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*Citation for published version (APA):*

Brandão, M., Mansouri, M., & Magnusson, M. (2022). Editorial: Responsible Robotics. *Frontiers in Robotics and AI*, 9.

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# Editorial: Responsible Robotics

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2 **Keywords:** Robotics, Responsible Innovation, Responsible Robotics, Trustworthy Robotics, Critical Robotics, AI and Society, Robot  
3 **Ethics**

## RESPONSIBLE AI AND ROBOTICS

4 Recent work in both academia, industry, and journalism has brought widespread attention to various  
5 kinds of harmful impact that AI can have on society. These are very often concentrated on marginalized  
6 social groups. AI algorithms may unintentionally reinforce social prejudice Bolukbasi et al. (2016) and  
7 biased conceptions of gender Adams and Loideáin (2019); Hamidi et al. (2018), race Sweeney (2013), age  
8 Rosales and Fernández-Ardèvol (2019) or disabilities Guo et al. (2020), they may lead to unfair access  
9 to opportunities Dastin (2018); Angwin et al. (2016), discriminatory pricing practices Bar-Gill (2019);  
10 Hannak et al. (2014), etc. Recent work has also shown that many seemingly technical issues in machine  
11 learning are actually socio-technical. For example: the over-fitting of machine learning models, the choice  
12 of dataset or learning objective, and other aspects of learning may lead to algorithms performing poorly  
13 on unrepresented or unmodeled groups of people Brandao (2019); Barocas et al. (2019); Buolamwini  
14 and Gebru (2018). A growing community of Fairness, Accountability, Transparency, and Ethics of AI<sup>1</sup> is  
15 now approaching these topics from a socio-technical point-of-view, in order to identify, understand, and  
16 alleviate such issues.

17 Robotics, as a technology focused on automation and intelligent behavior, also abounds in similar ethical  
18 and social issues that need to be identified, characterized, and considered in design. While many of the  
19 same problems with AI will also be present in robotics, the physical nature of robotics raises new aspects  
20 of the social and ethical nature of these technologies. As one example: models that are considerably less  
21 accurate on certain groups of people can lead to physical safety differentials Brandao (2019), where robots  
22 or autonomous vehicles using those models are more likely to collide with those groups. Additionally, there  
23 are physical safety concerns with respect to surgical and other medical robots Yang et al. (2017); Ficuciello  
24 et al. (2019), as well as concerns of physical and political security—not least concerning autonomous  
25 weapon systems and the dual-use of robot technologies like autonomous cars and drones Brundage et al.  
26 (2018); Sparrow (2007).

27 The physical design and visual appearance of robots also introduce new aspects to responsible  
28 development. For example, people's moral evaluation of robot decisions can be affected by whether

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<sup>1</sup> Example venues: ACM Conference on Fairness, Accountability, and Transparency (FAccT), AAAI/ACM Conference on Artificial Intelligence, Ethics, and Society (AIES)

29 the robot is more or less human-like Malle et al. (2016), the design of robots in a care setting affects  
30 caregivers and caretakers van Wynsberghe (2021); Kubota et al. (2021), the choice of sensors, measurements  
31 and motion has an impact of privacy Calo (2011); Eick and Antón (2020); Luo et al. (2020), and the ethics  
32 of deception takes on new shape Danaher (2020).

33 The robotics community has been discussing ethics for long<sup>2</sup>. Recent workshops have also started  
34 bringing attention to philosophical problems in robotics<sup>3</sup> and issues such as bias<sup>4</sup> and transparency<sup>5</sup>.  
35 These efforts share a common goal of developing robotics technologies responsibly—they are part of  
36 “Responsible Robotics” or “Trustworthy Robotics”.

37 A similar effort on “Critical Robotics” Serholt et al. (2021) has focused on questioning current practices  
38 in robotics research. These range from how older adults are represented in HRI Burema (2021) and ethical  
39 issues in education robots Serholt et al. (2017), to normative dimensions of speech used by researchers  
40 Brandao (2021), their technological optimism Šabanović (2010) and the influence of their social background  
41 in research directions Forsythe (2001); Šabanović (2010).

## THIS RESEARCH TOPIC

42 This research topic gathers a diverse set of articles on Responsible Robotics. They range from user  
43 studies and philosophical inquiry, to modeling, algorithmic, and governance methods. Our goal when  
44 organizing this research topic was exactly to join various approaches in a single edition—to allow for  
45 greater multidisciplinary exchange under the common mission of Responsible Robotics. We believe that  
46 Responsible Robotics should focus both on *identifying* social and ethical issues, and on *designing* methods  
47 to account for (and alleviate) such issues—thus the focus of this edition on both understanding and *acting*  
48 on social and ethical issues.

49 Two articles in the research topic are focused on eliciting social and ethical issues *from users and*  
50 *stakeholders*. Lutz and Tamò-Larrioux (2021) investigate privacy concerns of lay users and their impact on  
51 technology use intentions, when using social robots that are either privacy-friendly or privacy-invasive (e.g.  
52 listen to conversations, share data with third parties). Colombino et al. (2021) use ethnographic studies,  
53 interviews and futuristic autobiographies to identify organizational principles, potential roles, and ethical  
54 design considerations for a robot that collaborates with disabled employees.

55 Three articles are more focused on methods, or socio-technical solutions to ethical problems in robotics.  
56 Webb et al. (2021), for example, focus on methods for conducting investigations of accidents involving  
57 humans and robots. In particular, they propose and preliminarily evaluate a role-play-based methodology  
58 for investigating accidents, and to evaluate the testimonies that humans can give in forensic investigations  
59 of such accidents. Hurtado et al. (2021) focus on issues of harmful social bias in robot learning and how  
60 they could be detected and alleviated. Namely, they show through various examples how social robot  
61 navigation techniques that mimic human behavior may lead to harmful behavior, such as higher intrusion  
62 of personal space or longer waiting times for some groups compared to others. Winfield et al. (2021)  
63 focus on issues of transparency from a governance perspective. They describe a new draft standard on  
64 transparency for autonomous systems, with several contributions such as transparency levels, measurability,  
65 stakeholders, and example-based guidance on using the draft standard.

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<sup>2</sup> ICRA 2007/2009/2011 workshops on Roboethics, ICRA 2014 workshop on “Robotics and Military Applications”

<sup>3</sup> Robophilosophy Conference

<sup>4</sup> ICRA 2019 workshops on “Bias-sensitizing robot behaviours” and “Unlearning biases in robot design”

<sup>5</sup> HRI 2022 workshop on “Fairness and Transparency in HRI”, ICRA 2020 workshop “Against robot dystopias”

66 We then dive into philosophical inquiry and frameworks for robot ethics. Rhim et al. (2021) combine work  
67 in moral philosophy and psychology to propose a model that explains human decision-making in moral  
68 dilemmas involving autonomous vehicles. Pirni et al. (2021) consider aspects of autonomy and vulnerability  
69 in the ethics of designing care robots. And Kuipers (2022) argues that AI and robotics technologies rely  
70 heavily on over-simplified models, and that the widespread use of such models can lead to the erosion of  
71 trust and cooperation effectiveness. The article can serve as an argument for why more attention should be  
72 given to the *modeling* of complex socio-technical factors in AI/robotics.

73 Finally, two articles in the research topic dive into issues of jobs and economics in robotics and automation.  
74 Studley (2021) argues that we should consider how robotics impacts global supply chains, international  
75 development, and global economic disparities. Kyvik Nordås and Klügl (2021) then use modeling to  
76 understand the uptake of automation technologies and its relationship with unemployment and engineering,  
77 consultancy, and manufacturing jobs. The authors use this analysis to suggest an automation policy focus  
78 on user costs and education.

79 We believe that the contributions collected in this special issue can be relevant to roboticists, AI  
80 practitioners, policy makers and any other stakeholders concerned with the societal impacts of AI and  
81 robotics. We hope this special issue will stimulate future work on responsible robotics.

82 We end with an important remark. While the abundance of social and ethical issues raised in this  
83 editorial and this Research Topic might feel overwhelming or hopeless, we believe the opposite is the case.  
84 Responsible Robotics is about clearly identifying potential issues, because by doing so it is also possible  
85 to work towards responsible methods that mitigate them. This ultimately facilitates the application of  
86 robotics and AI in ways that increase safety, efficiency, and wellbeing in many areas of life: transportation,  
87 healthcare, work life, just to name a few.

## AUTHOR CONTRIBUTIONS

88 All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it  
89 for publication.

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