Negotiating the Ethical Decision-making Process when designing and developing new digital technologies

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Abstract

There is a requirement to establish and maintain standards of professional competence, conduct and ethical practice with regard to the development of future digital technologies. This paper proposes to explore mechanisms that might be used by systems engineers, developers, and educators, to facilitate consideration of ethical issues in this context. A major problem in the development, implementation, and operation of new technologies is the failure to address social factors. This concern is not new, and even though measures have been taken, to date, it has still not been adequately addressed. The paper will draw upon past and current work from a study of the development of models, and evaluation of existing models of ethical compliance to be used in creating awareness and consideration of these issues and challenges. The paper proposes a communication tool that can facilitate consideration of ethical issues by systems engineers and developers and those responsible for educating them. It is a contribution to a toolkit of practical techniques for visualising and creating awareness of the issues at stake in the ethical decision-making process when designing and developing new digital technologies.

Keywords: Ethics, Decision-making, digital technologies, social impact, unintended outcomes

1.0 Introduction and Background to the study

The advancement in technology is continuing to move at an exponential pace; are we educating future practitioners to deal with the inevitable consequences that these technologies will present and the impact they might have on society? The central problem being the lack of ethical consideration at the conception of these technologies and the issues tend to emerge after their implementation. Early recognition of ethical and related issues can save time and money, support user acceptance and promote beneficial aspects of the technology within industry and society as a whole. Will future computer scientists consider the ethical issues that might be raised and need to be addressed in the design and development of these new technologies? What requirement is there for practitioners to establish and maintain standards of professional competence, conduct, and ethical practice with regard to the development of these technologies? Do existing legal frameworks cover liability adequately? What frameworks and guidelines are currently in place, and what assurance is there that they are adhered to? Does the education system provide adequate means for future practitioners to have the required knowledge and understanding to deal with these issues? These are amongst the many questions that continue to remain inadequately answered, as failures and unintended outcomes continue to occur. McManus in a recent study, identified that over the last decade, within the European Union, billions of Euros have been wasted on failed technology projects. He highlights the following as contributing factors to these failures; *"The lack of software engineering that fully integrates elements of domain science, software construction and human and engineering processes, as in my experience as practitioner and academic, has been a major contributor and causal factor in many failed software projects the world over* [1].

We have, over the past two decades seen the rapid, exponential growth of the Internet and World Wide Web (www) that has created major changes to our lives and society as a whole. We have already experienced the many benefits of this new world environment, however, we have also been faced with its many challenges and unpredicted outcomes that were not previously anticipated by its creator. Consideration of the pros and cons for the development of new technologies on society and our well-being should therefore be of paramount importance. We may note the claim made some time ago by Allenby: *"We are currently moving towards an anthropogenic Earth characterized by integrated built/human/natural systems of extraordinary complexity, increasingly defined by technology and technology systems exhibiting accelerating rates of change. These raise substantial challenges for engineers and technologies, as well as for society as a whole"* [2].

We should be heeding the comments made by Allenby and reflect upon how we might initiate any preventive mechanisms within the development of new technologies and learn from the negative aspects we have experienced with the Internet and www to date. For example, The Internet of Things (IoT) is *"a new paradigm where connected devices create new global service opportunities based on real time physical world data. It has capabilities to facilitate communication*

and collaboration with everything to anything, anywhere, however, the impact and consequences of these new devices and services are not being considered from an ethical perspective to any great depth, if at all" [3]. It is claimed that the IoT is seen as the next major revolution in technology since the World Wide Web, and promises increasing service provisions with many benefits for the future, however, the complexity and outcomes of this technology are yet to be seen.

As technologies are being deployed without a deep understanding of the social repercussions for the duration of their lifetime, it is becoming increasingly important to develop new standards and educate practitioners in their responsibilities, transparency and accountability with regard to the ethical and social dimensions of their work. To what extent are ethical issues considered at the outset and conception of technologies? Ethics is a highly conceptual field and human beings may explicitly subscribe to a particular code of ethics; yet how many human beings would not confess to modifying their behaviour so as to contravene such a code when faced with a complex and changeable situation? Some see moral responsibility as being on the decline, others as this being simply the way in which attitudes change over time; cultural and moral attitudes change over time as well as differing from place to place [4].

Professional IT organisations can, and do try to adopt a common ethical stance through the definition of Codes of Conduct and Codes of Practice. We may reasonably assume that the adoption of these professional codes provides the computing professionals with the necessary skills and ability to resolve ethical conflicts. But are such Codes of Conduct and Codes of Practice a sufficiently effective mechanism? Are practitioners always made aware of these codes of conduct within organisations and how can we be sure that they do actually adhere to them. According to Herkert, professional societies "… could potentially serve as a conduit to bring together the entire continuum of ethical frameworks by linking individual and professional ethics and linking professional and social ethics" [5].

2.0 The Challenges facing practitioners

We have seen in the previous section some of the problems and issues that are to be addressed, we need to continue with innovation and progression, however, we must also be mindful of any ethical issues at the outset of emerging technologies.

We have also seen a rapid growth in the number, and power of RFID devices: these were originally thought of simply as remotely readable barcodes, but the influence of Moore's Law means that their power is increasing all the time. These devices have the capacity to be rewritten and updated, unlike barcodes, and they also have the potential to incorporate increasing degrees of intelligence. These devices can be considered as the new agents of the digital revolution, potentially gathering contextual information. The IoT is using RFID and wireless sensor networks

generating vast amounts of data with real time services and we are unsure to what extent security measures are being considered.

A number of ethical issues are emerging with these developments; amongst those issues of transparency, privacy, and accountability. We could, in the future, be faced by more ethically challenging issues as a society as is most graphically illustrated by the concept of IoT and cloud computing, M2M connectivity and related services that will be everywhere.

Cloud computing technology has already been widely adopted and is a complex technology, the future impact and outcomes of its use are not yet known and due to its complexity, they could have major societal consequences. The main issues are that people and organisations might not know where information and services are coming from or where their information is located, therefore incurring issues of accountability and security, control, storage, interconnection of multiple services and levels of functionality. Certain issues have been identified, but yet to date, remain unresolved. Cloud computing is one of the major technologies driving the IoT and as a result, we could be building on problems and creating even more complex, problematic situations. As these technologies are being deployed without a deep understanding of the social repercussions of their deployment, it is becoming increasingly important to develop new standards and to educate the practitioners in their responsibilities with regard to the adoption of these technologies and the ethical and social dimensions of their work.

2.1 How Developers Might Prepare for the Ethical Challenges

Ethical scrutiny is crucial if we are to change as a society where we need to consider corporate social responsibility and accountability with regards to honesty, obligation and integrity (questions of, must, ought, should) and consider issues with the development of emerging technologies for visualising and creating awareness of the issues at stake in the ethical decision-making process. Technological advances provoke ethical concerns when little attention is given to issues of social involvement, impact on the environment, and the psychological well-being of people. There is a need for the visualisation of the ethical decision-making process as its current intangibility does not allow for accountability and visibility. It is essential that we identify the complexity of the situation and have a direction for decision-making. A decision involving investment and probabilities of financial return can be informed by the use of statistical models – a decision involving ethical considerations is not as easy to evaluate and requires an explicit model of ethical decision making [4].

Legitimate developers may be well-meaning in their attempts to adhere to ethical guidelines during the process of creating technologies such as the IoT products and services, but it is not always clear where that guidance is available, and how to interpret it. This is especially the case for smaller operations which may not have requisite ethical expertise within organisations. Consequently, guidance should be provided for developers to assure themselves and others that they have considered

how these technological solutions may impact on society. In the context of the IoT, society is not solely concerned with the human-human or human-machine interrelationship. IoT extends into the machine-machine relationship, and where there is communication between any of these elements within an IoT network, there is a potential for an unethical transaction to take place.

Here, two tools are presented, the first developed by the author, and the second developed by colleagues as well as input from the author. These tools may help developers consider ethical issues more comprehensively during the development process. The tools can be used in any information system or computer systems development, given the potentially dangerous consequences that may arise if inappropriate decisions are taken, however inadvertent. A distinct advantage of these tools is that they can easily be used by organisations with little or no experience of ethical decision making, which although is undesirable in a perfect world, is something which pragmatically must be recognised.

The first tool, the 'ethical triangle' is a model that can be used as a basis for negotiation between stakeholders in any decision-making situation where both technical and societal risks need to be assessed [6]. It provides a simple and flexible framework for exposing potential ethical problems throughout a systems development process, so consequently can be used in conjunction with well-defined approaches such as EDUCATID (the second tool), or alternatively for projects that do not follow a specific development methodology. It enables discussion between people of different cultural backgrounds and allows different perceptions of the concepts at issue to be mapped on to each other. It is proposed as a means of facilitating negotiations towards the parameterisation of ethical stances within which issues can be located as rightness ("should" in a given situation), obligation ("ought" when an obligation exists) or duty ("must" – constrained by duty, regulations and laws). It is also proposed that an ethical audit should be carried out in the initial stages of projects, and re-visited at regular intervals during project development, implementation, and operation. This framework could also apply to the ethical decision-making process in the audit for the requirements and development of systems and products addressing issues of sustainability. An overview of the triangle is depicted in Figure 1.

Ethical considerations move from constrained, through negotiated and into situated, as the issues gravitate from the organisational to the individual. This conforms to the three normative theories of business ethics [7], which are listed on the right hand side of the triangle.

Figure 1: The Ethical Triangle

In the top two sectors of the triangle, we are operating under external constraints; we may refer to the ethical considerations arising here as constrained ethics. As we move down the triangle, we need to consider that ethics does concern the impact of the individual's actions on other people – or rather, for our practical purposes, the impact of the project on other people (see Figure 2 below):

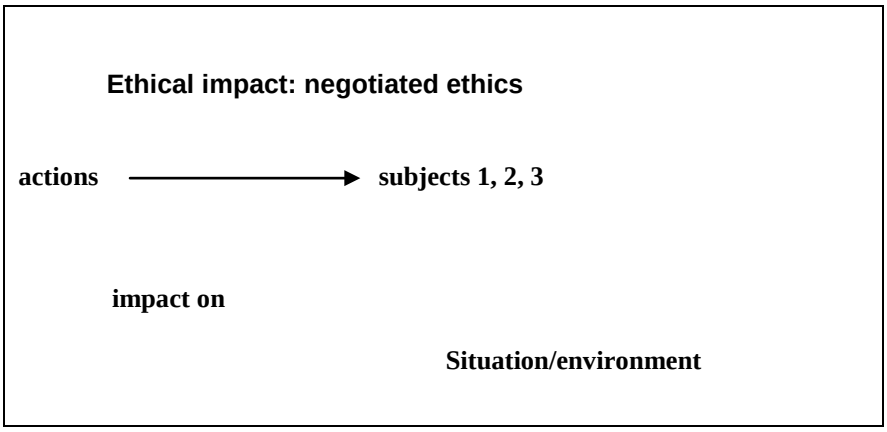

Figure 2: Ethical Impact

Hence we need to establish a priority for consideration of subjects – who is to be considered first (subject 1), second (subject 2), and so on.

Moving down to the bottom layer of the triangle ("should"), our practical approach means that we now take into account not only the subjects of our actions, but also the immediate circumstances and environment in which the information system is to be developed and operated – what we may term *situated ethics* – see Figure 3.

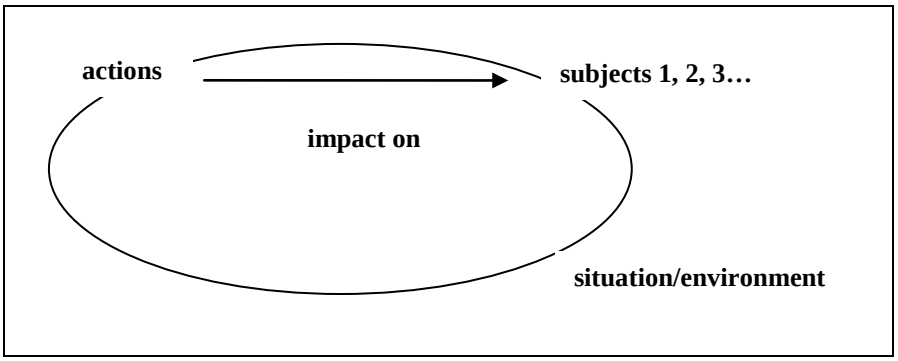

Figure 3: Ethical Impact: situated ethics

Example (sustainability)

Item X is found to be harmful or fatal to individuals in a very small number of cases and so is to be replaced by item Y within the federation of A, B, C...F. Item X has a long shelf-life. Item X is harder to dispose of in an environmental way than item Y (or, item Y than item X). Country A is rich, and has a long tradition of throw-away consumerism and a low death/sickness rate. Country F is poor, and has a long tradition of re-using items for as long as possible (often adapting them to novel uses). It has a high overall death/sickness rate, though death/sickness caused by item X is relatively low within this. How should the replacement of item X by item Y be ethically managed within the federation, and is the replacement ethically justified in the first place? The ethical issues raised are similar whether item X is a light bulb or a nuclear submarine, though the decisions taken may differ depending on the nature of the object.

Let us suppose that the decision is taken by a committee formed of a representative from each of the federated countries A, B, C…F (or, more realistically, by a sub-set of such representatives; they will still represent a number of different cultures, with different cultural presuppositions). Any decision reached will be a compromise, but how fair is a compromise, one that gives due weight to each person's culture, to be arrived at? For each point of disagreement that needs to be resolved, representatives making or countering points can use the triangle to quickly give the others a visual indication of their own perception of the weight of the ethical dimension of the issue involved. It's not an exact tool, but ethics has never been an exact science. It is a tool that will aid communication. It is the

resolution of these types of cross-cultural ethical questions that the ethical triangle is designed to facilitate [4].

At the top of the triangle are laws and then regulations. These have to be considered first – hence they appear at the top of the diagram. These constrained ethics are usually generic, and may be set in law, ethical codes of practice, organisational regulations or professional and statutory requirements. Further down the triangle, those ethical factors regarded to be of high importance ("must") are considered – where those participating in the ethical audit agree that a duty is imposed, followed by those of middle importance ("ought") where an obligation is imposed. Finally, the factors deemed to be of some importance ("should"), where it is felt that it is right to proceed in a certain way, are considered. Generally, the number of considerations is expected to expand as we move down the list, hence the triangular shape. Also, although all factors of the triangle can be considered throughout the development process, it is likely that those nearer the bottom will become more prevalent over time. Realisation and documentation of these factors in particular provide developers with an ethical audit of the development process, as well as a benchmark to monitor ethical issues during its lifetime.

The second tool is a development methodology EDUCATID [8], an ethically-driven, user-centred approach to interface development. As the acronym suggests, it is grounded in being ethically-driven, in that ethical issues are carefully scrutinised at the initial analysis phase, as well as in iterations of interface prototyping, development and evaluation. Similarly, it is user-centred in that users and stakeholders are involved in participative, narrative workshops in the initial analysis phase and also in the method's iterations, and naturally during the usability evaluation phase.

EDUCATID is a simple, rapid, and practical methodology which adheres to the four basic phases for interface design methods: analysis, design, development and evaluation. Each phase is informed by a fifth element, which we call the user analysis phase. This forms the central hub of the methodology, and involves the elicitation of user narratives as well as ethical and legal inspection (Fig. 4). EDUCATID follows a cyclical, prototyping paradigm, where each phase may be iterated a number of times, although through our experience of using it, we recommend a target of three iterations: the first concentrating on prototyping; the second focusing on detailed development; the third being a verification exercise. Each phase contains a number of activities which have specific inputs and outputs, and which are easy to understand, have little or no formality, and which are represented for end-user participation where appropriate. EDUCATID was developed and piloted during the research and development of pre-IoT ambient assisted living technologies (www.easylineplus.com) and has since been verified in a more generic scenario [9]. Experience of using EDUCATID has been compared with other user-centred approaches such as ISO13407 [10], KESSU [11], Jokela [12], and LUCID [13]. These approaches have many similarities with EDUCATID, in that they follow similar processes. However, they propose flexible frameworks

or models upon which to build methodological processes and method selections, whereas EDUCATID provides specific ethically-centred analysis, design and development techniques that are distinctly integrated into the process.

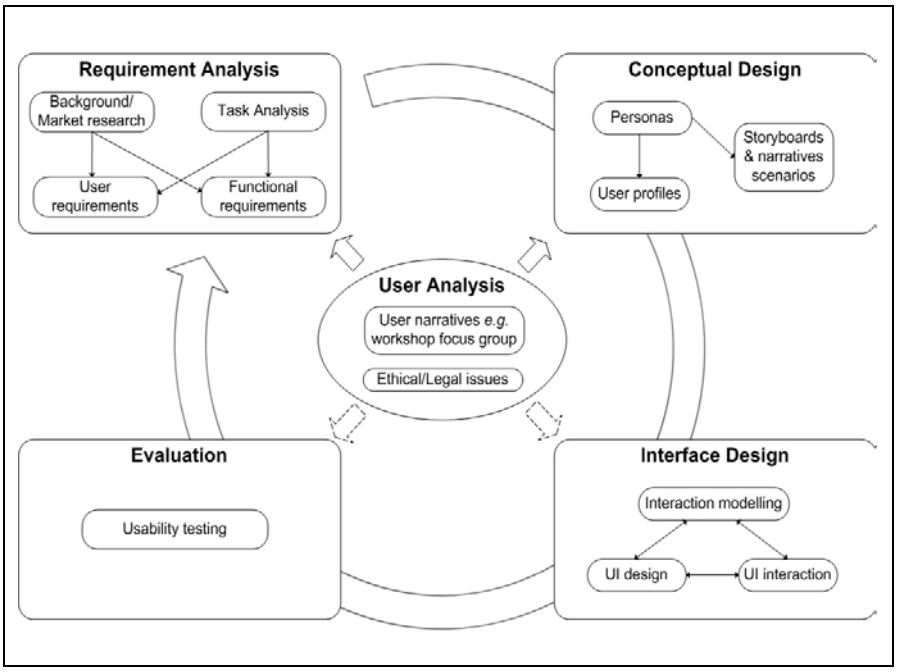

Figure 4: EDUCATID Methodology

3.0 Conclusion and Future Work

This paper has highlighted that there is a requirement to establish and maintain standards of professional competence, conduct and ethical practice with regard to the development of future digital technologies. Issues of control, division of responsibilities, rights or ability of individuals to exercise personal control, accountability, ownership, monopoly and power, privacy, dealing with diversity and governance should all be taken into consideration with the development of new technologies such as the IoT and others. Ethics is currently often seen to be merely a side issue or an afterthought and there is an urgent need to consider ethical issues in order to understand current and emerging technologies and identify any potential threats to society. This is an issue that affects us all both now, and will be, of increasing importance in the future.

A contribution to a toolkit of practical techniques for visualising and creating awareness of the issues at stake in the ethical decision-making process when

designing and developing new digital technologies has been highlighted as part of a possible solution. It is the early recognition of ethical and related issues that can save time and money, support user acceptance and promote beneficial aspects of the technology for stakeholders and society in general. Current and future work in the study is continuing with the development of mobile technologies to be used in the workplace, providing mechanisms for practitioners to identify, and be aware of, any ethical considerations at the outset of new developments. These technologies are being designed specifically so as not to impede upon the professionals time. These are already in the design stage.

Technologies such as the IoT will have a major revolutionary effect and will change our lives; everyone has a part to play, designers, directors, and actors in the decision-making process. It is essential that we identify the complexity of the situation and have a direction for ethical decision-making with these developments. The only foreseeable practical route is for professionals to address practical ethics within their own field to avoid major dilemmas and prevent unintended consequences, where we are building in quality processes; not additions as an afterthought. We should heed the comments made by Sackman in 1967; *"Humanistic automation means that computers serve human ends and that automation is not an end in itself. Computers are there to elevate man's intellect and increase his control over his environment"* [14].

We need to continue to be innovative in our technological developments, with emphasis on considering future consequences and to change the culture of "this does not concern us". It is crucial to have an understanding of the human, social and ethical dimensions, to be included as part of the creative process. We are not always sure what consequences technology will have on people, society and the environment; with the human factor comes moral responsibility. To ensure that sustainable growth takes place; a dialogue must take place between the innovators, creators and all stakeholders. We have to weigh up the balance of the pros and cons for the development of new technologies on society and our psychological well-being. The ethical triangle is one suggested tool that is a possible contribution to this.

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