The International Library of Ethics, Law and Technology 23

Kelly Laas
Michael Davis
Elisabeth Hildt *Editors*

Codes of Ethics and Ethical Guidelines

Emerging Technologies, Changing Fields

Springer

The International Library of Ethics, Law and Technology

Volume 23

Technologies are developing faster and their impact is bigger than ever before. Synergies emerge between formerly independent technologies that trigger accelerated and unpredicted effects. Alongside these technological advances new ethical ideas and powerful moral ideologies have appeared which force us to consider the application of these emerging technologies. In attempting to navigate utopian and dystopian visions of the future, it becomes clear that technological progress and its moral quandaries call for new policies and legislative responses. Against this backdrop, this book series from Springer provides a forum for interdisciplinary discussion and normative analysis of emerging technologies that are likely to have a significant impact on the environment, society and/or humanity. These will include, but be no means limited to nanotechnology, neurotechnology, information technology, biotechnology, weapons and security technology, energy technology, and space-based technologies.

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ISSN 1875-0044 ISSN 1875-0036 (electronic)
The International Library of Ethics, Law and Technology
ISBN 978-3-030-86200-8 ISBN 978-3-030-86201-5 (eBook)
https://doi.org/10.1007/978-3-030-86201-5

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Acknowledgments

This collected volume has been made possible through a generous grant from the John D. and Catherine T. MacArthur Foundation which funded the enhancement of the Ethics Codes Collection of the Center for the Study of Ethics in the Professions at the Illinois Institute of Technology and enabled new research on the current and future role of ethics codes within society.

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About the Editors

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Chapter 1
An Introduction to the Societal Roles of Ethics Codes

Kelly Laas, Michael Davis, and Elisabeth Hildt

Abstract In this collected volume, we are interested in the roles of ethics codes and ethical guidelines in professions in which research and innovation play an important role and where emerging technologies bring about considerable, sometimes fast-paced change.

Keywords Codes of ethics · Professional ethics · Responsible conduct of research · Emerging technologies

In this collected volume, we are interested in the roles of ethics codes and ethical guidelines in professions in which research and innovation play an important role and where emerging technologies bring about considerable, sometimes fast-paced change. These can be broad technological trends, for examples the expanding relevance of artificial intelligence in most of life, or very specific contexts such as guidelines for clinical care related to cardi-pulmonary resuscitation.

In all these contexts, innovations in science and technology are central, as are questions about how to deal with these innovations and developments, both at a professional and at a societal level.

This volume explores three principal areas surrounding the roles of ethics codes and guidelines in modern professional and public life. The first section of this volume discusses the role of ethics codes and guidelines in changing disciplines; the second section looks at how codes shift in response to and help shape the position of emerging technologies in societies around the world. The third and concluding section considers the current and future role of ethics codes.

Before we begin to explore how and why codes of ethics are an important way to study society, technological developments, and the changing role of professionals,

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K. Laas et al. (eds.), *Codes of Ethics and Ethical Guidelines*, The International Library of Ethics, Law and Technology 23,
https://doi.org/10.1007/978-3-030-86201-5_1

it is essential to gain a better understanding of why codes of ethics exist, how they are developed, and the different uses they have.

1.1 Roles of Ethics Codes and Ethical Guidelines and Why They Are Important

A code of ethics is an authoritative formulation of the (morally permissible) standards governing the conduct of members of a group, just because they are members of that group. A group consists of two or more moral agents. The authority of a code may derive from at least one of several sources: consent, custom, tradition, convenience, law, fairness, and so on; but to be a code of *ethics*, at least one source of its authority must be moral.

Codes of ethics have at least six uses: **First**, and most important, a code of ethics can document, declare, or establish special standards of conduct where experience has shown that common sense, industrial tradition, or occupational custom is no longer adequate. Codes of ethics can change practice for the better. **Second**, a code of ethics, being authoritative, can help those new to the practice learn how to act. Codes can teach, much as dictionaries can teach its readers what words mean. **Third**, a code can remind those with even considerable experience, of what they might otherwise forget. Codes have a mnemonic function. **Fourth**, a code can provide a framework for settling disputes, even disputes among those with considerable experience. **Fifth**, a code can help those outside the group ("the public") understand what may reasonably be expected of those in the group. **Sixth**, a code of ethics can justify discipline or legal liability. So, for example, once a profession has a formal code of ethics, courts can appeal to it when deciding what reasonable care in that profession is. The code's higher (more demanding) standard may, and should, replace the standard common sense would otherwise set for the group.

Attempts have been made to distinguish between (a) short, general, or uncontroversial codes ("code of ethics," "statement of values," or the like); and (b) longer, more practice oriented, more detailed, or more controversial codes ("code of conduct," "guidelines," "rules of practice," or the like). While some such distinction may sometimes be useful in practice, it is hard to defend in theory. A "code of conduct" is as much a special standard as a "code of ethics" is except where the "code of ethics," boiled down to a mere restatement of morality, is just "a moral code". "Codes of conduct" are also generally as morally binding as "codes of ethics." A code of ethics should be as long as it needs to be to do what it is supposed to do; the same holds for a "code of conduct."

Ethical guidelines, such as the research guidelines discussed by Philip Brey in Chap. 2 often apply to specific practices and groups of collaborators. In some cases, these ethics guidelines are set by professional associations, in others, these ethical guidelines are adopted by governmental organizations as a form of regulation; practitioners not following these guidelines can be subject to some form of enforcement,

such as the withdrawal of research funds or fines. Chap. 9 provides a discussion of the development of ethical guidelines for the responsible use of nanotechnologies in research and development and reflects on how these guidelines not only influence practitioners, but also public views on these emerging technologies. Guidelines need not only apply to research and scholarly publication. For example, the Association of National Advertisers has published their "Guidelines for Ethical Business Practice," in 2020 that include specific, updated guidance for digital marketing and mobile marketing practices (ANA 2020). Guidelines like this, discussed in Chap. 4, "Informed Consent in Digital Data Management", can help practitioners navigate current regulation, or are sometimes adopted by industry associations to pre-empt the passage of more restrictive or less informed regulations.

1.2 Ethics Codes Collection: An Introduction

The Ethics Codes Collection of the Center for the Study of Ethics in the Professions at the Illinois Institute of Technology (http://ethicscodescollection.org/) is a unique resource, comprising a curated collection of over 3000 ethics codes and guidelines[1] from over 1750 organizations. The ethics codes in the collection span over 220 years and include codes and guidelines from over 100 different disciplines and industry sectors. The collection serves as a dynamic global resource for informing ethical decision making in professional, entrepreneurial, scientific, technological, and other fields. It also serves to inform critical research into the advancement of ethical practices in a rapidly changing world. The Ethics Code Collection consists of both formal codes and sets of voluntary guidelines. The latter are distinct in character, and present interesting ethical questions in their own right.

The collection began with the founding of the Center for the Study of Ethics in the Professions at the Illinois Institute of Technology in 1976 and has continually grown over the past 45 years. In 1996, the Ethics Center received a grant from the National Science Foundation to put its paper collection of codes and guidelines online. In 2016, the Ethics Center received a generous grant from the John D. and Catherine T. MacArthur Foundation to enhance the Ethics Codes Collection. The grant provided the resources to embark on an extensive improvement of the digital Ethics Codes Collection and enabled new research on the current and future roles of ethics codes in professional, business, and technological innovation. This collected volume is one result of the MacArthur grant.

As interest in ethics codes continues to grow, so does the Ethics Codes Collection. The collection attempts to collect codes from professional associations, industry groups, government agencies and businesses over a large range of time, allowing scholars and practitioners to follow the development and growth of ethics reflection

[1] Except where they are explicitly distinguished, any mention of "ethics codes" in this introduction should be understood to refer both to codes and guidelines.

in different professions and fields. The collection also seeks to document the development of new professions and fields such as the rise of big data and artificial intelligence, as well as interest in the different ethical questions raised in these new contexts and growing technology use.

Many of the articles in this volume serve as examples of the scholarship the Ethics Codes Collection supports. This includes in-depth analysis of the changes that codes of ethics take over time – either through the lens of one professional association or over an entire profession as Michael Davis does in Chap. 3 for engineering. Scholars can also chart growing interest in ethical topics across multiple fields as Stjepan Ljudevit Marušić and Ana Marušić do in Chap. 5 in their analysis of mentions of research integrity in professional codes.

The Ethics Codes Collection also provides models for professionals and partitioners writing or revising their own code of ethics, such as the process outlined by Greg Adamson and Joe Herkert of the revision of the IEEE code to include the ethical design of artificial intelligence and machine learning in Chap. 8. For over 45 years, the Ethics Codes collection has been used as a starting point for the development of new codes, and the scholars and librarians of the Center for the Study of Ethics in the Professions at the Illinois Institute of Technology have been active in supporting these efforts in everything from providing feedback on provisional drafts to serving as members of code development committees. This includes the development of the Software Engineering Code of Ethics by the Association for Computing Machinery and IEEE, the development of ethical guidelines on research integrity for Big 10 Universities, and for many other smaller businesses and professional associations.

Though still limited in scope, the Ethics Codes Collection also seeks to collect international codes of ethics and guidelines to allow for the comparison of codes between countries. These comparisons can be extremely useful in several ways. As shown in part II of this volume, the comparison of ethics codes and guidelines internationally can showcase what ethical principles and issues different societies (at the professional, governmental, or public level) value by what the ethical codes stress – be it sustainable development, individual rights, or scientific progress. As international collaboration across borders continues to increase, it is important that professions, businesses, and governments continue to learn from one another and begin to develop international best practices to allow for the safe and ethical transfer of knowledge, information, and the benefits of scientific progress.

The Ethics Codes Collection not only explores the ethical principles of different professions and organizations; the development of ethical guidelines also provides a fascinating window into scientific and professional cultures that exist in a society. What concerns do the authors of these guidelines address, whose opinion is sought in the development of the guidelines, and how guidelines are distributed and ultimately enforced provides a snapshot into the inner workings of the institution who developed the guidelines or code, and their envisioned place in society.

The question of who has a seat at the table in the construction of codes of ethics and ethical guidelines is an interesting one that will come up in multiple chapters of this collection. A code of ethics written solely by a group of professionals will likely

be very different than one written by a group of legislators or ethicists, and what happens when members of the public have a seat on the authoring committee? Students and scholars of ethics codes quickly become attuned to when a code is solely inward facing and only addresses the concerns of members while leaving out concerns of clients, the public, and other stakeholder groups. Outward-facing codes can also be used as a defensive measure against criticism, but provide limited ethical guidance to group members.

The collection policy for the Ethics Codes Collection has been kept quite broad on purpose – it includes codes of ethics for major professional societies like the American Psychological Society and more obscure codes such as the Ethical Standards and Guidelines of the American College of Vedic Astrology. The only qualification is that it must be from a recognized organization – not from one individual – and the authors must consent that it be made publicly available via the Ethics Codes Collection. As of this year, the Collection contains codes for how to perform scientific research in disaster areas, guidelines developed by indigenous communities governing how researchers should collaborate with members of their community, and guidance for the ethical use of polygraph tests (IAVCEI 1998; South African SAN Institute 2017; American Polygraphy Association 2015). The goal is to provide users with the widest possible access to professional codes and guidelines accompanied by scholarly and technological tools to allow for innovative and new research to be performed. We hope that this volume serves as inspiration to professionals, practitioners, and scholars for how codes of ethics can be studied, developed and used to promote more ethical practice in all areas the Ethics Codes Collection covers.

1.3 Ethics Codes as Sources for Research into the Professions

Ethics codes represent ongoing conversations in the sciences, professions, and business about what standards, such as fairness and decency, should apply when the law does not. For instance, one can trace the emergence of attention to issues of sustainability and protection of the environment by following changes in architectural and engineering codes of ethics. The 1922, 1954, 1970, American Institute of Architects' "Canons of Ethics" and "Standards of Professional Practice," detail an architect's ethical obligation to their clients and fellow professionals. Only in the 1977 code do we see the first references to architects' duty to "conserve natural resources and the heritage of the past." This concept continues to develop during the next few years (1979, 1996, 2007, 2012, and 2017), the concept being defined as the standard demands more.

The American Anthropological Association (AAA) responded in the same manner when some members proposed amending the AAA Code of Ethics in 2007 to stop its members from working with the U.S. military as part of its Human Terrain

System (HTS). HTS, which began recruiting anthropologists in 2007, sought to improve the military's cultural awareness when deployed in complex social-cultural environments (Human Terrain System 2008). A statement by the AAA Executive board during that same year called the HTS an "unacceptable application of anthropological expertise" and asserted that "any anthropologist considering employment with HTS will have difficulty determining whether or not s/he will be able to follow the disciplinary Code of Ethics." The statement goes on to discuss concerns about avoiding doing harm to the individuals and communities that anthropologists study when working with the military in a war zone, and the ability of anthropologists to gain voluntary consent from participants in conflict situations. The 2012 version of the AAA Code, section 4, "Weigh Competing Ethical Obligations Due to Collaborators and Affected Parties," indirectly addressed these issues by going into details about how anthropologists must uphold the principle of "do no harm" in navigating these competing obligations to employers and funders, and their professional obligation to the communities they study and collaborate with.

One of the most critical aspects of the Ethics Codes Collection is the ability to trace how ideas, principles, and concepts travel between different professions through their codes. Concepts from the field of medicine have traveled from the clinical setting into the realm of information sciences, and many ethics codes go on to cite other professional codes that have helped guide their development. An example of this is the citation of the Code of Ethics of the National Association of Social Workers (2008, 2017) in the Online Therapy Institute's 2010 "Ethical Framework for the Use of Social Media by Mental Health Professionals", and the 2019 version of the American Health Information Management Code of Ethics.

1.4 Ethics Codes and Emerging Technologies

In addition, ethics codes and guidelines demonstrate how institutions and organizations address emerging situations and modern technologies. These can be technologies and practices new to a specific field of research, to emerging technologies that have the potential to change daily life for millions of people. This phenomenon can be seen in the fields of computer science, electrical engineering, biomedical research, and others.

Around the world, engineers, entrepreneurs, and researchers in many fields, including biotechnology, information systems, robotics, artificial intelligence, media, and communications, often enter new territory with improvised guidelines for their work. In response to such guidelines and the emerging technologies provoking them, many professional associations are rewriting their codes of professional ethics or developing more specific guidelines to address innovation in their fields. A prominent example is the Code of Ethics and Professional Conduct of the Association for Computing Machinery (ACM) published in 2018. There are also other organizations, such as the International Organization for Standardization (ISO), doing something similar. In Europe, the movement for Responsible Research

and Innovation seems to be shaping how researchers and practitioners approach innovation.

Changes in codes of professional ethics and more detailed guidelines represent an unparalleled window into the research, innovation, and emerging technologies they seek to regulate. They are crystallizations of ongoing conversations in scientific and professional fields about how justice, decency, safety, and the like should be realized in practice where the law is silent. They show how institutions and organizations are addressing modern technologies.

In fields of rapid innovation, ethics generally precedes legal regulation and, even in fields that are relatively settled, it seldom confines itself to legally required acts. Ethics provide flexibility law does not.

1.5 About This Collected Volume

This collected volume exemplifies the value of both codes of ethics and guidelines in general as well as the Ethics Codes Collection in particular. Many of the chapters in this book have drawn upon the Ethics Codes Collection to a great extent, allowing the authors to trace the development of ethics codes through a specific discipline or the prevalence of a principle, ethics topic, or even a particular phrase through the guidelines of hundreds of different organizations and disciplines.

The book explores three principal areas surrounding the role of ethics codes in professions where research and development are important and in fields in which emerging technologies and other developments produce substantial, often rapid change. The first part of this volume "Past, Present, and Future: Ethics Codes and Guidelines in Changing Fields" explores central concepts and principles in ethics codes and their modification through time. The second part "Ethics Codes, Emerging Technologies and International Viewpoints" looks at how codes shift in response to and help shape the position of emerging technologies in societies around the world. The third and concluding part "Changing Purposes and Different Uses of Ethics Codes" explores some possible limitations of ethics codes as they are currently written and used and suggests how they might change to better both our professional and personal lives.

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Part I
Past, Present, and Future: The Role of Ethics Codes and Guidelines in Changing Fields

Along with supporting education, professional practice and informing the public about ethical principles important to a specific profession or organization, a good code of ethics must be periodically revised to help guide practitioners as new issues, technologies, or practices become prevalent. Some revisions address systemic issues that impact relationships between professionals and practitioners, such as the American Physical Society's revision of its code in 2019 to better address bias, discrimination, and harassment as well as promote the fair treatment of colleagues, employees, and students (APS 2019). This specific revision stemmed from a seminal report from the National Academies, "Sexual Harassment of Women," released in 2018, as well as several reports from women studying or working in several academic fields citing instances of sexual harassment and unfair treatment (Swartout 2018; Aycock et al. 2019). Other revisions speak to specific practices, such as how changing technologies impact issues of informed consent in the digital collection of data. In all the following chapters, there are examples of how leaders and policymakers in diverse fields look to the ethical practices of other disciplines in shaping their response to new ethical challenges and questions. Focusing on the fields of research and development, and more specifically on the engineering, computer, and information sciences, the following chapters trace the development of new ethical principles to handle these emerging challenges and suggest better ways these guidelines could be utilized to educate upcoming generations of practitioners.

The changing field of research is a prime example of how these developments take place. In the U.S., the requirement for institutional review boards to review research involving human subjects began with the passage of the National Research Act in 1974 and the release of the Belmont Report in 1976 (United States, HHS 2019). Formatted with medical and behavior research in mind, the ethical principles and standards that institutional review boards utilize are, in many cases, not a perfect fit for research emanating from the computer, information, social, or engineering sciences (Koepsell et al. 2014; Vitak et al. 2017). Research ethics as a field has changed enormously in the past 60 years, expanding to include numerous other fields in the engineering, physical, social, and technical disciplines. In the same way, Philip Brey's Chap. 2, "Research Ethics Guidelines for the Engineering

Science and Computer and Information Sciences" discusses changes in research ethics guidelines for non-medical fields, and the development of new ethical frameworks for the engineering sciences and the computer and information sciences by the European-Commission-funded project SATORI that takes into account significant differences in the ethical issues faced by these fields.

Michael Davis's piece, "Codes of Engineering Ethics: Recent Trends" (Chap. 3) traces recent developments in the field of engineering, namely the spread of codes internationally, increased attention to sustainability and the environment, a movement toward shorter codes of ethics, and the continued independence of engineering ethics from other fields such as medical ethics. Davis clarifies what is meant by the terms "engineering," "code," and "ethics" and takes the reader on a detailed tour of these four major developments in engineering ethics. In the end, the history of engineering codes is one of both content and format and showcases how exemplary codes need to change over time to stay useful to their professionals.

In the next chapter, "Informed Consent in Digital Data Management" (Chap. 4) authors Elisabeth Hildt and Kelly Laas discuss how the model of informed consent, with its tradition in the biomedical field, can be used to inform different disciplines. The chapter looks at how codes of ethics from professional associations and guidelines from non-governmental organizations, businesses, and governmental organizations use specific elements of informed consent to govern digital data management among their members.

In some cases, needed changes to ethics codes may still be pending. Around the world, scientific associations and government agencies that fund science have been shining a stronger light on the need for professional associations to integrate issues of research integrity into their education and professional practice. The U.S. National Academies' 2017 report, "Fostering Integrity in Research," explicity recommends that "In order to better align the realities of research with its values and ideals, all stakeholders in the research enterprise—researchers, research institutions, research sponsors, journals, and societies—should significantly improve and update their practices and policies to respond to the threats to research integrity identified in this report" (p. 210).

Stjepan Ljudevit Marušić and Ana Marušić's Chap. 5, "Codes of Ethics and Research Integrity" provides an overview of how different professional ethics codes handle issues of research integrity. They point out that the divergence between policy-makers and researchers in what is meant by "research integrity" is likely to hinder the internalization of these principles into a researcher's work and the research community at large. While professional codes of ethics and guidelines should play a significant role in helping educate researchers and reinforcing research integrity as a crucial part of professional ethics, most codes do not focus on research integrity and those that do tend to focus on a small number of research integrity issues. The authors suggest several strategies that could help strengthen how professional ethics codes discuss concepts of research integrity to help stakeholders see these essential principles and practices as a critical component in their everyday work.

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Chapter 2
Research Ethics Guidelines for the Engineering Sciences and Computer and Information Sciences

Philip Brey

Abstract This chapter presents, discusses and defends research ethics guidelines for the engineering sciences and computer and information sciences. Only very recently has there been an effort to establish research ethics frameworks and ethics committees for these two fields. Arguments are presented concerning these developments, and a specific proposal is made for ethics guidelines for the engineering sciences and the computer and information sciences. It is argued that although there are shared issues and principles for research ethics across scientific fields, all scientific fields raise unique ethical issues that require special ethical principles and guidelines. Following this discussion, the historical development of professional ethics and research ethics in the engineering science and the computer and information sciences is discussed, and special guidelines for these fields are presented that were developed as part of a CEN (European Committee for Standardization) standard for research ethics within the European Commission-funded SATORI project on research ethics and ethics assessment.

Keywords Engineering sciences · Information sciences · Research ethics · Ethics assessment · Standardization

2.1 Introduction

This chapter considers the development of research ethics guidelines for the engineering sciences and computer and information sciences. Codes of professional ethics have existed for these fields for a long time, but research ethics guidelines have been developed for them only very recently. This is likely because, until recently, research ethics committees for these fields were hardly in existence. In recent years, however, there has been a push to establish dedicated research ethics committees for

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K. Laas et al. (eds.), *Codes of Ethics and Ethical Guidelines*, The International Library of Ethics, Law and Technology 23,
https://doi.org/10.1007/978-3-030-86201-5_2

these fields, as has already happened long before that in biomedicine. More and more universities and research institutions are subjecting engineering and computer science research to ethics review, and more and more companies (e.g., Apple, Microsoft, Facebook) are also instituting research ethics committees in these fields.

The distinction between professional ethics codes and research ethics guidelines is crucial in this chapter, which is why I will elaborate. Codes of professional ethics are guidelines for ethical behavior by individual professionals in various professional fields (Martin et al. 2010). They aim to regulate professional conduct so as to ensure it exhibits high ethical standards, professional quality, and trustworthiness. Codes of professional ethics are in place not only in professions that center around research and innovation but also in many other fields (e.g., for lawyers, nurses, and journalists). In professions in which research and innovation have an important place (in fields like computer science, engineering science, social science, and medicine), professional ethics codes to some extent cover expected professional behaviors in relation to research and innovation, but much of what they cover is more general. Professionals in these fields are likely to carry out research and innovation activities, but they may do a lot of other things as well, such as managing people, interacting with clients, teaching, writing a column for a newspaper, and sitting on a review committee in their company. A large part of professional ethics is typically devoted to general virtues and professional behaviors that define professional integrity, social responsibility, and professionalism in these fields.

Research ethics guidelines typically do not apply to individual conduct but to research and innovation practices (Ipfhofen 2020). These practices often involve multiple researchers, and it is not their individual conduct that the guidelines are directed at but the overall way in which the research is conducted. These guidelines are typically not only used by researchers themselves but also by research ethics committees that ethically assess research. Research ethics committees typically do not do this during or after the research activity, but prior to it, on the basis of a research plan or proposal. They assess whether the research proposal adheres to relevant ethical standards or guidelines. These guidelines cover the research design and not individual conduct. A research ethics committee cannot determine on the basis of a research plan if individual scientists involved in the research will act honestly and with integrity.

Research ethics has for long been virtually synonymous with medical research ethics, as is evidenced by the fact that until recently, the vast majority of research ethics committees were focused on biomedicine, and the vast majority of publications in research ethics focused on the medical field. This can be explained through an account of the nature and history of both medical and nonmedical fields. Medical research and medicine generally raise many ethical issues that are difficult to ignore since they involve many decisions that can have life and death consequences and are the subject of moral and religious disagreement. Medical research ethics gained a strong foothold after the Second World War when the Nuremberg trials led to the establishment of the Nuremberg Code, which sets out research ethics principles for human experimentation.

The natural sciences never developed a strong tradition in research ethics, in part because, for the most part, they do not involve human or animal experimentation and because their impact on people and society is quite indirect. The social sciences similarly often only have an indirect impact on people and society, and only some of their research involves human experimentation (especially psychology). Finally, the engineering sciences do have an identifiable impact on society that needs to be accounted for since its designs can involve risks to health, life, and the environment. However, these risks have traditionally been mitigated through technical standards and ethics codes for individual engineers, rather than a tradition of research ethics.

In recent years, this situation has changed, and there are now strong arguments to introduce a tradition of research ethics for many nonmedical fields as well. In the next section (Sect. 2.2), I will make this case, and I will moreover argue the ethical issues in these nonmedical fields are to some extent different from those in the medical field and require partially different ethical guidelines. Having established this, I will focus the discussion on appropriate ethical guidelines for the engineering sciences (Sect. 2.3), followed by an analysis of ethical guidelines for the computer and information sciences (Sect. 2.4). In a concluding section, I will take stock of the results of the analysis. The guidelines proposed in Sects. 2.3 and 2.4 are based on a CEN (European Committee for Standardization) Workshop Agreement (CWA), a standards document for research ethics committees that was developed in the SATORI project, a European Commission-funded project on the strengthening and harmonization of research ethics within the European Union.[1]

2.2 The Need for Research Ethics for Nonmedical Fields

In the SATORI project, we performed a study in which we aimed to identify ethical principles that apply to all research fields and ones that apply to only some research fields (Shelley-Egan et al. 2015). I here report our key findings. First, let us consider ethical principles that apply to all research fields. An obvious first one is *research integrity* (or scientific integrity), but this is in large part, not a principle that can be assessed for in research ethics, as it is intended to regulate individual conduct and cannot easily be verified on the basis of research plans. It is difficult to determine based on a research plan whether the researchers involved will act honestly and collegially, will be transparent and scrupulous, and will comply with professional ethical codes. However, some aspects of research integrity may be tested for in research ethics, notably the avoidance of and openness about potential conflicts of interest. Such potential conflicts can easily be disclosed and examined as part of an ethics review process. An ethics committee could also assess whether research methods

[1] SATORI (Stakeholders Acting Together on the Ethical Impact Assessment of Research and Innovation) received funding from the European Commission's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 612231. It ran from 2014 to 2017. The website, with all project deliverables, can be found at http://satoriproject.eu/

and procedures exhibit qualities of carefulness, justification, reliability, transparency and openness, qualities that are often associated with research integrity.

A second ethical principle that applies broadly across different fields is *the protection of human research participants*. Human research participants play a role in many types of research, including not only the medical sciences and social sciences, but also the engineering sciences and computer and information sciences, for example, in stakeholder engagement and the testing of new designs. Although specific principles for the protection of human research participants will be different for different fields, since they may involve different procedures, different risks, and different specific ethical issues, there will also be commonalities, such as the need to have informed consent, to respect dignity, autonomy, and personal integrity, to avoid risks of serious physical or psychological harm, and to have special provisions and protections for children and vulnerable groups.

Social responsibility is a third universal ethical principle and implies that researchers anticipate and consider the potential consequences of the research project or activity for society, including potential future applications, and take appropriate remedial action to address potential negative impacts in their research design. Social responsibility also implies taking into account the concerns of stakeholders when planning and conducting research, communicating research results and potential societal implications of it to stakeholders, take potential misuse of research results into account, and to ensure that research carried out in lower- and middle-income countries involves benefit sharing and takes local needs and interests into account.

A fourth general ethical principle is *the protection of and respect for animals used in research*. There is already considerable international agreement on this principle and, in particular, the three R approach based on *replacement* of animal experiments with other research where possible, *reduction* of the number of animals involved, and *refinement*, which means minimizing suffering (Russel and Burch 1959).

Fifth is the protection of researchers and the research environment. This is a sometimes overlooked principle, but nevertheless important. It ensures the protection not only of human subjects and animals in research, but also of researchers themselves (their health and safety), the local community, and the local environment where experiments or fieldwork are carried out.

A sixth principle, on which there is emerging consensus, is that of responsible data management.[2] This involves the secure storage of research data, awareness of actual and potential data flows, protection of personal data, and open access to research data where possible. In relation to this principle, we reference the FAIR Guiding Principles for scientific data management and stewardship and the open access guidelines of the European Commission (European Commission 2017). Our

[2] In our report, we refer to this as "protection and management of data and dissemination of research results".

personal data principles are in line with the European Union's General Data Protection Regulation.

I hereby present the six principles, with guidelines, in an abbreviated version. The full version can be found in CEN (2017).

Research Integrity

We include nine specific guidelines that concern the following issues:

- employing appropriate research methods
- avoiding bias, avoiding manipulations and distortions
- avoiding inclusion of data or observations that did not occur in data collection and experimentation
- ensuring autonomy and freedom of research
- avoiding conflict of interest
- avoiding the representation of the work of others as one's own
- avoiding misrepresentation of one's qualifications or accomplishments

We point out that these requirements are normally not tested for by research ethics committees, except that conflicts of interest in research design can be more easily addressed than many of the other listed issues. For this reason, we include separate guidelines for avoidance of and openness about potential conflicts of interest.

Social responsibility

We include six specific guidelines:

- Anticipating potential negative consequences for society and taking remedial actions
- Consideration of potential negative impacts on individuals and groups, or the common good
- Promotion of sustainable development
- Acknowledgment of the economic and cultural value of local and traditional knowledge
- Avoidance of misuse of research materials and results
- Communicating with stakeholders and taking their interests into account

We also include five special provisions for research involving low income or lower-middle income countries, including responsiveness to special needs, benefit sharing, involving local researchers in the research, minimizing the diversion of local (human) resources, and showing respect for local culture.