of robotics in the near future?

4.a Do you think that social robots can pose real risks for humans?
4.b Why?

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