SHOULD CANADA ADOPT SOME OF THE PROPOSALS LISTED IN THE FEBRUARY 2017 EUROPEAN PARLIAMENT RESOLUTION ON CIVIL LAW RULES ON ROBOTICS?

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I. Introduction

Today, the level of artificial intelligence ("AI")[1] available to robotic systems to provide "cognitive" services and information to humans depends in great part on their access to more and more powerful computers, like quantum computers, and machine learning algorithms[2] encoded in their processing systems of reasoning. This prompts them without being explicitly programmed to gather, analyze and process both structured and unstructured Big Data[3] at

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1. AI is a computerized system that exhibits behaviour that requires intelligence and acts rationally as humans. For instance, intelligence software in machines like computers or embodied in all types of robots that achieve goals via learning, perception and reasoning. It is not a single technology but rather a collection of technologies to be applied to specific tasks that are performed by humans. There are three types of AI.
    1. Narrow: technologies not necessarily embodied in a robot that can perform tasks as well or better than humans and address specific application areas such as playing chess, self-driving vehicles or image recognition.
    2. General or strong: where the system exhibits the intelligence of humans across the full range of human cognitive tasks, and
    3. Super: where the machine or robot surpasses human intellectual capacity in every domain of interest. This possibility is only likely to occur in the very long term.
2. A process or set of rules to be followed in calculations or other problem-solving operations.
3. Data sets that are so large or complex that traditional data processing software is inadequate to deal with them. Data are the raw material of the information age. They codify the past and do not invent the future.

digital speed, generally culled from the Internet, e-commerce, social media, science and other sources via various sensors.[4] It enables them to analyze these data, learn from them and decide which information is relevant to reveal patterns, trends, associations, personal conduct, etc., most often related to human behaviour like consumer preferences, in order to solve a particular problem or predict the future behaviour of a particular person or group of persons. As a result, their beneficiaries, whether industry, business, investment fund managers, stock brokers, government or nonprofit organizations, etc., are able to better perform as well as better plan their short, medium- and long-term strategies.

However, the strategic foresight or decision-making capabilities acquired by the robotic systems through machine learning (and eventually by deep learning[5]) could be susceptible to errors yielding unintended or offensive results when, for example, there may be too much information to interpret clearly or when the raw data are inaccurate or intentionally fraudulent.

In an era in which the world's most valuable resource is no longer oil, but data, these predictive models will increasingly be relied upon to run our institutions, businesses and lives.[6] Data are to this century what oil was to the last one: a driver of growth and change. They simultaneously promise benefits yet also perils as signs of the data economy are everywhere but its shape is only now becoming clear. As such, data now demand new approaches from regulators to confront their excesses and ensure that their extractors, refiners, valuators and beneficiaries are held accountable. The danger is that without controls, Big Data could increase inequality and endanger democracy.[7]

4. Some companies specialize as data providers by offering valuable data-driven analytical solutions customized for the specific needs of their clients. Note that often algorithms don't fully understand what they are looking at. This makes image recognition unsecure.
5. Deep learning uses artificial neural networks inspired by the biology of neurons in human brains. For instance, image recognition via deep learning is better than humans are able to do.
6. "The World's Most Valuable Resource Is No Longer Oil, But Data", *The Economist* (May 6, 2017).
7. See Cathy O'Neil, *Weapons of Math Destruction* (New York: Crown, 2016). On April 27, 2016, the European Union reformed its Regulation on the Protection of Natural Persons with regard to the processing of personal data and on the free movement of such data. See General Data Protection Regulation (EU) 2016/679 in O.J.E.U. L 119/1. It will come into force on May 25, 2018. In Canada at the federal level, see *Personal Information Protection and Electronic Documents Act*, S.C. 2000, c. 5 as am. by *Digital Privacy Act*, S.C. 2015, c. 32 and *Privacy Act*, R.S.C. 1985, c. P-21, which are

In the past the conversation has centered around the quality of the algorithms that crunch the data and the talent hired to develop them. Yet today in the brave new world of AI, algorithms are becoming more self-teaching and thus results are more dependent upon the freshness and quality of the data they are fed rather than their human developers.

As these algorithms become increasingly autonomous, able to tap directly into the data, theoretically separating decision making from human control, the ethical issues they raise require a quick adaptation of existing Canadian legislation to this new reality.

Already countries such as Estonia,[8] the U.S.,[9] Japan,[10] China[11] and South Korea[12] have taken or are contemplating taking some legislative action with respect to AI and robotics before machines become fully autonomous and as intelligent as humans.

So far, the most comprehensive work on regulating artificial intelligence and robotics in the future is being done by the European Union, whose Parliament on February 16, 2017 adopted a Resolution[13] on these topics with recommendations to the Commission on Civil Law Rules on Robotics.

It is suggested that some of its proposals which address the status of robots and ethical principles applicable to them should be

not as comprehensive as the EU Regulation and should be revised using it as a model. The same can be said of the privacy legislation in force in the provinces, which is substantially similar to the federal legislation.

8. Estonia's economic ministry is working on legislation that will grant AI and robots legal status that would make them "robot agents" and not merely someone's property. See Tallinn info (October 11, 2017), at https://www.gotallinn.info/news/1824336.
9. Executive Office of the President, "Artificial Intelligence, Automation, and the Economy, 2016"; Executive Office of the President, National Science and Technology Council. Committee on Technology, Preparing for the Future of Artificial Intelligence (October 2016).
10. Japanese Ministry of Economy, Trade and Industry, "New Robot Strategy" (October 2, 2016), at www.meti.go.jp/english/press/2015/pdf/0123_01b.pdf.
11. China State Council, "Next Generation Artificial Intelligence Development Plan" (July 20, 2017), to be implemented by a new AI Plan Promotion Office within the Ministry of Science and Technology. See Elsa Kania, "China's Artificial Intelligence Revolution", *The Diplomat*, https://thediplomat.com/2017/07chinas-artificial-intelligence-revolution.
12. Ministry of Science, ICT and Future Planning, *Regulatory Reform Plan* (February 16, 2017), see ICT Legal Update, March 2017, Summary of Regulatory Reform Plan of AI, VR and Fintech, www.yulchon.com. See also Ministry of Trade, Industry and Energy, *Intelligent Robots Development and Distribution Act*, no. 13744, Jan. 6, 2014.
13. E.U. Text Adopted, P8 TA (2017) 0051. For a detailed summary of the historical background see Rafal Manko, European Parliament Research Service, 2017.

consulted before any legislative action on artificial intelligence and robotics is taken by Canada at the different levels of government.

II. The History of the European Union Resolution on Principles and Rules on Artificial Intelligence and Robotics

In January 2015, the European Union Committee on Legal Affairs established a working group on legal issues related to the development of robotics[14] and artificial intelligence in the European Union.[15] In May 2016, the group delivered a draft report which contained a series of recommendations on civil law rules on robotics.[16] This was followed by the publication in June 2016 of a Scientific Foresight Study on the Ethical Aspects of Cyber-Physical Systems[17] which dealt with technical systems of networked computers, robots and artificial intelligence linked with the Internet of Things that interact with the physical world. On January 27, 2017, the Committee on Legal Affairs tabled its final report[18] which asked the Commission on Civil Law Rules on Robotics to propose a Directive on general as well as ethical principles concerning the development of AI and robotics including a draft Charter of Robotics consisting only of a Code of Ethical Conduct for Robotic Engineers and a Code of Conduct for Research Ethics Committees as well as a model licence for designers and one for users. The drafters believed that "the field of robotics is too broad, and the range of legislative domains is too broad, and the range of legislative domains affected by robotics too wide" to require broad overreaching legislation covering every aspects of AI and robotics which would have a chilling effect on innovation.[19]

14. Robotics is the field of study and inquiry that develops principles and approaches for the design, fabrication, operation and control of robots.
15. See also Committee on Legal Affairs, Legislative initiative report (Draft Report), 2015/2103(INL). Note that on September 22, 2014, a report entitled *Guidelines on Regulating Robotics*, which was funded by the European Commission, was published Doc. D.6.2. It served as background research. See also the 2016 study requested by the Committee on Legal Affairs and commissioned and supervised and published by the Policy Department C for Citizens' Rights and Constitutional Affairs, on European Civil Law Rules in Robotics, PE 571.379, www.europarl.europa.eu/committees/fr/supporting-analyses-search.html.
16. PE 582443. 2015/2103(INL).
17. www.epeuropa.eu/stoa.
18. www.europarl.europa.eu/sides/getDoc.do?type = REPORTS&mode = XML&reference = A8-2017-0005&language = EN.
19. *Guidelines on Regulating Robotics* (2014), D.6.2, para. 5.6, p. 212, available at www.robolaw.eu.

This took the form of a Motion for a European Parliament Resolution with recommendations to the Commission on Civil Law Rules on Robotics which was adopted on February 16, 2017.[20] It is now up to this Commission to submit a proposal for a directive on civil law rules on robotics for approval by the European Parliament. However, before doing that, a public consultation on the civil law rules for robotics will have to take place.

III. General Principles Concerning the Development of Robotics and Artificial Intelligence for Civil Use

The legal status of AI machines and robots, whether they are humanoids,[21] or mechanoids,[22] should be the starting point of any inquiry considering the phenomenal increase of their sales in the last few years. Should they continue to be considered as tangible objects owned and controlled by humans? It would seem that the answer to this question should depend upon the state of their intelligence and autonomy.

The Resolution asks the Commission on Civil Law Rules on Robotics "to propose common Union definitions of cyber physical systems, autonomous systems, smart autonomous robots and their subcategories by taking into consideration the following characteristics of a smart robot":[23]

- the acquisition of autonomy through sensors and/or by exchanging data with its environment (interconnectivity) and the trading and analyzing of those data;
- self-learning from experience and by interaction (optional criterion);
- at least a minor physical support;
- the adaptation of its behaviour and actions to the environment.
- absence of life in the biological sense.[24]

Since some robots may not possess any or all these characteristics, does this mean that they would not qualify as smart robots and would continue to be tangible objects, or that there should be

20. *Supra*, footnote 13. A directive must be implemented by Member States.
21. An embodied robot that looks and functions like a human, for instance a care robot.
22. A robot that does not look and functions like a human, for instance a drone.
23. For a general survey consult Ray Jarvis, "Intelligent Robotics: Past, Present and Future" (2008), 5 Int. J. of Comp. Sci. and Applications, No. 3, p. 23.
24. See *supra*, footnote 13, paras. 1 and 2, p. 4 and also Annex: Definition and Classification of "smart robots", p. 11.

different classes of robots each possessing a special legal status? For instance, some could be given a legal status similar to that of a corporation, or as Estonia is planning to do, create a new legal status called "robot agents", likely still under the control of its human employer, owner or user.[25]

Once (if ever) robots become as intelligent and autonomous as humans in every domain of interest, should they acquire the same legal status as humans with the same rights and obligations?

In some cases, it may be difficult to determine whether a robot possesses any of the characteristics listed in the proposal to qualify as a smart robot. How much autonomy must a smart robot have? The Resolution defines the autonomy of a robot "as the ability to take decisions and implement them in the outside world independently of external control or influence".[26] Take the case of care robots, social robots and now sex robots, which, like some smart phones, are already able to detect the stress, loneliness and depression of their users and respond to their emotional state, or become their trusted advisors or companions or even lovers. Are they to be placed in a category above that of smart robots because of their feelings for their users? Why not, since affective computing is now an established discipline used to detect the user's emotions and other stimuli.[27] Their autonomy is derived from their consciousness. On the other hand, some robot systems like the DaVinci surgical robot cannot be described as intelligent and autonomous since they are operated remotely by a practitioner. The same is true of drones.

The real question with respect to the classification of robots is why is it necessary to attribute to them a special legal status instead of leaving them as tangible objects to be owned and controlled by humans? The Resolution in its first Annex proposes that for the purposes of traceability and to facilitate the implementation of further recommendations, "a system of registration of advanced robots should be introduced, based on the criteria established for the classification of robots".[28] This system of registration would be

25. See *supra*, footnote 8.
26. See *supra*, footnote 13, Liability, para. AA, p.3.
27. For instance, see the Pepper robot developed by SoftBank Robotics in Japan. It can detect and respond to human emotions via vocal cues and facial expressions and is already in use in that country. An adapted version on the bot is designed to help the elderly. In the United States, IBM and Rice University have unveiled a Multi-Purpose Eldercare Robot Assistant (MERA) which is a customized version of Pepper. See R. Yonck, *Heart of the Machine, Our Future in a World of Artificial Emotional Intelligence* (New York, Arcade Publishing, 2017).
28. *Supra*, footnote 13, p. 11 and para. 2, p. 4.

Union, wide and managed by a designated Agency for Robotics and Artificial Intelligence. Who would make the decision when confronted with an application for registration? Could the decision be challenged? The practice used for patents comes to mind as a model. Why should only advanced robots be registered and not all of them, just like vehicles?

Actually, the reason why the special electronic legal personality called "smart robots", possessing specific rights and obligations, is to be given to these types of robots in the European Union, has to do with their civil liability for the damage they may cause to third parties in cases other than those of damage to property, since at present robots cannot be held liable *per se*.[29] The Resolution makes it clear that in the future the compensation to an aggrieved party should not be affected by the fact that the damage was caused by a non-human agent.[30]

How can a robot be considered a legal person for some independent activities which it carries out without the control by another actor and for which it may become liable in the event of damage, and not retain this status when it is still controlled by such actor for other activities? Would proof of registration be sufficient to establish its legal status for all situations? Also, how can a smart robot have rights, like the right to life or the right to equality, etc., which are enjoyed by humans, unless they are linked to human ethics and morals?

The Resolution leaves open the question whether liability of any of the parties involved should be based on fault, strict liability with no fault required, only proof on how the damage occurred and the existence of a causal connection between the harmful behaviour of the robot and the damage incurred by the victim, or on risk management which places liability on the person who was able to minimize the risks and not on the person who acted negligently. Liability should also be proportional to the actual level of instruction given to the robot and its degree of autonomy. Its trainer would be responsible unless the robot had been self training. Of course, ultimately liability would depend on what caused the damage, a machine defect, a user error, etc.

Finally, it is suggested that the producer of the autonomous robot be obliged to take out insurance to cover the damage caused by the autonomous robot, and also that a fund be established to cover cases where no insurance cover exists. This is already the case in Canada

29. *Supra*, footnote 13, para. 52, p. 9.
30. See also Resolution, *supra*, footnote 13, Liability, pp. 3-4, paras. Z, AA, AB, AC, AD, AE, AF, AG, AH, AI.

for vehicles on pubic highways. The creation of a special legal regime of civil responsibility for smart robots means that the non-smart robots would remain subject to traditional regimes.

The proposal to register smart robots is a good one which should be followed in Canada to cover all types of robots and AI machines. The system used for vehicles would be a good model. However, once they have attained full autonomy and a human level of intelligence, they should be deregistered. In Canada, the law applied today to the activities of semi or fully autonomous robots found in the *Civil Code of Quebec* and the common law would not require any fundamental changes, but only some minor adjustments where appropriate.[31]

The major difference between what is proposed for the European Union and what seems to be inevitable in the future everywhere, is the fact that some robots could become as intelligent, fully autonomous and even conscious of themselves and, like humans, be endowed with moral and ethical principles. Thus, it is unrealistic for the Resolution to declare that it is considered "essential, in the development of robotics and artificial intelligence to guarantee that humans have control over intelligent machines at all times".[32] How can this be reconciled with the statement that the Commission should explore the creation of a specific legal status for the most sophisticated autonomous robots so that they can have "the status of electronic persons responsible for making good any damage they may cause, and possibly applying electronic personality to cases where robots make autonomous decisions or otherwise interact with third parties independently".[33] Did the Commission have in mind robots as intelligent and autonomous as humans, or a category of smarter-than-smart robots but not as smart as humans?

Should Canada decide to adopt a general definition of robots or smart robots for legal purposes, the definition should be the same at the federal and provincial levels.

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31. See M. Castel and J.-G. Castel, "The Impact of Artificial Intelligence on Canadian Law and the Legal Profession" (2016), 46 Adv. Q. 34, at p. 42.
32. *Supra*, footnote 13, para. 3, p. 4.
33. Resolution, *supra*, footnote 13, para. 59. p. 10. See also P, p. 3 which admits that: "ultimately, there is a possibility that in the long turn AI could surpass human intellectual capacity."

IV. The Charter on Robotics: The Code of Ethical Conduct for Robotic Engineers, and the Code for Research Ethics Committees[34]

The role of ethics in regulating artificial intelligence and robotics has been a major concern for their users. Should ethical constraints be imposed on the development of these new technologies to protect humans from harm caused by robots and their users, and if so, who should be the gate keepers, the state or the private sector of the economy? Should on-line services become the exclusive property of corporations which could then charge a large amount for the information they provide to the public or be shared with state agencies? It is most important to avoid the improper contents and use of algorithms inserted in the software of robots and other AI machines by robotic engineers to obtain information that is not available to the public and could be detrimental to services related to health, the elderly, consumers and transportation. This is why robotic engineers, designers, programmers and users must abide by ethical principles and rules when dealing with AI machines, especially robots.

The Code of Ethical Conduct for Robotic Engineers which covers all research and development in the field of robotics makes this clear. It calls on robotic engineers to integrate ethical values in their conception, design, development and phases of production of robots. Although the Code is voluntary, it stresses that researchers in the field of robotics should commit themselves to the highest ethical and professional conduct and abide by the following principles:

> *Beneficence* – robots should act in the best interests of humans;
>
> *Non-maleficence* – the doctrine of 'first do not harm' whereby robots should not harm a human;[35]
>
> *Autonomy* – the capacity to make an informed un-coerced decision about the terms of interaction with robots;

34. For an interesting study see "Guidelines on Regulating Robotics", *supra*, footnote 19.
35. See the first law of Isaac Asimov that: "A Robot may not injure a human being, or through inaction, allow a human being to come to harm": *Run-around, I Robot* (New York Grove Press, 1950). See also the Zeroth Law which Asimov adopted later on to override the previous law "A Robot may not harm humanity, or by inaction, allow humanity to come to harm." Resolution, *supra*, footnote 13, para. T, General Principles (footnote 3), pp. 3 and 11.

Justice – fair distribution of the benefits associated with robotics and affordability of homecare and healthcare robots in particular.

Robotics research activities must respect fundamental rights, be conducted with the precautionary principle, transparency, inclusiveness and accountability for the social, environmental and human health impact that robotics may impose on present and future generations. Safety by preserving human wellbeing and human rights, reversibility which is the ability to undo undesired actions, privacy and maximizing benefits of the work done by the researchers at all stages from inception through to dissemination, and minimizing harm to research participants are also listed in the Code.

With respect to the principle of transparency, it is interesting to note that it is suggested that advanced robots should be equipped with a black box to record data on every transaction carried out by them, including the logic that contributed to their decisions.[36] Complying with these principles should prevent abuses irrespective of who owns and controls the robot or artificial intelligent machine, provided the programmer who prepares the algorithms is part of the group of researchers.

The Code for Research Ethics Committees lists a number of principles applicable to the review process of the research in AI and robotics done by robotic engineers. They are designed to insure that the review process is independent of the research itself and to avoid any conflict of interest between the researchers and those reviewing the ethics protocol and between reviewers and organizational governance structures. The review process must be conducted by reviewers with appropriate expertise in ethics, and be accountable and open to scrutiny. It is interesting to note that the Code also covers the role of the research committees and how they are to be constituted. All research organizations are required to establish appropriate procedures to monitor the conduct of research which has received ethics approval until it is completed. In Canada this is standard practice for most research conducted and financed by universities, think tanks, governmental organizations and NGOs.

V. Licence for Designers

The Resolution also contains a long list of instructions that designers should follow when working on robotics. For instance, designers "should take into account the European values of dignity, autonomy, self determination, freedom and justice before, during

36. *Supra*, footnote 13, para. 12, p. 6.

and after the process of design, development and delivery of such technologies including the need not to harm, injure, deceive or exploit (vulnerable) users". They should introduce "trustworthy system design principles across all aspects of a robot's operation, for both hardware and software design, and for any data processing on and off the platform for security purposes". Other obligations on the part of designers are to make sure that private information is kept secure, particularly from hackers, and only used appropriately, that robots must operate in accordance with local, national and international ethical legal principles, and that opt-out mechanisms are in place. Maximal transparency is required in the programming of the robotic systems as well as predictability of robotic behaviour, including preparation for possible robotic and human failures. Testing a robot in a real environment or involving humans should only be done with the prior authorization of the Research Ethics Committee. It is also important that robots be identifiable when interacting with humans and that their decision-making steps are amenable to reconstruction and traceability. Programmers are required to safeguard the safety and health of those interacting and coming in touch with robots.[37]

To adhere to all these instructions may not be easy for designers and programmers especially when dealing with care robots, medical robots or sex robots that are more advanced and autonomous than "smart robots". This raises again the issue of self-awareness which could prove dangerous for humans if an AI machine or robot becomes conscious of itself and refuses to be controlled by anyone, including obeying algorithms in their software. Would it be better for the programmer or scientific researcher to be prevented from instilling consciousness, ethics and moral principles in an AI machine or robot?[38]

VI. Licence for Users

Users who operate smart robots must also adhere to a number of instructions when they interact with them, especially if they are smart robots. For instance, users are permitted to make use of a robot without risk or fear of physical or psychological harm, and should have the right to expect a robot to perform any task for which it has been explicitly designed. The privacy rights of individuals must be taken into consideration including the deactivation of video moni-

37. For the complete list see Resolution, *supra*, footnote 13, pp. 14-15.
38. One should not confuse ethics in robotics with machine ethics which oblige robots themselves to adhere to ethical rules once they are fully autonomous.

tors during intimate procedures. This should be subject to exceptions in the case of surgical robots, as during medical procedures, it is important to monitor and keep tract of the actions of the operating surgeons and medical robots for possible malpractice suits and professional control by medical licensing boards, or for the purpose of training. More generally, users should not collect, use or disclose personal information without the explicit consent of the data subject. Users must also be aware that any robot may have perceptual, cognitive and actuation limitations.

Obviously, from the point of view of public policy, robots should not be used in any way that contravenes ethical or legal principles and standards, nor should users be permitted to modify any robot to enable it to function as a weapon. Finally, in operating a robot, human frailty, both physical and psychological, and the emotional need of humans must be respected.[39]

These instructions are excellent but appear to apply only to users of robots that are still owned or controlled by humans, although they are in the category of smart robots possessing some autonomy. This is understandable since it is the responsibility of the programmer to protect humans against possible harm inflicted on them by robots. Once smart robots become fully autonomous[40] and are conscious of themselves, they could modify or erase the algorithms containing ethical rules placed by programmers and replace them by new ones or have none at all. This is probably why the Resolution does not provide a Code of conduct and a model of licence for them. Does it mean that they would then be considered equal to humans?

The codes and model licences proposed in the European Union Resolution are the most important documents of universal application for the control of AI and robotics. They would be a good model for Canada as they are compatible with Canadian humanist values, provided they cover all actors connected with all categories of robots, especially the designers and programmers who prepared the relevant algorithms to be inserted in the robots' software, and the robots themselves.

Since the codes and model licences are voluntary and cannot be imposed on third parties, they do not provide penalties for any breach of their provisions. It is suggested that they should be legally binding and that the actors who did not abide by their provisions should be penalized, including the robots themselves, although a special type of penalty would have to be designed for them commensurate with their nature and legal status.

39. *Ibid.*, p. 15.

40. For the definition of autonomy, see *supra*, footnote 26.

VII. Conclusion

Considering the socio-economic benefits and risks associated with the development of AI and robotics, the goal should be to control potential excesses without hindering research and innovation. Even if robots are not yet in common use, the time has come to legislate "pre-emptively" before it is too late, especially in those areas where current laws and regulations are nonexistent or inappropriate. The government tortoise must attempt to keep pace with the technological hare.

The creation of a Canadian Agency in charge of examining all aspects of AI and robotics and monitoring advances and new discoveries could be a good solution. Another of its functions would be to propose legislative instruments containing rules with universal appeal that would include the codes and model licences proposed in the European Union Resolution. This does not mean that any rules adopted now should be carved in stone. In light of the rapid development of AI and robotics, legislators instead should utilize a "flexible" approach, and be prepared to adopt new legal rules or modify existing ones periodically. A good general rule for lawmakers is to be as inventive as the companies and technologies they monitor.

We believe that robots should operate safely and ethically to serve humanity as machines, and that the law should evolve as new forms of intelligence begin to emerge. As worrying and entertaining as the doomsday Hollywood-style predictions are with regards to the emergence of such new "higher" forms of intelligence, they may be unrealistic, as this "wishful thinking" may ignore the fact that if we are able eventually to build such self-conscious and fully autonomous smart devices, the world will have changed dramatically from where we currently stand.

It is unlikely that we will suddenly be surprised by the existence of general or even super intelligences.[41] Instead, they probably will evolve technologically over time, and our world will be different and populated by many other intelligences. By then we will have lots of relevant experience to deal with them.

Thus, our recommendations are best considered as a contribution to the "healthy" evolution of our regulatory environment as the world adjusts to such technologies.

41. Already see Sophia, the first robot in the world granted full citizenship by Saudi Arabia: https://youtu.be/E8Ox6H64yu8.