



From computer ethics to responsible research and innovation in ICT The transition of reference discourses informing ethics-related research in information systems[☆]



Bernd Carsten Stahl^{a,*}, Grace Eden^b, Marina Jirotko^b, Mark Coeckelbergh^a

^aDe Montfort University, Centre for Computing and Social Responsibility, The Gateway, Leicester LE1 9BH, United Kingdom

^bUniversity of Oxford, Department of Computer Science, Wolfson Building, Parks Road, Oxford OX1 3QD, United Kingdom

ARTICLE INFO

Article history:

Received 10 September 2013

Received in revised form 18 December 2013

Accepted 20 January 2014

Available online 6 February 2014

Keywords:

Ethics

Morality

Norms

Responsible research and innovation

Information systems

ABSTRACT

The discourse concerning computer ethics qualifies as a reference discourse for ethics-related IS research. Theories, topics and approaches of computer ethics are reflected in IS. The paper argues that there is currently a broader development in the area of research governance, which is referred to as 'responsible research and innovation' (RRI). RRI applied to information and communication technology (ICT) addresses some of the limitations of computer ethics and points toward a broader approach to the governance of science, technology and innovation. Taking this development into account will help IS increase its relevance and make optimal use of its established strengths.

© 2014 The Authors. Published by Elsevier B.V. All rights reserved.

1. Introduction

Information systems (IS) as a field of academic research and business practice has long considered the importance of ethical considerations, including questions of what counts as right and wrong, good or bad, moral or immoral. IS also theoretically reflects on why particular acts or rules may be considered moral or immoral. Such questions touch on the design and use of computing artefacts in organizations in many different ways. A perception of moral appropriateness, or the lack thereof, can be an important component of technology acceptance. One aspect of this may be seen in the tradition of 'applied ethics' within philosophy, which focuses on more practical questions in various fields, such as medicine and biotechnology but is also relevant within computing. Organizational policies are often driven by perceptions of (morally) correct ways of acting, and these are based on broader ethical positions that tend to be reflected in organizational visions and cultures. The societal governance of technology follows public perceptions and is often driven by majority (moral) concerns, such as in the case of access to pornography and the protection of digital intellectual property.

The theoretical and practical relevance of different ethical and moral questions is reflected in a long-standing stream of research that this paper refers to as 'ethics-related research in the field of IS'. Despite considerable attention, ethics has never been a mainstream concern in IS. The reasons for this are manifold. One likely reason is that ethics, in the sense of moral philosophy, is a complex subject with a long history of scholarly work. Recent attempts to raise the visibility of ethics in IS education point toward a perceived lack of relevant competence of IS graduates [1].

This raises the question of whether traditional notions of ethics provide an appropriate discourse for discussing ethics-related issues in IS; that is, whether this type of ethics gives us a language, a vocabulary that enables us to delineate and develop a field of inquiry that is both intellectually sound (i.e., to philosophers and other academics) and practically relevant to professionals working in IS (a more specific definition of discourse will be provided below). In other words, the problems mentioned raise the question of whether we can find or create a discourse that is better integrated with the discourses that are already present in IS. What should be the 'reference discourse', the main discourse in ethics-related IS research?

This paper discusses the ways in which computer ethics (CE) and responsible research and innovation (RRI) may inform ethics-related IS research, and how these discourses, held outside of the field, may contribute to IS research and practice. We begin by arguing that research in the field of CE has provided many insights into substantive moral problems as well as the theoretical

[☆] This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

* Corresponding author. Tel.: +44 116 2078252.

E-mail address: bstahl@dmu.ac.uk (B.C. Stahl).

underpinnings required to address them. After demonstrating this point by summarizing the main streams of activity in computer ethics and mapping them to ethics-related research in IS, we argue that, despite these contributions, there are limitations in CE that may be addressed by adopting a novel discourse that is currently held under the title of ‘responsible research and innovation in information and communication technologies (ICTs)’.

We argue that future ethics-related research in IS would benefit greatly from taking into consideration this change in reference discourse. The practical and application-oriented nature of the IS field renders it well equipped to address many of the issues arising from RRI in ICT. This is not to say that more philosophical-theoretical work is no longer welcome nor that there can be no other way of relating ethics to more practical concerns. Rather, the RRI discourse creates new opportunities for better integrating ethical concerns in IS that are directly linked to its ‘home’ discourse. Adopting RRI as a driving force of ethics-related research therefore constitutes the next step in build on the cumulative tradition of ethics-related work in IS. At the same time, adopting RRI means that IS work will need to look beyond its traditional boundaries and be more mindful of broader societal needs.

The argument put forward in this paper is important because it suggests new research directions for IS that fit into a broader research agenda in Europe and elsewhere. The suggestion of considering the concept of RRI plays on the traditional strengths of the IS discipline, namely its detailed empirical understanding of the role of ICTs in organizations and society. At the same time, this study shapes new research topics by focusing on significant social challenges. The paper furthermore contributes to the self-reflection of the IS discipline by demonstrating that there are important reference discourses that inform the way that ethical questions are addressed. By explicitly reflecting on such reference discourses, this paper allows scholars involved in ethics-related research to position their work in the broader social context, thereby contributing to greater societal and scholarly relevance in the field of IS.

To develop this argument, we start by reviewing the discourse in computer ethics and discuss its relevance in past ethics-related IS research. We define the basic terms of ethics, morality, norms and values. On this basis we then discuss topics, theories and approaches to computer ethics. This background is used to demonstrate the importance of what we refer to as ‘the reference discourse’ in shaping IS research. Having thus demonstrated the relevance of computer ethics as a reference discourse, we then introduce the discourse on RRI in ICT. This is done by showing that the limitations of computer ethics constitute a natural starting point for engaging with questions of governance of research and innovation. This provides the basis of a discussion of the degree to which the RRI discourse is already part of the IS research agenda and which steps would follow from integrating RRI into IS. The paper concludes by reflecting on its contribution and discussing future work.

2. Computer ethics and information systems

This section begins with an explanation of the approach taken by the paper. It explains the idea of reference discourse and outlines the methodological underpinnings of the narrative. This leads to a delineation of the subject area of ethics followed by a discussion of ideas and activities that may be considered under the heading of computer ethics. The section then demonstrates how work undertaken in computer ethics has influenced or is mirrored in the field of IS.

2.1. ‘Reference discourses’

At the core of this paper is the argument that ethics-related work in IS is influenced by external events related to society and

computing and that the current transition from computer ethics to RRI in ICT will be, or should be, reflected by IS research. We use the term ‘reference discourse’ to refer to these external influences. The term was chosen in explicit recognition of the long and continuing discussion of ‘reference disciplines’ in IS [2–4], where scholars recognize that the field of IS draws on prior and parallel scholarly activities. However, the term ‘reference discipline’ is stronger than required for our purposes. It would be difficult to argue that computer ethics constitutes a reference discipline because it is likely too small to be considered a discipline. Furthermore, it has its historical roots in philosophy and computer science [5].

However, the point of this paper is not to discuss whether there is a cumulative body of knowledge that is sufficiently mature and accepted as the ‘core’ of the IS discipline [6]. Rather, our interest lies in the fact that there is a discourse on computer ethics that is clear enough to constitute a recognizable influence factor on IS research and practice.

The definition of discourse used here is inspired by Habermas, who states that competing claims about truth, rightness and authenticity can be clarified by relying on the power of the best argument [7]. Without having to invoke potentially problematic aspects of Habermas’ position, such as the ideal speech situation, this paper argues that there is a discourse in computer ethics, (i.e., an enduring exchange of ideas that focuses on ethical questions related to computing) and that it becomes a reference discourse for IS if it influences and is influenced by research practice in IS. The following sections will broadly survey the discourse in both CE and RRI to trace the general lines of the computer ethics discourse and argue that new developments, such as RRI, should be incorporated into IS research.

2.2. Computer ethics: Theories, topics and approaches

One delimitation of computer ethics is any research activity that touches on right and wrong, good or bad, or moral or immoral in relation to computing. Philosophers may add moral intuition, character and virtue, explicit morality, ethical theory or reflection and meta-ethics insofar as it pertains to computing. However, this definition may be too broad to be practically useful because it would include a disparate body of work that is rooted in a wide range of disciplines.

The present paper therefore suggests a narrower definition that focuses on a community of practice. Willcocks [8] suggests a definition of information systems as ‘[...] those academics, researchers, teachers, students and indeed practitioners who gravitate around conferences such as ICIS, ECIS, HICSS, PACIS and AIS, tend to be members of the association for information systems or related/similar bodies, write research papers and books consciously within an IS discipline and publish in a self-defined group of ‘IS’ journals [...]’. This paper adopts an analogue definition of the field of computer ethics comprised of those individuals who would attend conferences, such as CEPE (computer ethics, philosophical inquiry), ETHICOMP or CAP (computers and philosophy), who are members of INSEIT (the international society for ethics and information technology) and who would publish in journals, such as Ethics and information technology, the *Journal of Information Communication and Ethics in Society* or the *International Review of Information Ethics*. It is important to note that computer ethics discourse journals are a less dominant publication venue than in other fields. Much of the work undertaken in computer ethics is published in single authored [9] or edited volumes, such as [10–14].

Most CE conferences and outlets were established in the 1990s. The history of some of the early members of this community and the interest in ethics and computing can be traced back further [5]. In fact, concern with the ethical aspects of computing coincides

with the beginnings of digital computing and was famously expressed by Norbert Wiener [15].

A field of research spanning nearly 70 years is difficult to describe. However, the majority of research in IS has taken place since the 1980s and 1990s, and there are a number of clearly recognizable streams of activities in computer ethics that can be categorized in terms of theories, topics and approaches, each discussed below.

2.2.1. Theories of computer ethics

The discourse in computer ethics is led by a significant number of scholars with a background in philosophy. It is therefore unsurprising that philosophical ethics plays an important role in the theoretical makeup of the discourse. One can observe numerous references to philosophical ethics, most notably the big three of (Kantian) deontology [16,17], utilitarian consequentialism [18] and virtue ethics in the Aristotelian tradition [19]. Deontology and consequentialism focus on principles of rational decision making in view of dilemmatic situations, whereas virtue ethics stresses the importance of individual character in evaluating the ethical character of the agent.

Although these three ethical positions are an integral part of the theoretical composition of the field, it is important to note that they are sometimes adapted specifically to questions and applications concerning computing [20]. Additionally, there are numerous other ethical approaches that are invoked in the area of computing, such as the ethics of care [21], which may be useful for understanding particular aspects, such as the ethical side of gender issues in computing [22], or the ethics underlying the capability approach developed by Sen [23] and Nussbaum [24], which has been shown to be relevant to ethics-related research on ICT [25], [26].

In addition to these examples of ethical theory applied to computing issues, there are also attempts to develop novel ethical approaches that are specific to problems of information or technology. Notable examples of such new ethical ideas are information ethics and disclosive ethics. Information ethics, which has been promoted by, and is strongly linked to, Luciano Floridi's work [12,27,28], is an attempt to develop an ethical position on the basis of the ontological properties of information. Disclosive ethics, on the other hand, [29] is an approach that attempts to make explicit the ethical assumptions embedded in technologies. Within the Dutch philosophy of (information) technology there have also been interesting new developments focusing on the link between ethics and design, such as value sensitive design [29], the morality of artefacts [30], and thinking about responsible innovation, which has contributed to the development of RRI in general [31].

Computer ethics draws on a broad range of theoretical positions that are relevant to the development or use of computing technologies. On the more technical side, there are theoretical positions stemming from areas such as engineering ethics [32] or technology ethics more broadly [33,34] that are relevant to computing. However, there has been a long tradition of research into ethical issues in organizations and societies, much of which touches on specific questions or problems raised by computing technology [35,36]. Computer ethics therefore draws on discussions in business ethics [37–39] and corporate social responsibility [40,41].

A final set of theoretical influences on the computer ethics discourse comes from philosophical disciplines other than moral philosophy. Computer ethics benefits from insights into the relationship between normative questions and other philosophical fields, such as epistemology, philosophical anthropology or ontology. An interesting recent example of this is the 'Onlife Manifesto' [42], in which a number of leading scholars explore the ways in which computing technologies fundamentally change the world we live in and the way we relate to it.

2.2.2. Topics of computer ethics

The complexity and multiple nature of theories in computer ethics is reflected by a broad array of topics discussed in the field. Brey and Soraker [43] identified a set of central issues of the field that they list as 'privacy, security, computer crime, intellectual property, free expression, and equity and access, and issues of responsibility and professional ethics'. A recent attempt by the European Group on Ethics in Science and New Technologies [44] to provide general guidance for European ICT researchers focuses on the fields of personal identity, changes to the social sphere, political participation and citizenship, and the sphere of e-commerce.

Each of these fields is the home of a number of different sub-topics that, due to space restrictions, cannot be discussed in detail in the present paper. However, there are a number of easily identifiable core issues worth listing because they have led to political debates in various countries [45] and are often examined by IS researchers. The most visible and dominant topic of computer ethics is that of privacy. While the discourse on privacy can be traced back to Warren and Brandeis' seminal paper [46], the current relevance to computer ethics is that the availability of digital information and the possibility of storing, processing and disseminating it changes the nature of how we perceive privacy [47]. This is directly related, albeit not identical, to the question of data protection [48].

Current debates around privacy and data protection, fuelled by recent political developments and the revelation of large-scale surveillance by several government agencies, show a direct link to the tension between individual rights and national security. Security is a complex topic that has been at the center of attention in computer ethics from its inception. Attempts to ethically evaluate security principles and practices have shown the ambiguities inherent in security. On the one hand, a feeling of security appears to be a necessity for human development and can therefore be argued to be of high ethical relevance [49]. On the other hand, concerns about security can be used to enforce potentially problematic power relationships. Security can be seen here as an ethically problematic mechanism of domination [50].

A further topic of discussion for computer ethics scholars is that of intellectual property. Like privacy and security, intellectual property is not fundamentally a new problem. Questions of ethical and legal justification and protection can be traced back through the history of philosophy [51,52]. However, the use of computing technology has changed important aspects of intellectual property. Digitizing content, such as books or movies, leads to new challenges that traditional property and intellectual property governance did not consider, notably, the negligible cost of reproducing content combined with the ease of copying leads to conceptual problems when applying traditional notions such as theft [53]. A further aspect of this debate refers to specific problems of software. The ownership of software and its justification raises issues that are hotly contested on philosophical as well as legal grounds. The widely used and arguably highly misleading metaphor of "piracy" to denote intellectual property infringements [54–57] is an indication of the visceral quality of the debate.

Intellectual property has influenced further debates in computer ethics regarding justice and the equity of the availability of computing resources. The more that computing is used throughout society, the more important it is for most individuals to be able to access it to live fulfilling personal and professional lives. Computer ethics therefore has long engaged in debates about ethical issues related to access that is often framed in terms of "digital divides" [58,59]. An important aspect of this is the question of participation in public discourses and the influence that computing has on political processes and decision making [60], which links to another well-established topic of computer ethics, namely that of

freedom of speech. Again, this is a well-established topic of ethical reflection that takes on a new urgency because of the capability of computers to facilitate a simple and broad dissemination of ideas while simultaneously offering new ways of censoring and prosecuting unwanted contributions [61].

The ever-broader uptake of computing and its pervasive role in many contexts has led to a more recent focus in computer ethics on issues related to the interplay between technology and humans as well as between technology and society. This covers new threats, such as identity theft, and more fundamental questions about the way we conceptualize humans and how modern technologies affect our individual and collective views of ourselves [42]. This covers topics such as the construction of gender [62] and the way we protect ourselves against crime as well as issues around what constitutes a good life and how we want to live it [20,63]. Spending our leisure time with and mediating our social contacts through technology is one example of this issue.

This list of topics in computer ethics cannot claim comprehensive coverage. It is meant to give an indication of some of the items discussed in the field. The list concludes with a reference to a central issue, namely that of professionalism. Within CE there has been a long debate about the degree to which computing can be perceived as a professional field and the way in which professionalism in computing may be used to address ethical concerns [64–66].

2.2.3. Approaches to computer ethics

The final aspect of computer ethics to be introduced here is the set of different approaches and research activities in the field. Just as there are a multitude of theories and topics, one can observe a number of research approaches. One observation of central importance to this paper is that, likely due to the strong influence of academic philosophy on computer ethics, there is a dominance of conceptual and reflective work, with empirical research playing a relatively minor role.

One likely cause of this is that philosophers realize that it is not straightforward to relate descriptions and prescriptions or, to use a different term, to move from 'is' to 'ought'. Philosophers have had long discussions of what is sometimes referred to as Hume's law or Hume's Guillotine [67], which states that description cannot lead to prescriptive or normative statements. In terms of computer ethics, this means that one cannot deduce the ethical acceptability of a particular position from an observation of actions or preferences of people with regard to this position. For example, a piece of research showing that a vast majority of respondents believe that sharing software is acceptable does not allow the conclusion that it is morally justified.

A second possible explanation for the relative paucity of empirical work in computer ethics is that neither philosophical training nor the technical training that computer scientists receive normally prepares a scholar for social inquiry. Questions of methodology that have a key place in social science-oriented publications, such as those in the field of IS, are rarely found in computer ethics.

The dominant approach to computer ethics is that of philosophical argument. Assumptions of concepts and discourses are made explicit and critically discussed to come to new insights. This is usually done using the background of philosophical ethics. The aim tends to be to improve conceptual clarity. Such improvement has recently been often linked to attempts to formulate possible consequences or policies. Examples of this are the development of a comprehensive ethics impact assessment [68] and technically addressing ethical issues in computing by, for example, developing ways of integrating values into technology through methods such as value-sensitive design [31,69,70] or privacy by design [71]. This paper argues that this practical turn is

an expression of the move from computer ethics to RRI in ICT. However, before we come to this argument, the relationship between computer ethics and ethics-related research in IS must be established.

2.3. Computer ethics as a reference discourse of information systems

The argument made here relies on the recognition that computer ethics can be seen as a reference discourse for ethics-related IS research. To demonstrate this, one needs to show that theories, topics and approaches of computer ethics are reflected in IS. It is important to note that this relationship is not one way and that one can observe an inverse relationship with IS as a reference discourse for computer ethics. However, this inverse relationship is less central to the argument made in this paper.

A look at the history of ethics-related IS research (cf. [72]) shows that theories, topics and approaches of computer ethics are all reflected in IS, albeit to different degrees. In recent years there has been some interest in ethical theory and its relevance to Information Systems [73–76]. In general, one can safely say that ethical theory has not been at the center of attention for IS scholars interested in ethical questions. Where ethics is the topic of investigation, one can typically find brief dictionary-style definitions of ethics and sometimes more specific references to some of the better-known ethical positions. The majority of the more intricate ethical discussions and, in particular, meta-ethical positions that are often at the core of computer ethics play a minor role in ethics-related IS research.

The role of computer ethics as a reference discourse for ethics-related IS research becomes much more prominent when one looks at the topics being investigated. The seminal discussion of ethics in Information Systems by Mason in 1986 [77], which coined the oft-cited acronym PAPA, touched on several of the aforementioned topics of computer ethics, namely, privacy, accuracy, property and access. However, it is interesting to note that the paper was written as an opinion piece that included only two references, neither of which could be considered related to computer ethics. When tracing the history of ethics-related research in IS, one can nevertheless find numerous further examples of investigations into the topics of relevance of computer ethics.

Privacy, most likely the most dominant topic of computer ethics, plays a similarly important role in ethics-related IS research. Not only is it the first 'P' in Mason's PAPA acronym, it is also a recurring topic in numerous prominent early ethics-related IS papers, such as [78,79]. The problematic relationship between privacy and security also finds its reflection in IS research [80]. Questions of intellectual property have similarly been of interest to IS researchers, who frequently attempt to identify the attitudes of professionals or users toward the ownership of content or software. This interest in intellectual property is reflected in related investigations that touch on questions of ownership, such as open source software [81], computer fraud [82] or perceptions of plagiarism [83].

In other topic areas, there is less overlap between computer ethics and ethics-related IS research. Some of the larger problems concerning the nature of identity, the development of culture and social interaction are less prominent in IS. At the same time, there is more of a focus on the ethical aspects of the use of computing technologies in IS [84]. One can nevertheless argue that there is significant overlap in the topics of interest between computer ethics and ethics-related IS research.

However, the same would be difficult to argue for with regard to research approaches and methodologies. IS research is often perceived to be part of the social science tradition. As a result, there is a strong dominance of empirical research using the various

paradigms, methods and methodologies that have been established in the field [85].

To summarize, one can say that computer ethics plays the role of a reference discourse for ethics-related IS research in the sense that much of the key areas of interest can be found in both. This does not make a strong statement about the direction of the relationship between the two. As indicated above, one can equally argue that IS research has the function of a reference discourse for at least some work in computer ethics. A further possibility would be to see both streams of research reflect the public interest in important social concerns. For the purposes of this paper, the details of the mechanisms facilitating it are of secondary importance. The paper argues that computer ethics is taking a novel turn toward RRI in ICT, which IS may wish to reflect. Although the ground for this turn was prepared by those working in computer ethics [31,86], it is worth emphasizing the new discourse and its advantages in comparison to (traditional) computer ethics. This point is made in detail in the following section, which introduces the concept of RRI in ICT as the next step in building on computer ethics.

3. Responsible research and innovation in ICT

This section argues that there is a novel discourse that has the potential to build upon and integrate computer ethics but takes the theories, topics and approaches further and in a slightly different direction. The section starts by discussing the limitations of (mainstream) computer ethics, which may account for why the RRI discourse can offer novel avenues that are attractive to computer ethicists. The following subsections briefly outline the current actors, activities and underpinnings of RRI. This leads to a discussion of the implications of adoption of RRI in IS.

3.1. Limitations of the computer ethics discourse

As suggested, the discourse on computer ethics has a number of limitations whose resolution is likely to require new ideas and approaches. The first and most obvious shortcoming is that of the term 'computer'. When the discourse on computer ethics began, a computer was a clearly recognizable artefact. As computers changed their shape and role from large mainframes to distributed terminals and personal computers, they remained clearly identifiable. However, the distinction between computers and other artefacts is no longer obvious (e.g., cyber-infrastructure, mobile computing and sensor networks). Additionally, most technical artefacts, from cars to telephones, include and are often based on computing technology.

In addition to this ubiquity there is a convergence of technologies. Several types of currently developed fields of technology are intimately connected to computing. One can find reference to the convergence of nano, bio, information and cognitive technologies [87,88]. This convergence renders it difficult to see how a coherent discourse on computer ethics can be sustained. It is likely that the distinction between computing and other technologies will be even less clearly defined in the future than it is in the present [89].

The ubiquity of computers and computing technology and their convergence with other technologies may be why some authors prefer the term 'information and communication technology' (ICT). Consequently, one can observe the use of the term ICT ethics [20,90]. Another strategy is to move away from the link to the artefact, which appears to be the focus of computer ethics, to an ethical focus on the concept of information, as is done by scholars concentrating on information ethics [27,91].

This shift in focus to information from computing artefact may go some way toward defining the boundaries of computer ethics

discourse. It does not necessarily address one of the other key challenges, namely, the unclear 'practical relevance' of the CE discourse to IS researchers and practitioners. Complaints about lack of relevance are not confined to computer ethics because the discussion in IS on the relationship of rigor versus relevance [92–94] demonstrates. Nor is this concern particularly novel, which was noted by Gotterbarn 20 years ago [95]. This paper does not take a position on whether the observation of the lack of relevance of computer ethics is justified. However, it is plausible to assume that the increasingly ubiquitous nature of computing technologies calls for a reflection of related ethical concerns in public discourse and policy and for a stronger presence of computer ethics in such policy discussions would be desirable.¹

A final reason why the (mainstream) computer ethics discourse may be deemed to be in need of novel impulses is that some of the traditional ways of dealing with ethics research appear to be reaching their limits when applied to innovations in computing. A primary example is that of informed consent, the cornerstone of biomedical and research ethics, which is also used in other disciplines that conduct empirical research. It is unclear whether established procedures of informed consent are applicable or whether they are principle conceivable [96]. Traditional concepts of responsibility that focus on the clearly delineated action of the individual are increasingly difficult to apply to the mediated and networked world of computing technologies.

None of these limitations of the computer ethics discourse are insurmountable, and most have been discussed and addressed [43,97]. However, these limitations may explain to some degree why the novel discourse on responsible innovation resonates and points to activities concerning the ethics of computing.

3.2. Definition, actors, activities, normative foundations of RRI

The concept of responsible research and innovation (RRI) is a relatively new one that aims primarily at research governance. Thus, RRI it is not focused on computing or ICT. However, a number of aspects and components of RRI are directly related to the ethics of research and technology development. In many respects it is a natural extension of other discourses, such as the discourse on computer ethics, and particularly on novel approaches within that discourse.

Many of the ideas and principles underpinning RRI can be traced to the Enlightenment. However, the history of the term 'RRI' began much more recently. The term 'responsible development', which is one of the roots of RRI, first appeared in the 21st century nano-technology research and development act (Public Law 108-153 [2]) in the US, where the concept is promoted as part of an initiative to strengthen nano-technological research.

Originally aimed at preventing harm arising from research and innovation activities [98], RRI has since broadened its objectives. Its starting point is the dilemma that we may not know the future but that it seems likely that there are significant socio-economic and technical problems (often referred to as grand challenges [99]) that will require input from research and innovation systems if they are to be satisfactorily addressed [100]. These grand challenges are often global or cover large parts of humanity. Examples include demographic developments, security and sustainability. At the same time, there are no global mechanisms for identifying such challenges, much less for a unified response to them.

¹ Such reflection is present in current computer ethics, particularly in work that connects the ethics of information technology with studies of science and technology (STS), and thinking about the link between theoretical and empirical concerns is certainly present in the field (see, for example, Dutch philosophy of technology). However, mainstream, traditional computer ethics – particularly computer ethics treated as a branch of 'applied ethics', has not spent much effort on practical concerns – including policy issues.

RRI is meant to address the gap in time between the initial phases of research strategy formulation to the point at which individuals and organizations regularly use products and services based on research output. Various definitions exist [101–103]. However, the key component of each definition is that they all express a need to develop greater democratic accountability within the innovation lifecycle. RRI is concerned with creating a new mode of research governance that can transform existing processes with a view to ensuring a greater acceptability and even desirability of novel research and innovation outcomes.

A widely quoted definition of RRI from Von Schomberg [104] follows:

Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).

This definition is critically discussed in [105]. However, for this paper, one can underline the intention of ensuring acceptability, sustainability and desirability of both the process and products of innovation. Additionally, it is important to note that this requires the mutual responsiveness of various societal actors. RRI has gained considerable prominence in European policy discussions and has been adopted by the European Commission as a cross-cutting activity that will govern all research funded under Horizon 2020, the next European research framework program that will run from 2014 to 2020 and have an overall value of more than €70 billion. This research framework has an important influence on ICT research, which will receive approximately €8 to €9 billion of this amount. Activities directly related to RRI are concentrated in a funding stream on 'Science with and for Society', which has a budget of €462 million over the lifetime of the Horizon 2020 program.²

We have elsewhere [106] argued that RRI can be interpreted as a higher-level responsibility or meta-responsibility that aims to shape, maintain, develop, coordinate and align existing and novel research and innovation-related processes, actors and responsibilities with a view to ensuring desirable and acceptable research outcomes. This means that RRI can and will incorporate a number of extant components (and this is likely to include numerous aspects of computer ethics), but goes beyond them by supporting actions that will allow these components to contribute to the acceptability and desirability of the outcomes of research and innovation.

Many of the activities that contribute to RRI are well established. Examples include various types of assessments, such as risk assessment and impact assessments [107,108]; technology assessment [109]; various types of research governance structures, such as research ethics reviews [110] and research integrity measures [111]; public engagement in research [112]; the education of researchers [98]; and the support for the development of professionalism [101], to name just some of the more prominent assessments. It is interesting to note that there is some overlap with the applications of computer ethics discussed above. However, RRI has a much broader goal of integrating research and innovation into social discussion and reflection.

It is worth noting here that RRI overlaps to a large degree with technology assessment, although RRI is broader and encompasses many of the ideas and principles that have been developed in technology assessment since the 1970s [113].

The focus on acceptability and desirability means that RRI must actively reflect on its normative underpinnings. In view of

the global nature of research and innovation systems as well as of the global challenges that humanity faces, the search for generally binding normative underpinnings is important [114]. Normative foundations on which RRI can be based include human rights and internationally binding treaties, such as the EU treaties for EU Member States. Normative principles can furthermore be sought in philosophical ethics, with some scholars suggesting that there are generally accepted principles [86,115] that are sufficiently defined to provide the basis for collective action. Further normative principles can be deduced from established processes, such as ethics reviews, which can draw on a long history of debate in biomedical research ethics. The implementation of RRI activities through research governance measures can make use of widely shared principles of research governance, such as the integration of democratic principles into research [116], the precautionary principle [117,118] or the principle of regulatory parsimony [116].

The debate about the exact shape that RRI will take and the way in which existing and new responsibilities can be defined and realized is in its infancy. One can observe attempts to implement principles of RRI in some of the more contested areas of research and innovation, such as synthetic biology [119,120], nanotechnology [121–123] or geoengineering [124,125]. RRI must contend with a number of fundamental questions, such as the limits of foresight and the legitimacy of research governance that may be difficult to address. There is likely to be resistance to RRI from numerous actors who may see it as a threat to the academic freedom of research. The global nature of the challenges to be addressed will require novel forms of transnational research governance, which may be difficult to agree on and implement. It is thus by no means certain that RRI will be successful. At the same time, one can see that RRI has spawned a lively debate and that it offers an exciting opportunity to think about new research concepts, innovation and governance.

Returning to the discussion of the relationship between RRI and computer ethics, one can see that there is space for all of the concerns of computer ethics in RRI. At the same time, RRI is broader and specifically focused on the outcomes of research with attention to grand challenges and the desirability and acceptability of both research processes and products. The move from computer ethics to RRI in ICT is thus not a disruption, but rather can be seen as an evolutionary development that addresses some of the limitations of mainstream, traditional computer ethics and allows for the tradition of computer ethics to be embedded into a broader social context.

3.3. Consequences of adopting the RRI discourse in IS

If the thesis of this paper is correct, namely that there is a development from computer ethics to RRI in ICT and that computer ethics serves as a reference discourse to ethics-related research in IS, then an important question is how IS can react to this change in the reference discourse.

An initial response to this question is that ethics-related research in IS can examine broader topics. Traditionally, much attention has been paid to ethical issues related to the use of ICT in organizations and to questions of the legal status of activities and enforcement of organizational policies. Such research will remain relevant. However, in the spirit of RRI, a more prominent question will focus on whether and how information systems can contribute to the resolution of grand challenges. Initial developments in this direction can already be observed. There are now examples of papers in IS that look at various grand challenges [126,127]. An alternative way of framing this broader perspective has been suggested by Walsham [128] in considering whether IS research is creating a better world.

² https://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/applying-for-funding/find-a-call/h2020-structure-and-budget_en.htm, accessed 17.12.2013.

This broadening of the research agenda can be supported by paying more attention to the likely future consequences of IS. Again, this is a stream of research that already exists [129] but would need to become more central to support the RRI agenda.

RRI is explicitly normative. To reflect and translate this normative foundation, IS research, in taking RRI seriously, would need more time to reflect on ethical theory and its relevance in IS. As previously outlined, this is a recent development and should be supported.

However, a core aspect of RRI not currently strongly reflected in IS is that of public participation and engagement. Much organization-focused IS research accepts the existing socio-economic structures in current commercial organizations where participation and engagement have a place as user feedback, at best. However, it is worth noting that there is a long tradition of participative IS design [130,131], particularly strong in Scandinavian IS [132], which can serve as a bridgehead for a more general democratic and participative approach to IS governance. Additionally, IS can further learn from technology assessment, which includes approaches to organizing and public participation in decisions concerning technology.

4. Conclusion

This paper has argued that computer ethics constitutes a reference discourse for IS. That is to say, an ongoing body of work has inspired, and is inspired by, IS research, particularly ethics-related IS research. By discussing the underlying concepts, theories, topics and approaches to computer ethics, this paper has made the case that the correspondence between this discourse and ethics-related IS research is sufficient to justify the contention that computer ethics is a reference discourse.

The paper then argued that the computer ethics discourse is evolving to constitute part of a broader discourse on responsible research and innovation. This can at least be partly explained by some of the limitations of traditional computer ethics (and perhaps also traditional technology assessment), which can be addressed in RRI. The paper then outlined the RRI discourse, highlighting its motivation, definition, main actors, activities and normative foundations.

Returning to the idea of a reference discourse, the paper further argued that the field of IS, at least insofar as it is interested in ethics, should take this discussion of RRI seriously. The paper outlined what this may mean for the theory and practice of IS research.

One contribution of the paper is an opening to theoretical discussions that can be of relevance to IS. Much research has been undertaken in areas ranging from ethical theory [72] to future foresight [133,134], to research governance [102]. IS researchers can make use of this prior research to inform their work and integrate it into larger discussions cf. [135].

The development from computer ethics to RRI in ICT, furthermore, can lead not only to a reconsideration of the purpose of ethics-related IS work but also arguably to that of the field of IS more generally. Much IS research focuses on the organizational use of ICT, often with an explicit or implicit agenda of improving the use of technology. The majority of this work takes for granted the socio-economic context in which IS is used. Through the lens of RRI, IS researchers may obtain a better understanding of the grand challenges that humanity and most societies face and may be encouraged to consider how their research can contribute to addressing these challenges. From this perspective, it is imperative to question the way we organize and critically review our assumptions of what constitutes legitimate social practice, including ICT research and development, and the use of ICT in organizations and society. This means a fundamental reevaluation

of the very nature of the technologies we use and how we use them.

This is a serious challenge for any discipline, including IS. At the same time, one can argue that in light of many of the problems we face, and the important role ICT can play in constituting as well as resolving those problems, the IS field can embrace such a redefinition.

It is important to highlight the important contribution that IS can make to grand challenges. Unlike conceptual and philosophically oriented computer ethics, the field of IS has a strong background in empirical research. Additionally, IS further has a rich repertoire of theoretical positions that aid in understanding the role of ICT and its interaction with individuals, organizations and society. ICTs have the potential to play a critical role in addressing societal challenges but doing so successfully requires a detailed understanding of both the technical capabilities and the socio-technical practices that shape the role of ICT in society. IS can thus play a key role in addressing the challenges of modern societies. Both society and IS as a discipline would benefit from a willingness and ability of IS scholars to accept this challenge.

Acknowledgements

This paper benefited from the activities undertaken within the project 'Framework for Responsible Research and Innovation in ICT' (EPSRC reference EP/J000019/1). For more information, see www.responsible-innovation.org.uk.

This study received funding from the European Community's Seventh Framework Programme (FP7/2007–2013) under grant agreements no. 230318 (ETICA). Additionally, the paper benefited from work undertaken in preparation for the EU project, 'Responsible-Industry', grant agreement no. 609817.

References

- [1] A.L. Harris, M. Lang, D. Yates, S.E. Kruck, Incorporating ethics and social responsibility in IS education, *J. Inf. Syst. Educ.* 22 (Fall (3)), 2011, pp. 183–189.
- [2] P. Keen, MIS research: reference disciplines and a cumulative tradition, *Proceedings of the First International Conference on Information Systems* 1980.
- [3] A.S. Lee, M.I.S.R. Center, University of Minnesota, Architecture as a Reference Discipline for MIS, Management Information Systems Research Center, Curtis L. Carlson School of Management, University of Minnesota, 1991.
- [4] R.L. Baskerville, M.D. Myers, Information systems as a reference discipline, *MIS Q.* 26 (1), 2002, pp. 1–14.
- [5] T. Bynum, Computer and Information Ethics, *Stanford Encyclopedia of Philosophy*, 2008.
- [6] I.R.W. Benbasat Zmud, The identity crisis within the IS discipline: defining and communicating the discipline's core properties, *MIS Q.* 27 (2), 2003, pp. 183–194.
- [7] J. Habermas, *Theorie des Kommunikativen Handelns*, Suhrkamp, 1981.
- [8] L. Willcocks, Foucault, power/knowledge and information systems: reconstructing the present, in: J. Mingers, L. Willcocks (Eds.), *Social Theory and Philosophy for Information Systems*, Wiley, Chichester, 2004, pp. 238–296.
- [9] D.G. Johnson, *Computer Ethics*, 1st ed., Prentice Hall, Upper Saddle River, New Jersey, 1985.
- [10] K.E. Himma, H.T. Tavani, *The Handbook of Information and Computer Ethics*, N.J.: Wiley, Hoboken, 2008.
- [11] J. van den Hoven, J. Weckert (Eds.), *Information Technology and Moral Philosophy*, 1st ed., Cambridge University Press, 2008.
- [12] L. Floridi, in: L. Floridi (Ed.), *Information ethics*, Cambridge University Press, 2010, pp. 77–97.
- [13] R.A. Spinello, H.T. Tavani, *Readings in Cyber Ethics*, Jones and Bartlett Publishers Inc., 2001.
- [14] D.G. Johnson, H. Nissenbaum, *Computers, Ethics and Social Values*, 1st ed., Pearson, 1995.
- [15] N. Wiener, *The Human Use of Human Beings*, Doubleday, New York, 1954.
- [16] I. Kant, *Kritik der praktischen Vernunft*, Reclam, Ditzingen, 1986.
- [17] I. Kant, *Grundlegung zur Metaphysik der Sitten*, Reclam, Ditzingen, 1998.
- [18] J.S. Mill, *Utilitarianism*, 2nd ed., Hackett Publishing Co., Inc., 2002.
- [19] Aristotle, *The Nicomachean Ethics*, Filiquarian Publishing, LLC, 2007.
- [20] T.W. Bynum, Flourishing ethics, *Ethics Inf. Technol.* 8 (1), 2006, pp. 157–173.
- [21] C. Gilligan, *In a Different Voice: Psychological Theory and Women's Development*, Reissue, Harvard University Press, 1990.
- [22] A. Adam, Computer ethics in a different voice, *Inf. Organ.* 11 (4), 2001, pp. 235–261.
- [23] A. Sen, *The Idea of Justice*, Allen Lane, 2009.

- [24] M.C. Nussbaum, *Creating Capabilities: The Human Development Approach*, Harvard University Press, 2011.
- [25] J. Johnstone, Technology as empowerment: a capability approach to computer ethics, *Ethics Inf. Technol.* 9 (1), 2007, pp. 73–87.
- [26] I. Oosterlaken, J. van den Hoven (Eds.), *The Capability Approach Technology and Design*, 2012th ed., Springer, 2012.
- [27] L. Floridi, Information ethics: on the philosophical foundations of computer ethics, *Ethics Inf. Technol.* 1 (1), 1999, pp. 33–52.
- [28] C. Ess, Luciano Floridi's philosophy of information and information ethics: critical reflections and the state of the art, *Ethics Inf. Technol.* 10 (2–3), 2008, pp. 89–96.
- [29] P. Brey, *Disclosive computer ethics: exposure and evaluation of embedded normativity in computer technology*, CEPE Computer Ethics: Philosophical Enquiry, Dartmouth College, 2000.
- [30] P.-P. Verbeek, The moral relevance of technological artifacts, in: P. Sollie, M. Düwell (Eds.), *Evaluating New Technologies: Methodological Problems for the Ethical Assessment of Technology Developments*, Springer, 2009, pp. 63–78.
- [31] J. van den Hoven, D. Helbing, D. Pedreschi, J. Domingo-Ferrer, F. Gianotti, M. Christen, *FuturICT – The Road Towards Ethical ICT*, arXiv:1210.8181, Oct. 2012.
- [32] Royal Academy of Engineering, *Engineering Ethics in Practice: A Guide for Engineers*, Royal Academy of Engineering, London, 2011.
- [33] A. Grunwald, Technology assessment or ethics of technology? *Ethical Perspect.* 6 (2), 1999, pp. 170–182.
- [34] L. Magnani, The mediating effect of material cultures as human hybridization, in: S. Hongladarom, C. Ess (Eds.), *Information Technology Ethics: Cultural Perspectives*, Illustrated ed., Information Science Reference, 2006, pp. 31–53.
- [35] R.T. De George, *The Ethics of Information Technology and Business*, Wiley-Blackwell, 2003.
- [36] P. Duquenoy, N. Dando, I. Harris, *Ethics in the Provision and Use of IT for Business*, Institute of Business Ethics in association with the BCS, London, 2010.
- [37] E. Cohen, L. Cornwell, A question of ethics: developing information system ethics, *J. Bus. Ethics* 8 (June (6)), 1989, pp. 431–437.
- [38] D.G. Johnson, Corporate excellence, ethics, and the role of IT, *Bus. Soc. Rev.* 111 (4), Dec. 2006, pp. 457–470.
- [39] D.B.J.L. Payne Landry, A uniform code of ethics: business and IT professional ethics, *Commun. Acrm.* 49 (11), 2006, pp. 80–84.
- [40] M.E. Porter, M.R. Kramer, The link between competitive advantage and corporate social responsibility, *Harv. Bus. Rev.* 84 (12), 2006, pp. 78–92.
- [41] *Blue and Green Tomorrow, The Guide to Corporate Social Responsibility 2013*, Apr. 2013.
- [42] S. Broadbent, N. Dewandre, C. Ess, L. Floridi, J.-G. Ganascia, M. Hildebrandt, Y. Laouris, C. Lobet-Maris, S. Oates, U. Pagallo, J. Simon, M. Torseth, P.-P. Verbeek, *The Onlife Initiative*, European Commission, 2013.
- [43] P. Brey, J.H. Soraker, *Philosophy of computing and information technology*, in: D.M. Gabbay, A.W.M. Meijers, J. Woods, P. Thagard (Eds.), *Philosophy of Technology*, Engineering Sciences: 9, North Holland, 2009, pp. 1341–1408.
- [44] European Group on Ethics in Science and New Technologies, *Ethics of Information and Communication Technologies*, BEPA – Bureau of European Policy Advisors, Brussels, Opinion of the EGE 26, Feb. 2012.
- [45] European Commission, *Monitoring Policy and Research Activities on Science in Society in Europe (MASIS) – Final Synthesis Report*, Directorate-General for Research and Innovation, Brussels, 2012.
- [46] S.D. Warren, L.D. Brandeis, *Right to privacy*, *Harv. Law Rev.* 4, 1891, p. 193.
- [47] H. Tavani, *Informational privacy: concepts, theories and controversies*, in: J.V.D. Hoven, J. Weckert (Eds.), *Information Technology, Moral Philosophy*, Cambridge University Press, Cambridge, 2008, pp. 131–164.
- [48] L.M. Lee, L.O. Gostin, *Ethical collection, storage, and use of public health data a proposal for a national privacy protection*, *JAMA-J. Am. Med. Assoc.* 302 (1), 2009, pp. 82–84.
- [49] W.S. Brown, *Ontological security, existential anxiety and workplace privacy*, *J. Bus. Ethics* 23 (1), 2000, pp. 61–65.
- [50] J. Arquilla, *Conflict, security and computer ethics*, in: L. Floridi (Ed.), *The Cambridge Handbook of Formation, Computer Ethics*, Cambridge University Press, 2010, pp. 133–148.
- [51] A.D. Moore, *Personality-based, rule-utilitarian and Lockean justifications of intellectual property*, in: J.V.D. Hoven, J. Weckert (Eds.), *Information Technology and Moral Philosophy*, Cambridge University Press, Cambridge, 2008, pp. 105–130.
- [52] G. Hull, *Robert merges: justifying intellectual property*, *Ethics Inf. Technol.* 14 (2), 2012, pp. 169–177.
- [53] T. Thomas, M. Ahyick, *Can we help information systems students improve their ethical decision making? Interdiscip. J. Inf. Knowl. Manag.* 5, 2010, pp. 209–224.
- [54] R.D. Gopal, G.L. Sanders, *International software piracy: analysis of key issues and impacts*, *Inf. Syst. Res.* 9 (4), 1998, pp. 380–397.
- [55] W.-B. Chiou, P.-H. Wan, C.-S. Wan, *A new look at software piracy: soft lifting primes an inauthentic sense of self, prompting further unethical behavior*, *Int. J. Hum. Comput. Stud.* 70 (2), 2012, pp. 107–115.
- [56] T.T. Moores, J.C. Chang, *Ethical decision making in software piracy: initial development and test of a four-component model*, *Mis Q.* 30 (1), 2006, pp. 167–180.
- [57] T.T. Moores, A. Nill, M.A. Rothenberger, *Knowledge of software piracy as an antecedent to reducing pirating behavior*, *J. Comput. Inf. Syst.* 50 (1), 2009, pp. 82–89.
- [58] K. McSorley, *The secular salvation story of the digital divide*, *Ethics Inf. Technol.* 5 (2), 2003, pp. 75–87.
- [59] G. Parayil, *The digital divide and increasing returns: contradictions of informational capitalism*, *Inf. Soc.* 21 (1), 2005, pp. 41–51.
- [60] W. Olphert, L. Damodaran, *Citizen participation and engagement in the design of e-government services: the missing link in effective ICT design and delivery*, *J. Assoc. Inf. Syst.* 8 (9), 2007, pp. 491–507.
- [61] B. Leiter, *Cleaning cyber-cesspools: google and free speech*, in: S. Levmore, M.C. Nussbaum (Eds.), *Offensive ternet: Speech, Privacy, Reputation*, Harvard University Press, 2010, pp. 155–173.
- [62] A. Adam, *Gender, Ethics and Information Technology*, Palgrave Macmillan, Basingstoke, 2005.
- [63] S. Vallor, *Flourishing on facebook: virtue friendship and new social media*, *Ethics Inf. Technol.* 14 (3), 2012, pp. 185–199.
- [64] D. Gotterbarn, K. Miller, S. Rogerson, *Software engineering code of ethics is approved*, *Commun. ACM* 42 (10), 1999, pp. 102–107.
- [65] M.E. Gorman, *Turning students into ethical professionals*, *IEEE Technol. Soc. Mag.* 20 (Winter/2001 (4)), 2002, pp. 21–27.
- [66] D.G. Johnson, *Computing ethics computer experts: guns-for-hire or professionals?* *Commun. ACM* 51 (10), 2008, pp. 24–26.
- [67] D. Hume, *An Enquiry Concerning the Principles of Morals*, Project Gutenberg, 1777.
- [68] D. Wright, *A framework for the ethical impact assessment of information technology*, *Ethics Inf. Technol.* 13 (3), 2011, pp. 199–226.
- [69] B. Friedman, D. Howe, E. Felten, *Informed consent in the mozilla browser: implementing value sensitive design*, *Hawaii International Conference on System Sciences*, Los Alamitos, CA, USA, 2002, p. 247.
- [70] B. Friedman, P. Kahn, A. Borning, *Value sensitive design and information systems*, in: K. Himma, H. Tavani (Eds.), *The Handbook of formation, Computer Ethics*, Wiley Blackwell, 2008, pp. 69–102.
- [71] S. Gürses, C. Troncoso, C. Diaz, *Engineering privacy by design*, Presented at the Conference on Computers, Privacy and Data Protection (CPDP 2011), 2011.
- [72] B. Stahl, *Morality, ethics, and reflection: a categorization of normative IS research*, *J. Assoc. Inf. Syst.* 13 (August (8)), 2012.
- [73] A. Bryant, F. Land, J.L. King, *Editor's introduction to the special issue on ethical issues in IS research*, *J. Assoc. Inf. Syst.* 10 (11), 2009, pp. 782–786.
- [74] J.G. Mingers Walsham, *Towards ethical information systems: the contribution of discourse ethics*, *MIS Q.* 34 (4), 2010, pp. 833–854.
- [75] C. Bull, *A review of ethical theory in the 'upper echelons' of information systems research*, in: *Proceedings of the 17th European Conference on Information Systems*, Verona, Italy, Verona, Italy, 2009.
- [76] S. Sarker, M. Fuller, S. Chatterjee, *Ethical information systems development: a baumanian postmodernist perspective*, *J. Assoc. Inf. Syst.* 10 (November (11)), 2009, pp. 787–815.
- [77] R.O. Mason, *Four ethical issues of the information age*, *MIS Q.* 10 (1), 1986, pp. 5–12.
- [78] D.W. Straub, R.W. Collins, *Key information liability issues facing managers: software piracy, proprietary databases, and individual rights to privacy*, *MIS Q.* 14 (2), 1990, pp. 143–156.
- [79] H.J. Smith, S.J. Milberg, S.J. Burke, *Information privacy: measuring individuals' concerns about organizational practices*, *MIS Q.* 20 (June (2)), 1996, pp. 167–196.
- [80] S. Conger, K.D. Loch, B.L. Helft, *Ethics and information technology use: a factor analysis of attitudes to computer use*, *Inf. Syst. J.* 5 (3), 1995, pp. 161–183.
- [81] K.J. Stewart, S. Gosain, *The impact of ideology on effectiveness in open source software development teams*, *MIS Q.* 30 (June (2)), 2006, pp. 291–314.
- [82] J. Wareham, D. Robey, C. Chua, *The role of online trading communities in managing internet auction fraud*, *Manag. Inf. Syst. Q.* 31 (November (4)), 2008, pp. 759–781.
- [83] R. Davison, N. Kock, *Dealing with plagiarism in the information systems research community: a look at factors that drive plagiarism and ways to address them*, *Manag. Inf. Syst. Q.* 27 (December (4)), 2003.
- [84] H.J. Smith, J. Hasnas, *Ethics and information systems: the corporate domain*, *Mis Q.* 23 (1), 1999, pp. 109–127.
- [85] W.J. Orlikowski, J.J. Baroudi, *Studying information technology in organizations: research approaches and assumptions*, *Inf. Syst. Res.* 2 (1), 1991, pp. 1–28.
- [86] P.A.E. Brey, *Anticipating ethical issues in emerging IT*, *Ethics Inf. Technol.* 14 (May (4)), 2012, pp. 305–317.
- [87] G. Khushf, *Systems theory and the ethics of human enhancement – a framework for NBIC convergence*, in: M.C. Roco, C.D. Montemagno (Eds.), *Coevolution of Human Potential Converging Technologies*, (1013), 2004, pp. 124–149.
- [88] B. Gordijn, *Converging NBIC technologies for improving human performance: a critical assessment of the novelty and the prospects of the project*, *J. Law Med. Ethics* 34 (December (4)), 2006, pp. 726–732.
- [89] P. Sollie, M. Düwell (Eds.), *Evaluating New Technologies: Methodological Problems for the Ethical Assessment of Technology Developments*, Springer, 2009.
- [90] K. Górniak-Kocikowska, *From computer ethics to the ethics of global ICT systems*, *Libr. Hi Tech* 25 (March (1)), 2007, pp. 47–57.
- [91] K. Mathiesen, *What is information ethics?* *ACM SIGCAS Comput. Soc.* 34 (1), 2004, pp. 6–15.
- [92] P. Darke, G. Shanks, M. Broadbent, *Successfully completing case study research: combining rigour, relevance and pragmatism*, *Inf. Syst. J.* 8 (October (4)), 1998, pp. 273–289.
- [93] I. Benbasat, R.W. Zmud, *Empirical research in information systems: the practice of relevance*, *MIS Q.* 23 (March (1)), 1999, pp. 3–16.
- [94] P.G.W. Keen, *Relevance and rigor in information systems research: improving quality, confidence, cohesion and impact*, in: H.-E. Nissen, H.K. Klein, R. Hirschheim (Eds.), *Information Systems Research: Contemporary Approaches, Emergent Traditions*, North Holland, Amsterdam, 1991, pp. 27–49.

- [95] D. Gotterbarn, Computer ethics – responsibility regained, in: D.G. Johnson, H. Nissenbaum (Eds.), *Computers, Ethics and Social Values*, 1st ed., Prentice Hall, Upper Saddle River, 1995, pp. 18–24.
- [96] E.-H.W. Kluge, Ethical and legal challenges for health telematics in a global world: telehealth and the technological imperative, *Int. J. Med. Inf.* 80 (2), 2011, pp. E1–E5.
- [97] T.W. Bynum, S. Rogerson, *Computer Ethics and Professional Responsibility: Introductory Text and Readings*, Wiley-Blackwell, 2003.
- [98] Technopolis and Fraunhofer I.S.I, *Interim Evaluation and Assessment of Future Options for Science in Society Actions Executive Summary Final Report*, Technopolis group, Brighton, UK, 2012.
- [99] M. Boden, R. Johnston, F. Scapolo, The role of FTA in responding to grand challenges: a new approach for STI policy? *Sci. Public Policy SPP* 39 (March (2)), 2012, pp. 135–139.
- [100] L. Levidow, C. Neubauer, Opening up societal futures through EU research and innovation agendas, *EASST Rev.* 31 (3), 2012, pp. 4–11.
- [101] H. Sutcliffe, *A report on Responsible Research and Innovation*, 2011.
- [102] R. von Schomberg (Ed.), *Towards Responsible Research and Innovation in the Information and Communication Technologies and Security Technologies Fields*, Publication Office of the European Union, Luxembourg, 2011.
- [103] R. Owen, P. Macnaghten, J. Stilgoe, Responsible research and innovation: from science in society to science for society, with society, *Sci. Public Policy* 39 (6), 2012, pp. 751–760.
- [104] R. von Schomberg, A vision of responsible research and innovation, in: R. Owen, M. Heintz, J. Bessant (Eds.), *Responsible Innovation*, Wiley, 2013, pp. 51–74.
- [105] R. Owen, M. Heintz, J. Bessant (Eds.), *Responsible Innovation*, Wiley, 2013.
- [106] B.C. Stahl, Responsible research and innovation: the role of privacy in an emerging framework, *Sci. Public Policy* (September), 2013, p. sct067.
- [107] R. Owen, N. Goldberg, Responsible innovation: a pilot study with the U.K. engineering and physical sciences research council, *Risk Anal. Int. J.* 30 (November (11)), 2010, pp. 1699–1707.
- [108] D. Wright, R. Gellert, S. Gutwirth, M. Friedewald, Precaution and privacy impact assessment as modes towards risk governance, in: R. Von Schomberg (Ed.), *Towards Responsible Research and Innovation in the formation, Communication Technologies, Security Technologies Fields*, Publication Office of the European Union, Luxembourg, 2011, pp. 83–97.
- [109] A. Grunwald, Technology assessment: concept and methods, in: D.M. Gabbay, A.W.M. Meijers, J. Woods, P. Thagard (Eds.), *Philosophy of Technology, Engineering Sciences*: 9, North Holland, 2009, pp. 1103–1146.
- [110] European Commission, *Ethics for Researchers – Facilitating Research Excellence*, European Commission Directorate-General for Research, Luxembourg, 2007.
- [111] RCUK, *Integrity, Clarity and Good Management – RCUK Policy and Code of Conduct on the Governance of Good Research Conduct*, Jul. 2009.
- [112] R. van Est, The broad challenge of public engagement in science, *Sci. Eng. Ethics* 17 (December (4)), 2011, pp. 639–648.
- [113] C. Coenen, E. Simakova, STS policy interactions, technology assessment and the governance of technovisionary sciences, *Sci. Technol. Innov. Stud.* 9 (2), 2013, pp. 3–20.
- [114] European Commission, *Ethical and Regulatory Challenges to Science and Research Policy at the Global Level*, Directorate-General for Research and Innovation, Luxembourg, 2012.
- [115] T. Holmes, E. Blackmore, R. Hawkins, *The Common Cause Handbook: A Guide to Values and Frames for Campaigners, Community Organisers, Civil Servants, Fundraisers, Educators, Social..., Funders, Politicians, and Everyone in Between*, Public Interest Research Centre Ltd, 2011.
- [116] A. Gutmann, The ethics of synthetic biology: guiding principles for emerging technologies, *Hastings Cent. Rep.* 41 (4), 2011, pp. 17–22.
- [117] S. Clarke, New technologies, common sense and the paradoxical precautionary principle, in: P. Sollie, M. Düwell (Eds.), *Evaluating New Technologies: Methodological Problems for the Ethical Assessment of Technology Developments*, Springer, 2009, pp. 159–173.
- [118] S.M. Gardiner, A core precautionary principle, *J. Polit. Philos.* 14 (1), 2006, pp. 33–60.
- [119] Technology Strategy Board, *Responsible Innovation Framework for Commercialisation of Research Findings for Use in Synthetic Biology Feasibility Studies Competition : Advancing the Industrial Application of Synthetic Biology*, Technology Strategy Board, 2012.
- [120] U.K. Synthetic Biology Roadmap Coordination Group, *A Synthetic Biology Roadmap for the UK*, Technology Strategy Board, 2012.
- [121] K.L. Kjølberg, R. Strand, Conversations About Responsible Nanoresearch, *NanoEthics* 5 (1), 2011, pp. 99–113.
- [122] European Commission, *Commission Recommendation on 07/02/2008 on a Code of Conduct for Responsible Nanosciences and Nanotechnology*, European Commission, Brussels, C, 2008, 424 final.
- [123] E. Simakova, Making nano matter: An inquiry into the discourses of governable Science, *Sci. Technol. Hum. Values* (April), 2012.
- [124] P. Macnaghten, R. Owen, Good governance for geoengineering, *Nature* 479 (November (7373)), 2011.
- [125] K. Parkhill, N. Pidgeon, A. Corner, N. Vaughan, Deliberation and responsible innovation: A geoengineering case study, in: R. Owen, M. Heintz, J. Bessant (Eds.), *Responsible Innovation*, Wiley, 2013, pp. 219–240.
- [126] D. Hovorka, J. Corbett, IS sustainability research: a trans-disciplinary framework for a 'grand challenge', *Proceedings ICIS 2012*, December 2012.
- [127] S.J. Winter, B.S. Butler, Creating bigger problems: grand challenges as boundary objects and the legitimacy of the information systems field, *J. Inf. Technol.* 26 (2), 2011, pp. 99–108.
- [128] G. Walsham, Are we making a better world with ICTs? Reflections on a future agenda for the IS field *J. Inf. Technol.* 27 (2), 2012, pp. 87–93.
- [129] P. Gray, A. Hovav, Methods for studying the information systems future, in: M. Chiasson, O. Henfridsson, H. Karsten, J.I. DeGross (Eds.), *Researching the Future in Information Systems: IFIP WG.8.2 Working Conference, Future IS 2011*, Turkey, Finland, June 6–8, 2011, *Proceedings, 1st Ed.*, Springer, Heidelberg, 2011, pp. 299–316.
- [130] E. Mumford, D. Henshall, *Participative Approach to Computer Systems Design*, Halsted Press, New York, 1978.
- [131] E. Mumford, The story of socio-technical design: reflections on its successes, failures and potential, *Inf. Syst. J.* 16 (4), 2006, pp. 317–342.
- [132] M. Kyng, Designing for cooperation: cooperating in design, *Commun. ACM* 4 (December (12)), 1991, pp. 65–73.
- [133] K. Cuhls, From forecasting to foresight processes – new participative foresight activities in Germany, *J. Forecast.* 22 (2), 2003, pp. 93–111.
- [134] Z. Sardar, The namesake: futures; futures studies; futurology; futuristic; foresight – what's in a name? *Futures* 42 (April (3)), 2010.
- [135] G. Eden, M. Jirotko, B.C. Stahl, *Responsible Research and Innovation: Critical reflection into the potential social consequences of ICT*, Presented at the Research Challenges in Information Science (RCIS), Paris, 2013.

Bernd Carsten Stahl is Professor of Critical Research in Technology and Director the Centre for Computing and Social Responsibility at De Montfort University, Leicester, UK. His interests cover philosophical issues arising from the intersections of business, technology, and information. This includes ethical questions of current and emerging ICTs, critical approaches to information systems and issues related to responsible research and innovation.

Dr Grace Eden Grace Eden is a Senior Research Associate at the University of Oxford Computer Science Department. She engages in interdisciplinary research with a focus on understanding the ways in which technology effects communication, collaboration and knowledge exchange within scientific, work and home settings. Her research extends across three areas of social science research; the sociology of scientific knowledge (SSK), with its focus on how scientific knowledge is produced, shared and modified; computer supported cooperative work (CSCW), with its focus on understanding the details of day-to-day practices and collaboration; and the broader impacts of science and innovation upon wider society.

Marina Jirotko is Associate Professor in the Department of Computer Science and Associate Director of the Oxford e-Research Centre at the University of Oxford. Her research interests lie at the interface between the Computer and Social Sciences and are concerned with bringing a richer comprehension of socially organised work practice into the process of engineering technological systems. She leads the Human Centred Computing group which researches into: Workplace studies and Design of ICT, Responsible Research and Innovation in ICT, and Social Collective Intelligence. Marina is a BCS Chartered IT Professional and sits on their ICT Ethics Specialist Group committee. She has published widely in international journals and conferences in e-Science, Human Computer Interaction, Computer Supported Cooperative Work and Requirements Engineering.

Mark Coeckelbergh is Professor of Technology and Social Responsibility at the Centre for Computing and Social Responsibility, De Montfort University, UK and teaches at the Department of Philosophy, University of Twente, The Netherlands. He is also co-Chair of the IEEE Robotics & Automation Society Technical Committee on Robot Ethics and is involved in European research projects in the areas of robotics and responsible innovation. Previously he was Managing Director of the 3TU Centre for Ethics and Technology. His publications include *Growing Moral Relations* (Palgrave Macmillan 2012), *Human Being @ Risk* (Springer 2013), and numerous articles on ethics and technology, in particular robotics and ICT. He also has research interests in environmental philosophy and financial ethics.