ETHICAL REFLECTIONS
on the Workforce for the Digital Transformation

Gordana Dodig-Crnkovic
Professor in Computer Science at Mälardalen University and
Professor of Interaction Design at Chalmers University of Technology

Web pages:
http://gordana.se/ Personal
http://www.gordana.se/work/presentations.html

Chalmers University of Technology
https://www.chalmers.se/en/staff/Pages/gordana-dodig-crnkovic.aspx

Mälardalen University
http://www.es.mdh.se/staff/37-Gordana_Dodig_Crnkovic

18th European Computer Science Summit, 24-26 October 2022 Hamburg
TOPICS OF REFLECTIONS

- Grand challenges of the future and ethics
- Approaches to ethics from different perspectives
- Importance of Value systems
- My experiences from teaching ethics – quick pointer to courses, teaching methods, and results
- Stakeholders involvement
- Ethics in research
- Summary of reflections
Workforce for the Digital Transformation

● **Today’s workforce**
Ethical reflection in technology is a new phenomenon. In the classical era with slowly developing technologies, there was no sense of **urgency** for the solution of ethical problems caused by technology. 
Today’s workforce within the technology sector has typically no education in the ethics of technology. Example of new development: Ethics course for teachers in CS at Mälardalen University (follow up of ETHICS4EU project).

● **Future workforce**
Students in technology and especially informatics (computing) are more and more exposed to public debates about emerging technologies (such as AI, nano, robotics, ubiquitous computing, etc.) and often have either dedicated lectures or courses in ethics of computing/informatics. Example of new development: Ethics4EU
FACING GRAND CHALLENGES OF THE FUTURE THROUGH DIGITAL TRANSFORMATION
Facing grand challenges

**Natural challenges:** Global warming, Insufficient supplies of energy, water, and food, Aging societies, Public health, pandemics, Security, Environmental degradation

**Unintended consequences of technology:** AGI (artificial general intelligence), Nano-technology, Biotechnology/Bioinformatics, Autonomous machinery and control: Big data, Internet of things – internet of everything, Intelligent cities, Autonomous cars, Autonomous intelligent software as control physical systems, information systems etc.

...  
The Centre for the Study of Existential Risk (University of Cambridge; [http://cser.org](http://cser.org))

Education of new generations of engineers often focuses on training abstract skills without careful consideration of the role of embeddedness of technology into context.
The transformation of the “ivory tower” context-independent to a socially-aware paradigm in increasingly information-rich knowledge-based societies.

The **triple helix model** connects:
- ACADEMIC
- INDUSTRY/BUSINESS
- GOVERNMENT

Inspired by biology: THE TRIPLE HELIX
Gene, Organism, and Environment by Richard Lewontin

[Image: https://inquiryumn.files.wordpress.com/2014/09/triple-helix.png]
We are educating engineers that will solve future problems.

Future is already at our doors: it comes in form of digitalization that is going to radically change our technology and society.

Choices are made all the time in design and engineering and sensitivity to the consequences of choices is needed – involves moral judgment and established value systems.
APPROACHES TO ETHICS
Ethics is an old field meeting a new world with its policy gaps

One side of the coin: Prominent professionals within informatics identify ethical problems with emerging technologies

PROFESSIONALS ARE THE ONLY PEOPLE WHO KNOW EXACTLY WHAT IS IN THOSE BLACK BOXES

**Event Type:** Seminar

**Speaker:** Paul Gibson, Telecom Sud Paris

**Title:** IDT Open Seminar: Can we build trustworthy and trusted on-line voting systems?

**Date:** Oct 18, 2022 13:15

**Location:** Ypsilon

**Contact person:** Radu Dobrin
Ethics is an old field meeting a new world with policy gaps

The other side of the coin: Ethics is a very old field. Professional ethicists have a toolbox for ethical analysis that we should know about.

And one could also say, I beg you, if you work on the Ethics of AI, learn something about ethics. Too many folk are reinventing the ethics wheel, as if a degree in CS makes one an expert in whatever. Luckily we have great people who are good in both, or willing to learn

Timnit Gebru @timnitGebru · 10h
I have my PhD in "AI" & spent my career in tech as an engineer & then researcher. The skills required to understand how a system harms society aren't the same as those required to build it.

Ppl don't need to know how face recognition works to know that it harms them. twitter.com/scottjshapiro/...
You will recognize this domain-based view in the analysis of many different types of problems – organization of society, sustainability of cities, ecology, economics, ethical aspects etc.
Source: American Psychological Association website
Complexity aspects relating
Micro – Meso – Exo – Macro
levels of analysis – example of a city

A holarchy, in the terminology of Arthur Koestler, is a connection between holons, where a holon is both a part and a whole. The term was coined in Koestler's 1967 book The Ghost in the Machine.

http://www.newsociety.com/Books/I/Integral-City
The Elements of Digital Ethic

https://axbom.com/elements/ Per Axbom – FROM THE. PERSPECTIVE OF PROFESSION
Question for discussion

YOUR EXPERIENCES
EXAMPLES OF DIFFERENT LEVELS
OF ABSTRACTION IN THE DEBATE
VALUES
Often, new technology develops with little attention to its impact on human values.
VALUES AND ETHICS IN KNOWLEDGE PRODUCTION

Nancy Tuana (2015)
Coupled Ethical-Epistemic Analysis in Teaching Ethics. Critical reflection on value choices.
CACM VOL. 500 NO. 12. Pages 27-29

ETHICAL-EPISTEMIC* ANALYSIS
How values and priorities affect knowledge production

“Computer experts aren’t just building and manipulating hardware, software, and code, they are building systems that help to achieve important social functions, systems that constitute social arrangements, relationships, institutions. Computer experts can facilitate and constrain behavior, and materialize social values.”

Deborah Johnson

Values serve as a guide to action and knowledge.

Epistemology-the branch of philosophy concerned with the nature and scope of knowledge.
Values in knowledge production

Knowledge

Values

Science

Values

Information

Values

Data

Values
VALUES

Values serve as a guide to action and knowledge. They are relevant to all aspects of scientific and engineering practice, including discovery, analysis, and application.

Cognitive scientists have found values to be integral parts of STEM (Science, Technology, Engineering, and Mathematics) research.
TYPES OF VALUES

Various types of values can be involved in decision making and reasoning:

- ethical values (the good of society, equity, sustainability)
- aesthetic values (simplicity, elegance, complexity), or
- epistemic values (predictive power, reliability, coherence, scope).
- economic values, etc.
Research integrity basic values

**Reliability** in ensuring the quality of research is reflected in the design, the methodology, the analysis, and the use of resources.

**Honesty** in developing, undertaking, reviewing, reporting, and communicating research in a transparent, fair, full, and unbiased way.

**Respect** for colleagues, research participants, society, ecosystems, cultural heritage and the environment.

**Accountability** for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts.

The European Science Foundations Code of Conduct for Research Integrity
Values related to risks

- Reliability
- Safety
- Security
- Privacy
- Human well-being

VALUES IN RESEARCH
– THE CHOICES WE MAKE

● The selection of research topics. What is a good basis for
(We get involved with existing research. Or we get funding for a specific
research. Or we choose freely. Why is this research worth our time and effort?)

● Choice of approach, methodology, tools. What are the values
of a model, hypothesis, or theoretical explanation in providing
convincing explanation?

● Judgment of the support for a research result. What values of
evidence constitute robust evidence?

● How are ethical aspects of research taken care of?
REQUIREMENT FOR TRANSPARENCY OF VALUES

Transparency of values is essential for trustworthiness and credibility of research. It is central to transdisciplinary research such as e.g., the National Science Foundation’s Sustainability Research Network on Sustainable Climate Risk Management (SCRiM, http://scrimhub.org).

Coupled ethical-epistemic analysis helps to identify new and refined research topics, and inform modeling for multi-objective, robust decision making.
Ethical IT innovation: a value-based system design approach

Sarah Spiekermann:

IEEE P7000
The first global standard process for addressing ethical concerns in system design

Question for the audience

YOUR EXPERIENCES
WITH THE ROLE OF VALUES IN YOUR PROFESSIONAL LIFE
MY EXPERIENCES OF TEACHING ETHICS
Courses on Ethics and Topic Lectures

During more than twenty years, since 2001, I have been teaching students of Computer Science, Engineering, Interaction Design and occasionally Economics, in the following courses:

2001-2014 “Professional ethics” at Mälardalen University (Bachelor, MSc and PhD) and 2014-2017 “Research Ethics and Sustainable Development” at Chalmers University of Technology (PhD, Chalmers).

Even other courses that I have been teaching have important parts dedicated to ethics:
“Emerging trends and Critical Topics in Interaction Design” (Chalmers)
“Human-centered design” (BSc & MSc, Chalmers)
“Research Methods in Natural Sciences and Engineering” (PhD & MSc, MDH)
“Advanced Computational Thinking and Writing Research Toolbox” (2009-2012, MDH)
“Computational Thinking and Writing Research Toolbox” (20012-2013, MDH)

I have regular guest lectures in Professional Ethics, Ethics of Computing, Ethics of AI, Design Ethics, Ethics for Cognitive Scientists, Robotic Ethics and Ethics of Autonomous Cars for different classes of computer science and engineering students.
PROFESSIONAL ETHICS COURSE
AT MÄLARDALEN UNIVERSITY
SWEDEN
PROFESSIONAL ETHICS COURSE
7.5 ECTS
Mälardalen University, Sweden

Gordana Dodig Crnkovic
Mälardalen University, Sweden
http://www.es.mdh.se/staff/37-Gordana_Dodig_Crnkovic
https://www.mdh.se/staff?id=gdc01
# LECTURES

Professional Ethics in Science and Engineering, CD5590

Teacher and examiner: Gordana Dodig-Crnkovic, gordana.dodig-crnkovic@mdh.se

*Time & Place:* Monday & Thursday, 13:15 - 15:00, Classroom V220 (V222 on 11-27 and 12-05)

<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Nov</td>
<td>GETTING STARTED. Course Preliminaries.</td>
</tr>
<tr>
<td></td>
<td>Introduction. Administrivia.</td>
</tr>
<tr>
<td>L1</td>
<td>Identifying Moral Issues</td>
</tr>
<tr>
<td></td>
<td>Basic Moral Orientations</td>
</tr>
<tr>
<td>6 Nov</td>
<td>METHODS AND TOOLS OF ANALYSIS OF ETHICAL ARGUMENT</td>
</tr>
<tr>
<td>L2</td>
<td>Philosophical Foundations of Ethics</td>
</tr>
<tr>
<td></td>
<td>Ethical Relativism, Absolutism and Pluralism</td>
</tr>
<tr>
<td>10 Nov</td>
<td>The Ethics of Conscience</td>
</tr>
<tr>
<td>L3</td>
<td>The Ethical Egoism</td>
</tr>
<tr>
<td></td>
<td>The Ethics of Duty</td>
</tr>
<tr>
<td></td>
<td>The Ethics of Respect</td>
</tr>
<tr>
<td>Date</td>
<td>Lecture</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>13 Nov</td>
<td>L4</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>17 Nov</td>
<td>L5</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Nov</td>
<td>L6/E1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>24 Nov</td>
<td>L7/E2</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>27 Nov</td>
<td>L8</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>01 Dec</td>
<td>L9</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Class</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>4 Dec</td>
<td>L10/E3</td>
</tr>
<tr>
<td>5 Dec</td>
<td>L11</td>
</tr>
<tr>
<td>8 Dec</td>
<td>L12/E4</td>
</tr>
<tr>
<td>11 Dec</td>
<td>L13/E5</td>
</tr>
<tr>
<td>12 Dec</td>
<td>L14/E6</td>
</tr>
<tr>
<td>15 Dec</td>
<td>L15</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RESEARCH ETHICS & SUSTAINABLE DEVELOPMENT

CHALMERS UNIVERSITY OF TECHNOLOGY
SWEDEN
The aims of this course are to:

1) understand the **nature and range of ethical issues** in research and **sustainable development**;

2) understand what is meant by **sustainable development** and potential implications for research, in particular in the own research project;

3) familiarize with a **framework for decision making** when faced with ethical issues and

4) appreciate the **complex relation between science and society**.
A successful completion of this course will be judged on the following:

1. **Attendance and preparation for the in-class discussions.**
2. **Writing an essay describing ethical and sustainability aspects of the PhD research project (or equivalent) of the participant.** It is based on the interviews with at least two stakeholders.
3. **Participation in a peer review seminar** in which you give feedback on other graduate students essays and receive feedback on your own essay.
4. **Group work** preparing presentations for the Mini-conference.
5. **A Mini-conference with “lightning talk” presentations of individual essays, common group conclusions and the subsequent class discussion.**
Course Overview

Problems & Principles
- Course intro & Ethics (Gordana)
- Sustainable Development (Magdalena)

Science and Society
- Research Policy (Sven)
- Publishing Ethics & Societal Aspects of Technology (Guest lectures)

Day 1
Assignment and readings

Day 2
Assignment and readings
Peer Review Meeting for SD-RE Essays (Class in Review Groups)

Group Meetings (Class, preparation for Mini-conf.)

Day 3

Day 4

Essay SD-RE

Preparation for the Mini-conference
Course Overview

Day 5

Mini-conference
(Class, Gordana)
1 2 3 4 5 6 7 8

“Lightning talk” individual presentations; group conclusions followed by the class discussion
EXAMINATION FORMS IN MY ETHICS COURSES

- INDIVIDUAL CLASS-NOTES – What did I find interesting in this lecture – students’ own reflections

- IN-CLASS PRESENTATION OF A CHOSEN TOPIC – Students choose a topic from their research. For undergrads, topics that interest them.

- RESEARCH PAPER, WITH THE AIM TO PRESENT AT A CONFERENCE OR PUBLISH IN A JOURNAL

- PRESENTATION ON THE MINI-CONFERENCE (IN CLASS)
Ethics publications in collaboration with my students


  https://dl.acm.org/doi/10.1145/3194770.3194772


Ethics publications in collaboration with my students

- Dodig-Crnkovic G. and Çürüklü B. **Robots - Ethical by Design**, Ethics and Information Technology 2011, Volume 14, Number 1, pp. 61-71. [http://www.springerlink.com/content/f432g33181787u63/fulltext.html](http://www.springerlink.com/content/f432g33181787u63/fulltext.html)
- Irfan Šljivo, Elena Lisova, Sara Afshar (2017) **Agent-Centred Approach for Assuring Ethics in Dependable Service Systems**. 2017 IEEE World Congress on Services (SERVICES), Legal, Social and Ethical Aspects of Services Science. pp. 51-58
- Dodig-Crnkovic, G. and Sapienza, G., **Ethical Aspects of Technology in the Multi-Criteria Decision Analysis**. IACAP conference, Ferrara, June 14-17, 2016.
Ethics publications in collaboration with my students

Ethics publications in collaboration with my students


- Dodig-Crnkovic G., and Larsson, T. *Game Ethics - Homo Ludens as a Computer Game Designer and Consumer*. International Journal of Information Ethics, Special Issue on The Ethics of E-Games, Vol. 4 - December 2005


Doctoral symposium @IS4SI conference 2017

Papers written by my students based on their course essays

APA Computing and Philosophy journal

Papers written by my students based on their course essays

  APA Computing and Philosophy journal
Articles from the course Computing and Philosophy

Computing and Philosophy course started in 2004nas Swedish National Course, developed as a result of collaboration in a research network PI (Torbjörn Lager, Joakim Nivre, Jan Odelstad, Björn Lisper, Peter Funk, Jan Gustafsson, Ulla Ahonen-Jonnarth, Gordana Dodig-Crnkovic). Participants from different universities (Blekinge, Dalarna, Mälardalen, Skövde, Uppsala) have taken part in the course. They have presented their research papers at the Mini-conference. Several articles written for the course have been accepted for international conferences and published otherwise.

Afterward, for several years, the CAP course was held in collaboration with the University of Illinois Springfield (Peter Boltuc) with guest lecturers Luciano Floridi, Erik Sandewall, Lars-Göran Johansson, Vincent Müller, and others).

Thomas Larsson: Ethics of the Hyperreal

Magnus Johansson: When Simulations Become Reality

Kim Anttila: Ethics in the Computer Profession

Mikael Sandberg: Gender Distribution Normalization in the Computer Game Development Arena

Omar Bagdadi: Is Big Brother a Human Necessity?

Virginia Horniak: Privacy of Computing – An Ethical Analysis
Articles from the course Computing and Philosophy


Two MSc students presenting at ECAP-2010 conference:


Before starting a Phd course on Ethics

Student identify ethical questions important for their research fields.
An Example of an introductory survey for Ph.D. students in SE with a focus on automation - August 2018

IDEA League School Engineering Complex Systems with Big data and Information Technology ECS-BIT’18, Gothenburg 2018 08 31

FORA Fog Computing for Robotics and Industrial Automation Summer School Seminar on ETHICS, Vienna 2018 06 08

Topics with ethical relevance that students identified in the questionnaire before the lecture – technology aspects

**Data-related**
- Data provenance (attribution, background)
- Data confidentiality
- Data privacy
- Public understanding of technology and protection of private data
- Data quality, property and equality
- Data-driven approaches
- Reproducibility of real time datasets
- Data is never “neutral”
- Data collection influences behavior
- Data-streching used in political purpose
- security and reliability of the IoT devices
- “Surplus data” from screening of patients that can reveal much more
- Transparency vs. quality

**Sustainability-related**
- Fuel economy, lower emissions, reduced take-off and landing noise
- Environmental contributions of battery production, use and disposal
- Environmental impact of massive electronic production
- Increasing demand of rare elements
- Lack of life cycle assessment
- Rebound effect
- Digital sustainability?
Topics with ethical relevance identified - methodology aspects

- Values
- The method
- Epistemic problems related work - acknowledging its limitations
- Reducing reality into a model, with loss of depth and variety of perspectives?
- Marginalizing the designer in the design process?
- Level of transparency is acceptable for an automated tool?
- Should we rely on automated tools if we consider the intrinsic limits of the learning process?
- Data-driven development methodology
- Genetic discrimination
- Genetic modification/engineering
- Tradeoff between safety and innovation

- OPEN SCIENCE
- Simulation compared to real experiments
- Making connection between qualitative and quantitative information
- Application of the complex system in Landscape studies
- Reproducibility
- System’s performance almost always evaluated in isolation [QUESTION OF INTERPRETATION OF RESEARCH RESULTS]
- Authors do not verify their results thoroughly enough, or they hide complications
- THE REVIEW PROCESS IS NOT DOUBLE-BLIND
- Presentation of results (overemphasizing of their importance)
- Value of an intervention compared to other applications
The topic is huge – Introduction to ethics

What this lecture can do is to open the window with a view

https://www.flickr.com/photos/mercolino/3424888900
Societal normative systems
Question for the audience

Academic integrity course confidentiality of the content that students discuss in the classroom, like ethically questionable behavior of supervisors. Q: Should the teacher in the course report e.g. power abuse by a supervisor?

STAKEHOLDERS INVOLVEMENT
ETHICS AS A CONTINUUM,
AN ONGOING CONVERSATION
Ethics as continuum
- An ongoing conversation

- World changes constantly, and we have to interpret/construe it over and over again.

- We come back to ideas again and again, finding new meaning in them.

- Professional discussions of ethical issues in journals.

See http://www.utm.edu/research/iep/e/ethics.htm Ethics
POLICY VACUUMS
Ethics of present-day technology and developing society – example of computer ethics

“A typical problem in computer ethics arises because there is a policy vacuum about how computer technology should be used. Computers provide us with new capabilities and these in turn give us new choices for action. Often, either no policies for conduct in these situations exist or existing policies seem inadequate. A central task of computer ethics is to determine what we should do in such cases, i.e., to formulate policies to guide our actions. Of course, some ethical situations confront us as individuals and some as a society. Computer ethics includes consideration of both personal and social policies for the ethical use of computer technology.”

What if we could see in any wavelength of the electromagnetic spectrum, from gamma-rays to radio waves? How would the world appear to us?
STAKEHOLDERS IN AN ACADEMIC RESEARCH PROJECT

Academia

International Academic research community

Professional Organizations Societies

Research Communities

Financing bodies

Society at Large

Family, Relatives, Friends (Private Sphere)

Nature
STAKEHOLDERS IN AN INDUSTRIAL RESEARCH PROJECT

- Clients
- Consumers
- Industry (Other firms)
- Profession (Societies)
- Engineering firm
- Engineer
- Colleagues
- Managers
- Nature
- Family, Relatives, Friends (Private Sphere)
- Society at Large
- Nature
The informational model of moral action - Floridi

1. (Set of) 1./2. Objects (Agent - Patient)
2. A
3. Information process
4. 4. Shell (Subjective Info-frame encapsulation)
5. activates
6. affects
7. 6. Envelope (Moral Situation)

5. Factual information
7. Infosphere
3. Message
HUMAN COGNITIVE BIASES

The Top 12 Most Useful & Universal Mental Models

Copyright Michael Simmons. Medium.com/@michaeldsimmons
ETHICS IN RESEARCH
ETHICS IN RESEARCH

The state of the art in today’s research and society
“Mode 1” and “Mode 2” research

Mode 1, classical academic
Mode 2, collaboration with industry and society, usually undertaken as a succession of projects, each justified in advance to a funding body whose members are usually not scientists.

Important feature of “mode-2” science is that it is largely the work of teams of scientists, often networked over several different institutions.

Where, then, do the ethical responsibilities lie?

OPEN QUESTION: HOW DO WE INVOLVE ALL IMPORTANT STAKEHOLDERS AND HOW TO NEGOTIATE COMMON SOLUTIONS? (THINKING IN TERMS OF COMPLEX SOCIO-TECHNOLOGICAL NETWORKS)
Ethical sensitivity

Why must scientists become more ethically sensitive than they used to be? John Ziman 1998

“Academic science” vs. “Industrial science”
Academic science basically individualistic, following Merton norms (1942) Science as free “speech community.”

“The only constraint—an immensely powerful one in practice—was that the results of their research would be closely scrutinized by other members of one of the innumerable specialized research communities that partition the scientific world.” [PEER REVIEW]
ETHICAL DECISION MAKING

- Recognizing the moral issue
- Evaluating alternative actions from various moral points of view
- Making a decision
- Acting
- Considering the action in retrospect
EXAMPLE OF DOCUMENTS ADDRESSING ETHICAL CONSIDERATIONS

Future Intelligent Autonomous Systems

The IEEE Global Initiative for Ethical Considerations in Artificial Intelligence and Autonomous Systems

http://standards.ieee.org/develop/indconn/ec/autonomous_systems.html

Prioritizing human well being in the age of artificial intelligence: https://youtu.be/z5yZU8tp9W8 (5:56)
EXAMPLE OF DOCUMENTS ADDRESSING ETHICAL CONSIDERATIONS

The European Science Foundations Code of Conduct for Research Integrity
REFLECTIONS, SUMMARY
REFLECTIONS FROM EXPERIENCE IN “WORKING FOR ETHICS IN COMPUTING/INFORMATICS/CS”

- Relevance of ethics topics for students’ own context
- Applicability and generalizability of approaches from what is learned
- Humble teaching attitude – no preaching and no besserwisser (know-all) style
- Using authority/power with utmost care
- Ethics is not about being perfect but being as good as reasonably possible, given human cognitive (including emotional) constraints
- Introducing students to the world of research ethics and real-world problems
- Cultivating analytic-synthetic thinking, and logical reasoning/argument
- Respect for different positions/traditions/cultures, stakeholders
- Necessity of understanding the subject matter (technology) to make informed judgments
- Interdisciplinarity/Transdisciplinarity center-stage
- Keeping in mind – we are educating for the FUTURE – identifying seeds of future developments and addressing their promises and challenges
- Educating T-SHAPED ENGINEERS – deep in technology, broad in humanities (Barry Bohm)
BEYOND COMPLIANCE

DISTRIBUTED COGNITION IN NETWORKS OF AGENTS LEARNS IN DIFFERENT NODES OF THE SYSTEM, EXCHANGING EXPERIENCES

STRENGTH OF DIVERSITY

CONTINUOUSLY LEARNING SYSTEM

https://www.ercim.eu/beyond-compliance Forum on Digital Ethics in Research October 17/18, 2022, Paris and online
REFERENCES

References in full text can be found on my web page:
http://gordana.se/