1. **Introduction**

The development of new technologies, that give rise to new ethical concerns is not a new phenomenon unique to the 20th or 21st centuries. In 1890, Warren and Brandeis published their seminal paper “The Right to Privacy” (Warren and Brandeis, 1890). Regarding the new privacy concerns with regards to new development is photographic and printing technologies.

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

A recent development is Responsible Research and Innovation (RRI). Researchers can now use the principles of (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 these ethical theories into a couple of categories namely Consequentialism, Deontology and Virtue ethics. All of which are Normative ethical theories. Normative theories try to determine what ought to be done in ethically challenging situations and is thus a prescriptive in nature (Stahl *et al.*, 2016, p. 4).

In Consequentialism, whether an action is good or bad, i.e. ethical, depends on the consequences of the action in question. The most prominent consequentialist theory is utilitarianism. Which can be describes as doing the most amount of good to the largest amount of people (Stahl *et al.*, 2016, p. 4).

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). The name comes from the Greek for “duty”. The most famous deontological theory is Kantianism. Named after its creator, the 18th century German philosopher Immanuel Kant (Stahl, 2012, p. 641).

Where in virtue ethics, morality depends on the individual character (Stahl, Eden and Jirotka, 2013). An example of this kind of work is Wiltshire (2015), where an attempt is made to develop an artificial agent with “heroic” attributes (Stahl *et al.*, 2016, p. 4).

A prominent theory is Luciano Floridi’s theory of 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). In a system with such “Distributed Morality”, the criterion for judging the morality is not the action of each component, but rather on the impact on the larger environment this system is in. This is because in such a system, individual agents can be morally neutral, e.g. a GPS System or AI Driver, and thus complicating the ability to judge morality on the agent level (Floridi, 2013, pp. 727–731).

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).

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

As previously mentioned, according to Moor it is policy vacuums that create computer ethics problems (Moor, 1985, p. 266). 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 process of technological devices and technologies incorporates certain ethical assumptions into the device or technology. These assumptions can be unknowingly added by the developer. Value-sensitive design (VSD) as a field of study tries to make values a key part of technological design process. In a sense making any ethical views built into the system known. 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 are usually blamed (Kraemer, van Overveld and Peterson, 2011, p. 251). This is justified when the developers have control over the actions of the ICT system (Matthias 2004). But this becomes a problem in systems based on learning, for example machine learning algorithms like 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? Answers to this ethical dilemma is required. The field of computer ethics have not found a consensus to this dilemma. But many agree that more research is needed.

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”. The persons in charge of overseeing the RRI process, should ensure that the process “reflect(s) 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; Stahl, Eden and Jirotka, 2013).

The most discussed topic in computer ethics literature is privacy (Stahl *et al.*, 2016, p. 22). One form of privacy is Data Protection. This can enabled through an electronic privacy policy when paper based policies fail (Mizani and Baykal, 2007, p. 695).

While in the European Union, Data Protection is a “fundamental right” according to Article 8(1) of the Charter of Fundamental rights of the European Union (European Union, 2012). This right to Data Protection will be enforced through the new General Data Protection Regulation (GDPR) (European Union, 2016). According to Stahl (2013, p. 712) these regulations “show that there are ways of democratically regulating contested technology related issues”.

Even though standardizing ethical approaches through policy or legislation has benefits, this can lead to a reduction in researcher’s engagement with ethical decision making. This leads to a “tick-box” approach to ethics (Leonelli, 2018, p. 7) and becomes an uninteresting daily task that must be performed. What is needed is for researchers to ask more questions and critically evaluate each ethical problem that arises (Leonelli, 2018, p. 10).

1. **Conclusion**

Ethics of computing is a large vibrant field with many competing theories trying to explain ethical approaches to issues in the ICT field. Ethics in computing remains relevant and influences our lives with topics reaching the mass media, like the Google Glass fiasco of 2014 or the Cambridge Analytica scandal of 2018.

The European Union is on the forefront of the implementation of RRI and all the fruits of their labour remains to be seen.

More research needs to be done to solve problems like privacy in social media or who is ethically responsible for computer agents developed with neural networks where responsibility can be difficult to assign.

Ethics of computing remains relevant and requires more attention.

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