1. Introduction

Cybernetics, developed by Norman Wiener in the 1950s, can be regarded as the foundational discipline for Computer Ethics. (Floridi, 2015, p. 91) His new discipline covered many of the same topics that we would today regard as central to Computer Ethics. These include access to computers for people with disabilities, computer security, professionalism in computing, unemployment due to computing, automation and many more. (Bynum, 2016)

The term we use today, “Computer Ethics”, has its origins with Walter Maner (Maner, 1980; Bynum, 2016)

Today Computer ethics covers a broad range of topics including: security, privacy, copyright as in computer “piracy”, access to computing for the disabled, environmental impact and sustainability of computing system and research ethics etc. Of these, privacy, is currently the most discussed topic in the field. (Stahl *et al.*, 2016, p. 3,28)

Researchers can now use the principles of Responsible Research and Innovation (RRI) to manage the ethical considerations of how their research impact on society.(Eden, Jirotka and Stahl, 2013, p. 1)

1. Definition of Ethical Computing

According to the Cambridge Dictionary of Philosophy, ethics is “the philosophical study of morality” (Audi, 1999). Therefore, Ethical Computing relates to the study of morality as it relates to Computing. In simple terms, morality can be thought of as the study of what is right and what is wrong.

James H, Moor defines Computer ethics as “… the analysis of the nature and social impact of computer technology and the corresponding formulation and justification of policies for the ethical use of such technology” (Moor, 1985, p. 266).

There are a few competing ethical theories used in Computer Ethics.

Firstly, we can classify ethical theories into a couple of categories. Consequentialism, Deontology and Virtue ethics. All of which are Normative ethical theories. In Consequentialism, whether an action is good or bad, i.e. ethical, depends on the consequences of the action. The most prominent consequentialist theory is utilitarianism. Which can be describes as doing the most amount of good to the largest amount of people. Deontology on the other hand hold that the intention of agent doing the action determines whether it is ethical or not (Stahl *et al.*, 2016, p. 4). Where in virtue ethics it depends on the individual character (Stahl, Eden and Jirotka, 2013, p. 812).

Another prominent theory is Luciano Floridi’s Information ethics (Stahl *et al.*, 2014, p. 812). Floridi’s theory is an ontology of information. Everything can be fundamentally seen as information with an emphasis on the relationship between information agents. (Ess, 2008, pp. 160–161) As Floridi puts it “moral actions are the result of complex interactions among distributed systems integrated on a scale larger than the single human being” (Floridi, 2008, p. 198).

1. Importance of Ethical Computing

In our society we are constantly inundated with ethical dilemmas in the Information and Communication Technology sector. From issues about privacy and consent (Carter, Laurie and Dixon-Woods, 2015; de Bruin and Floridi, 2017) to copyright infringement (Chiou, Wan and Wan, 2012, p. 108). Most prominent are issues relating to privacy. Examples are the 2010 cyber-attack on Gmail and the NSA spying scandal of 2013 (de Bruin and Floridi, 2017, p. 22).

People have an innate sense of right and wrong. What is right or wrong can differ between nationalities, groups or people. These ideas need to be openly discussed and reasoned about. But there needs to be agreement on what is right and what is wrong. That is why we need ethical theory (Stahl, 2012, pp. 638–640).

As previously mentioned, according to Moor it is policy vacuums that create computer ethics problems (Moor, 1985, p. 266). Responsible Research and Innovation (RRI) can be used to develop policies for how researchers are to respond to the consequences of their ICT research and innovation (Eden, Jirotka and Stahl, 2013, p. 1). This approach has become prominent in Europe where it will underpin Horizon 2020, the European research framework (Stahl, 2013, p. 1).

Incorporating values in the design from the outset can have a bearing on the successfulness of the project. The Google Glass project was tested in 2014 and did not seem to consider the ethical problems associated with the technology and how society would react to it. Many people were concerned about how much this new technology would infringe upon their privacy. This led to the project being stopped in 2015 (Van Den Hoven, 2017, p. 71).

The design of technological devices incorporates in them certain ethical assumptions. Value-sensitive design (VSD) as a field of study tries to make values a key part of technological design process. This field of study started at Stanford in the 1970s (Van Den Hoven, 2017, p. 69). Some believe that VSD can support RRI and that RRI can benefit from the knowledge gained in the VSD field (Simon, 2016, p. 220).

When an ICT system breaks or does something society sees as immoral, the developers of that system is usually blamed. This only works if the developers had control over the actions of the ICT system. This becomes a problem in systems based on learning, for example neural networks. Here the developer does not understand everything about how the system reaches certain conclusions. Is the developer now responsible for an outcome they could not have foreseen or at least was very difficult to foresee? The field of computer ethics have not found an answer to this dilemma. But many agree that more research is needed. (Mittelstadt *et al.*, 2016, pp. 10–12)

Privacy

Piracy

Equal access

Check (Carter, Laurie and Dixon-Woods, 2015; Floridi and Taddeo, 2016)

Also see (Mittelstadt and Floridi, 2016)

Moor describes that a policy vacuum creates issues in computer ethics.

Policy vacuum is to be filled with the help of RRI(Eden, Jirotka and Stahl, 2013)

RRI (Von Schomberg, 2013)

1. Some guidelines on being ethical within the computing environment

One study felt that researchers and developers in the Information and communications technology (ICT) industry needs to understand that moral assumptions are made during the development of new technology and products. The researcher or developer brings in their own “views and values” into the product. The product is thus not “morally neutral”. Ethical issues need to be brought up early in the development process. The earlier in the development lifecycle these considerations are addressed, the easier it is to make the necessary changes. Additionally these ethical requirements should be put on par with the other non-ethics related requirements and not regarded as secondary or less important requirements (Van Den Hoven, 2017, pp. 66–70).

Governance of RRI needs to be “reflective”. Governance should “… reflect upon its own assumptions, presuppositions and required consequences”. This needs to be applied to different views there currently is on privacy and to what extend privacy is wanted or needed (Stahl, 2013, p. 713; Stahl, Eden and Jirotka, 2013, pp. 212–214).

When it comes to privacy and data protection, the principal of informed consent should be followed.

1. Conclusion
2. References

Audi, R. (1999) ‘The Cambridge Dictionary of Phiosophy, Second Edition’.

de Bruin, B. and Floridi, L. (2017) ‘The Ethics of Cloud Computing’, *Science and Engineering Ethics*, 23(1), pp. 21–39. doi: 10.1007/s11948-016-9759-0.

Bynum, T. (2016) *Computer and Information Ethics*. Winter 201. Edited by Edward N. Zalta. Metaphysics Research Lab, Stanford University. Available at: https://plato.stanford.edu/entries/ethics-computer/ (Accessed: 25 March 2018).

Carter, P., Laurie, G. T. and Dixon-Woods, M. (2015) ‘The social licence for research: why care.data ran into trouble’, *J Med Ethics*, 41, pp. 404–409. doi: 10.1136/medethics-2014-102374.

Chiou, W.-B., Wan, P.-H. and Wan, C.-S. (2012) ‘A new look at software piracy: Soft lifting primes an inauthentic sense of self, prompting further unethical behavior’, *Int. J. Human-Computer Studies*, 70, pp. 107–115. doi: 10.1016/j.ijhcs.2011.09.001.

Eden, G., Jirotka, M. and Stahl, B. (2013) ‘Responsible research and innovation: Critical reflection into the potential social consequences of ICT’, in *Proceedings - International Conference on Research Challenges in Information Science*. doi: 10.1109/RCIS.2013.6577706.

Ess, C. (2008) ‘Luciano Floridi’s philosophy of information and information ethics: Critical reflections and the state of the art’, *Ethics and Information Technology*, 10(2–3), pp. 89–96. doi: 10.1007/s10676-008-9172-8.

Floridi, L. (2008) ‘Information ethics: A Reappraisal’, *Ethics and Information Technology*, 10(2–3), pp. 189–204. doi: 10.1007/s10676-008-9176-4.

Floridi, L. (2015) *The onlife manifesto*. Springer. doi: 10.1007/978-3-319-04093-6.

Floridi, L. and Taddeo, M. (2016) ‘What is data ethics?’, *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 374(2083), p. 20160360. doi: 10.1098/rsta.2016.0360.

Van Den Hoven, J. (2017) ‘Ethics for the Digital Age: Where Are the Moral Specs?’, in Werthner, H. and van Harmelen, F. (eds) *Informatics in the Future*, pp. 65–76. doi: 10.1007/978-3-319-55735-9\_6.

Maner, W. (1980) ‘Starter kit in computer ethics’, *Hyde Park, NY: Helvetia Press and the National Information and Resource Center for Teaching Philosophy*.

Mittelstadt, B. D. *et al.* (2016) ‘The ethics of algorithms: Mapping the debate’, *Big Data & Society*, 3(2), p. 205395171667967. doi: 10.1177/2053951716679679.

Mittelstadt, B. D. and Floridi, L. (2016) ‘The Ethics of Big Data: Current and Foreseeable Issues in Biomedical Contexts’, *Science and Engineering Ethics*, pp. 303–341. doi: 10.1007/s11948-015-9652-2.

Moor, J. H. (1985) ‘What is Computer Ethics?’, pp. 67–69. Available at: https://pdfs.semanticscholar.org/2b26/2968529c25ebc2647f58cbb50a46fffcce17.pdf (Accessed: 25 March 2018).

Von Schomberg, R. (2013) ‘A Vision of Responsible Research and Innovation’, *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society*, pp. 51–74. doi: 10.1002/9781118551424.ch3.

Simon, J. (2016) ‘Value-Sensitive Design and Responsible Research and Innovation’, *The Ethics of Technology: Methods and Approaches*, 1, pp. 219–236. Available at: https://s3.amazonaws.com/academia.edu.documents/52749810/Simon-VID-in\_Hansson.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1528215809&Signature=kQAXeLR7ym1SyJoMwFHPDaDA8z0%3D&response-content-disposition=inline%3B filename%3DValue-Sensitive\_Design\_and\_ (Accessed: 5 June 2018).

Stahl, B. C. (2012) ‘Morality, Ethics, and Reflection: A Categorization of Normative IS Research’, *Journal of the Association for Information Systems*, 13(8), pp. 636–656. Available at: http://search.proquest.com.ezproxylocal.library.nova.edu/docview/1039704452?accountid=6579.

Stahl, B. C. (2013) ‘Responsible research and innovation: The role of privacy in an emerging framework’, *Science and Public Policy*, 40(6), pp. 708–716. doi: 10.1093/scipol/sct067.

Stahl, B. C. *et al.* (2014) ‘From computer ethics to responsible research and innovation in ICT: The transition of reference discourses informing ethics-related research in information systems’, *Information & Management*, 51, pp. 810–818. doi: 10.1016/j.im.2014.01.001.

Stahl, B. C. *et al.* (2016) ‘The Ethics of Computing: A Survey of the Computing-Oriented Literature’, *ACM Computing Surveys*, 48(4), pp. 1–38. doi: 10.1145/2871196.

Stahl, B. C., Eden, G. and Jirotka, M. (2013) ‘Responsible Research and Innovation in Information and Communication Technology: Identifying and Engaging with the Ethical Implications of ICTs’, in *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society*. Wiley-Blackwell, pp. 199–218. doi: 10.1002/9781118551424.ch11.