CHALMERS | UNIVERSITY OF GOTHENBURG

IEEE Croatia. Section Systems, Man and Cybernetics/
Odjel za sustave, čovjeka i kibernetiku Hrvatske sekcije IEEE
Sveučilište Josipa Jurja Strossmayera, Osijek, 31-10-2017


# PROFESIONALNA ETIKA KAO PRIPREMA PROGRAMSKIH INŽENJERA ZA DRUŠTVENE IZAZOVE BUDUĆNOSTI

Professional ethics for software engineering students as preparation for the challenges of the future

Gordana Dodig Crnkovic
Mälardalen University, School of Innovation, Design and Engineering
Division of Computer Science and Engineering, Chalmers University of Technology

# Gordana Dodig Crnkovic

Chalmers University of Technology
Computer Science and Engineering
Interaction Design, Associate Professor
dodig@chalmers.se

Mälardalen University,
School of Innovation, Design and Engineering,
Professor of Computer Science/
Profesor računalnih znanosti
gordana.dodig-crnkovic@mdh.se

http://www.idt.mdh.se/~gdc/


"The beauty of math, of course, is that we don't need an ethicist."

https://www.math.ualberta.ca/pi/images/harris09.jpg

# Veliki izazovi i potencijali budućnosti

“Globalna zajednica se suočava sa velikim izazovima. Europsko društvo znanja mora se uhvatiti u koštac s njima kroz adekvatne analize, odgovarjuće akcije i sa povećanim sredstavima. Izazovi se moraju pretvoriti u održiva rješenja ( ... ) ”  Lundska deklaracija, 2009.

Prirodni izazovi, kao što su

Globalno zatopljenje, Nedovoljne zalihe energije, vode i hrane, starenje društva, nedostatno zdravstvo, pandemije, nedovoljna sigurnost, uništavanje okoliša, itd.

Neželjene posljedice novih tehnologija, kao što su

AGI (umjetna generalna inteligencija), nano-tehnologija, biotehnologija / bioinformatika, autonomni strojevi i kontrola: “big data”, “internet stvari “- “internet svega”, inteligentni gradovi, autonomna vozila (automobili, vlakovi, brodovi, letjelice) , autonomni inteligentni programi za kontrolu fizičkih sustava, inteligentni informacijski sustavi, itd

# PRIMJER AKTUALNOG ETIČKOG IZAZOVA:
# BUDUĆI INTELIGENTNI AUTONOMNI SUSTAVI –
## EU PARLAMENTARCI, ZNANSTVENICI, FILOZOFI, PRAVNICI

Prioritizing human well being in the age of artificial intelligence:
https://youtu.be/z5yZU8tp9W8 (5:56)

The IEEE Global Initiative for Ethical Considerations
in Artificial Intelligence and Autonomous Systems
http://standards.ieee.org/develop/indconn/ec/autonomous_systems.html IEEE standards

https://naturalsciences.ch/topics/co-producing_knowledge
Co-producing knowledge (Swiss Academy of Sciences)

# ETIČKI IZAZOVA NA VODEĆIM KONFERENCIJAMA IZ RAČUNARSTVA

## ICSE 2018 Gothenburg

Software Engineering and Society https://www.icse2018.org/track/icse-2018-Software-Engineering-in-Society

## ECSS Informatics Europe (2018 Gothenburg)

http://www.informatics-europe.org/

ECSS 2017 Panel on Ethics. Panel Chair: José Luiz Fiadeiro - Royal Holloway University of London

Panelists:

Isabel Aldinhas Ferreira (Institute for Systems and Robotics, U. NOVA de Lisboa)

Fabrizio Gagliardi (Barcelona Supercomputing Center)

Leszek Pacholski (Emeritus Wroclav University, Computer Science, Logic)

João Sequeira (Institute for Systems and Robotics, IST, Lisboa)

# Odgovorno istraživanje i inovacija (RRI)

Globalni izazovi i mogućnosti zahtijevaju Odgovorno istraživanje i inovaciju (RRI ), definirane kao:

*"Transparentan, interaktivni proces u kojem društveni akteri i istraživači/ inovatori međusobno dogovaraju (etičku) prihvatljivost, održivost i društvenu poželjnost inovacijskog procesa i njegovih rezultata (kako bi se omogućilo ispravno ugrađivanje znanstvenih rezultata u tehnološki napredak u društvu ) . "*

*Von Schomberg [ 2 ]*

Edukacija budućih inženjera treba slijediti iste principe!

# Sveučilište u društvu budućnosti

Preobrazba ”bjelokosnog tornja" znanosti – kontekst-neovisne u društveno – svijesnu znanost – u sve vise informacijski bogatom i društvu znanja.

Trostruki helix model povezuje:

–ACADEMIJU

–POSLOVNU SFERU/INDUSTRIJU

–SISTEM UPRAVLJANJA (GOVERNMENT)


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

https://inquiryumn.files.wordpress.com/2014/09/triple-helix.png

# Znanost sa drustvom i za društvo,

## Horizon 2020

Kao globalna zajednica suočavamo se sa egzistencijalnim izazovima.

Među mogucim odgovorima na te izazove okvirni program za europska istraživanja i tehnološki razvoj, Horizon 2020, formulirao je program rada pod naslovom “Znanost sa drustvom i za društvo”, koji postavlja temelje odgovornog istraživanja, inženjerstva i inovacija s ciljem kako bi podržao znanost i njene primjene koje doprinose napretku čovječanstva i ade na sprečavanju katastrofalnih događaja i njihovih posljedica.

# Znanost sa drustvom i za društvo

Cilj inicijative “Znanost sa drustvom i za društvo” može se postići samo ako se obrazuje inženjere i znanstvenike sa ne samo dubokim tehničkim znanjem nego i sa osjećajem odgovornosti i širokom socijalnom kompetencijom.

Iskustava sa dva švedske sveučilišta, Mälardalen University i Chalmers University of Technology, u radu sa dodiplomskim i postdiplomskim studentima pokazuju neophodnost nastave profesionalne etike i održivog razvoja za studenate iz podrucja znanosti i inženjerstva.

Programski inženjeri u ovom kontekstu igraju posebno značajnu ulogu jer programi kontroliraju sve veće dijelove naše svakodnevice.

# Znanost sa društvom i za društvo - program

Društveni izazovi za 2020 su formulirani u programu Znanost sa drustvom i za društvo, koja treba:

“Pomoći u izgradnji efikasne suradnje između znanosti i društva, regrutiranju novih talenata za znanost i osigurenje praćenja znanstvene izvrsnosti i društvene svijesti i odgovornosti "
Znanost sa društvom i za društvo  Program rada 2014-2015

Ovaj novi pristup potice sve zainteresirane aktere (građane, istraživače, poslovni ljude, kreatore politike, itd ) na interakciju tokom procesa istraživanja i inovacija da bi se koordiniralo i uskladilo oba procesa i njihovih rezultata sa društvenim vrijednostima i potrebama, prema principima odgovornog istraživanja i inovacije (RRI) .

Socijalne vrijednosti i potrebe: održivost, sigurnost, privatnost, jednakost, raznolikost (diversity), itd

# Organizacijska adaptacija u doba kompleksnosti i kontinuirane promjene

Nužnost definiranja društvene / organizacijske odgovornosti uz uobičajenu osobnu odgovornost .

Treba uzeti u obzir i predvidive/ željene i moguće neželjene posljedice istraživanja i tehnologije kroz anticipirajući proces učenja koji će u prvom redu spriječiti incidente i nesreće, a u najgorem slučaju ublažiti njihove posljedice.

Suvremeno globalno društvo se organizira u mrežama interakcije agenata. Svaki pojedinac pripada brojnim mrežama, koje definiraju njihove različite uloge aktera u različitim aspektima istraživanja i tehnologije. U tom kontekstu složenost i transdisciplinarnost / interdisciplinarnosti dolazi kao važan aspekt istraživanja i razvoja.

Vrijednosti, prioriteti, akcije se pregovaraju od strane zainteresiranih aktera (stakeholders), globalno.

# Etika u nastavi za inženjere – Debata o jedinstvenosti inženjerske etike

Uvid o potrebi nastave etike i diskusije etičkog aspekta u obrazovanju otvara nova pitanja.

Je li etika inženjerskih disciplina jedinstvena ili je dovoljna direktna primjena postojećih klasičnih etičkih teorija?

Trebaju li iskusni profesionalci iz inženjerskih disciplina ili filozofi (profesionalni etičari) predavati etiku inženjerima ?

# Obrazovanje inženjera za budućnost

Sveučilište obrazuje inženjere koji će riješavati probleme budućnosti.

Budućnost je već pred našim vratima.
("The Singularity Is Near: When Humans Transcend Biology" – Ray Kurzweil)

U dizajnu i inženjeringu odluke se donose cijelo vrijeme, bazirane na odlukama i izborima koje stalno radimo.

# Moj doprinos obrazovanju inženjera

https://student.portal.chalmers.se/doctoralportal/gts/courses/Pages/Research_Ethics.aspx Research Ethics & Sustainable Development, Chalmers, PhD

http://www.idt.mdh.se/kurser/cd5590/ Professional Ethics course, MDH, PhD

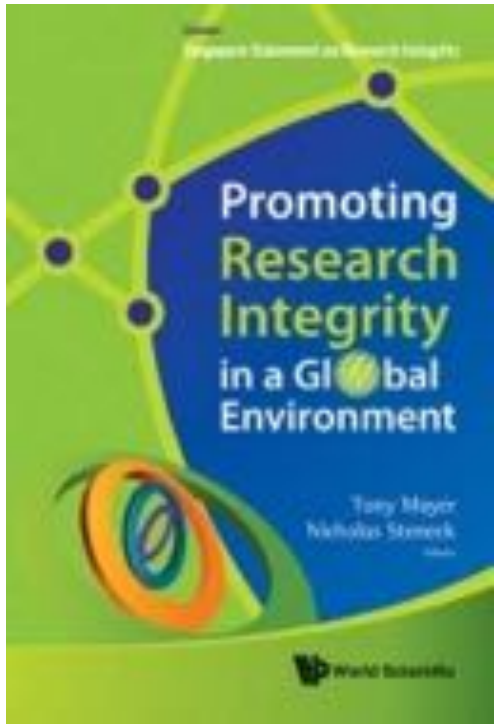
http://www.idt.mdh.se/kurser/ct3340/ Research Methods course [Academic Honesty Practices, Paper Writing and Publication], MDH, Masters/PhD

# ETKA PRODUKCIJE ZNANJA I DRUŠTVENI INTERESI 2017

Peer Review, by AJC1, Flickr.com

# PROMICANJE INTEGRITETA ISTRAŽIVANJA
## PROMOTING RESEARCH INTEGRITY IN A GLOBAL ENVIRONMENT

http://www.worldscientific.com/worldscibooks/10.1142/8102 Promoting Research Integrity in a Global Environment




### Sample Chapters

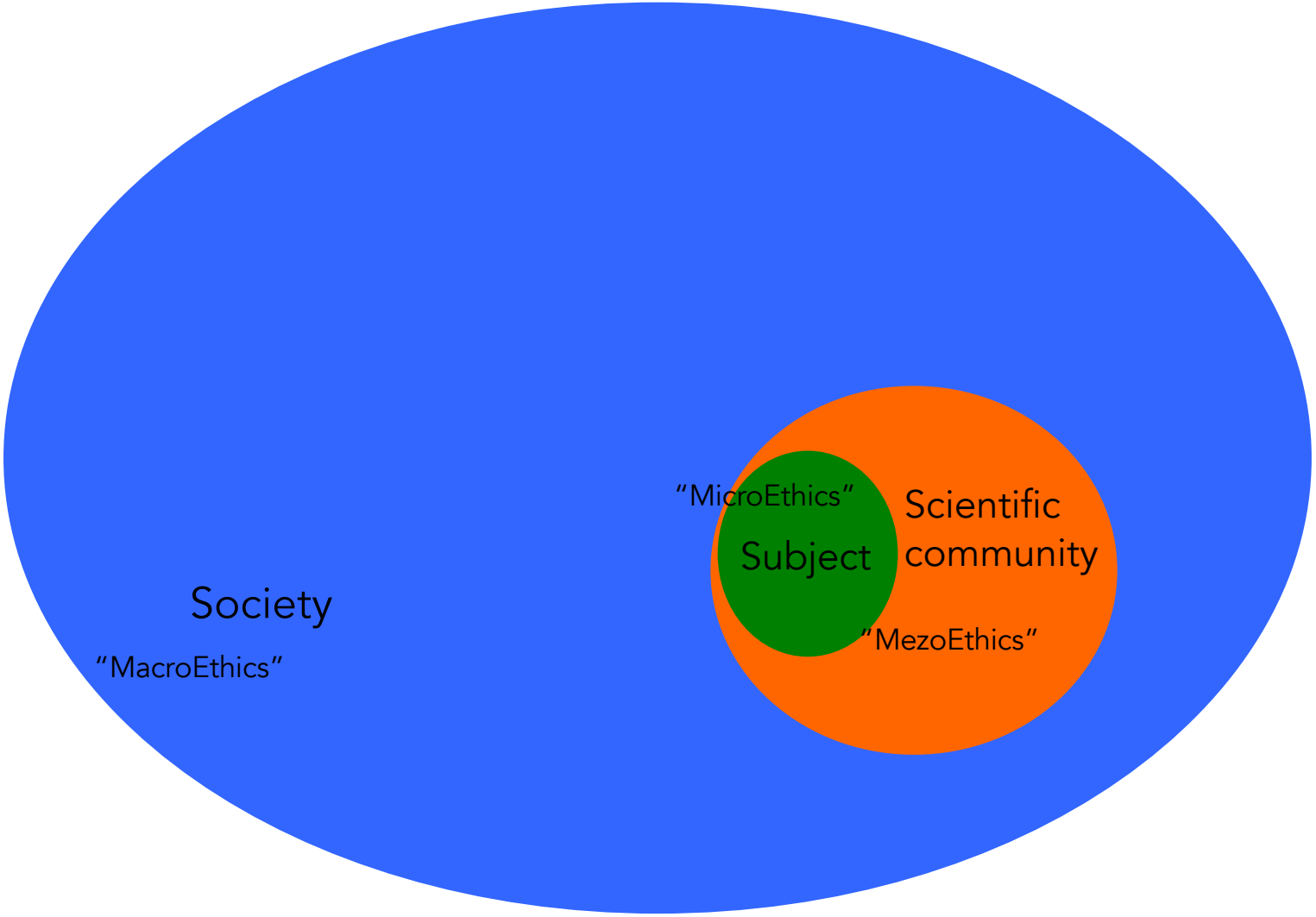
- Introduction http://www.worldscientific.com/doi/suppl/10.1142/8102/suppl_file/8102_intro.pdf
- Section II: Research Integrity Structures http://www.beck-shop.de/fachbuch/leseprobe/9789814340977_Excerpt_001.pdf
- Section III: Research Misconduct http://www.worldscientific.com/doi/suppl/10.1142/8102/suppl_file/8102_chap14.pdf

http://books.google.de/books?id=q3TZu6sovJMC&printsec=frontcover&hl=de&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false Promoting Research Integrity in a Global Environment

# PEER REVIEW AND MANUSCRIPT MANAGEMENT


http://books.google.se/books?id=cz3KZ--RajQC&printsec=frontcover&dq=peer+review+and+manuscript&hl=en&sa=X&ei=bfz4UsiLCM3bsgbwrIDgAg&ved=0CCwQ6AEwAA#v=onepage&q=peer%20review%20and%20manuscript&f=false

# Domains of Research Ethics



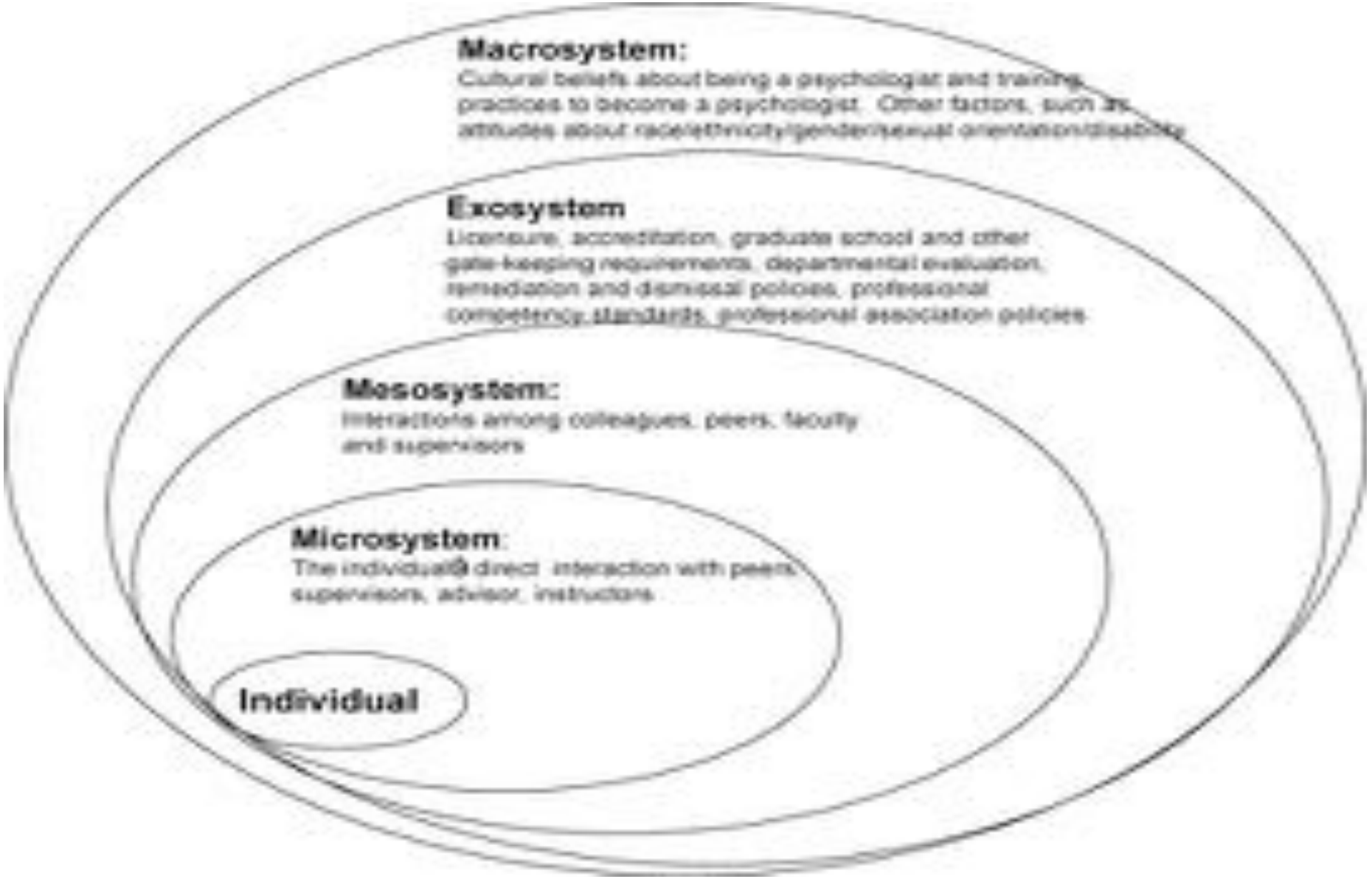

Is it true?
1. Scientific integrity

Is it fair?
2. Collegiality
3. Protection of human subjects
4.Animal welfare
5. Institutional integrity

Is it wise?
6. Social responsibility

Kenneth D. Pimple (2002) "Six Domains of Research Ethics. A Heuristic Framework for the Responsible Conduct of Research". Science and Engineering Ethics 8 , 191-205

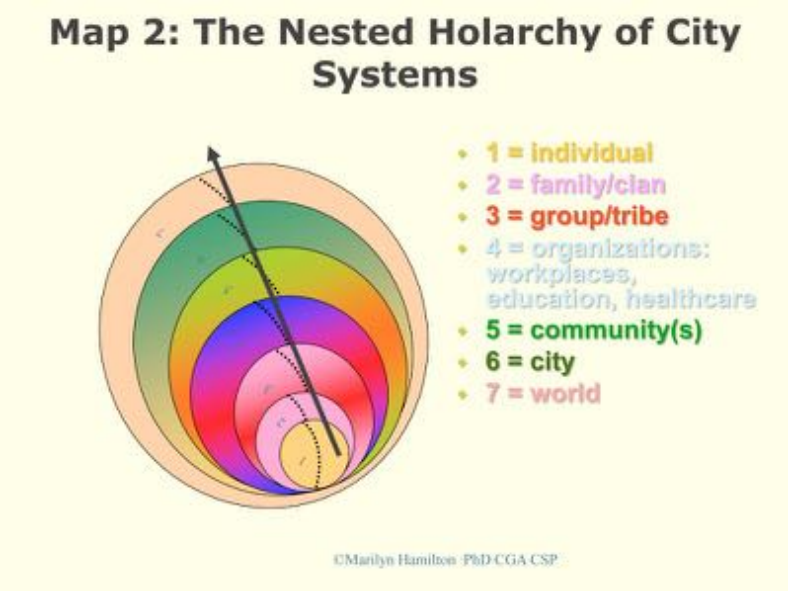
# Micro – Meso – Exo – Macro Domains of Ethics



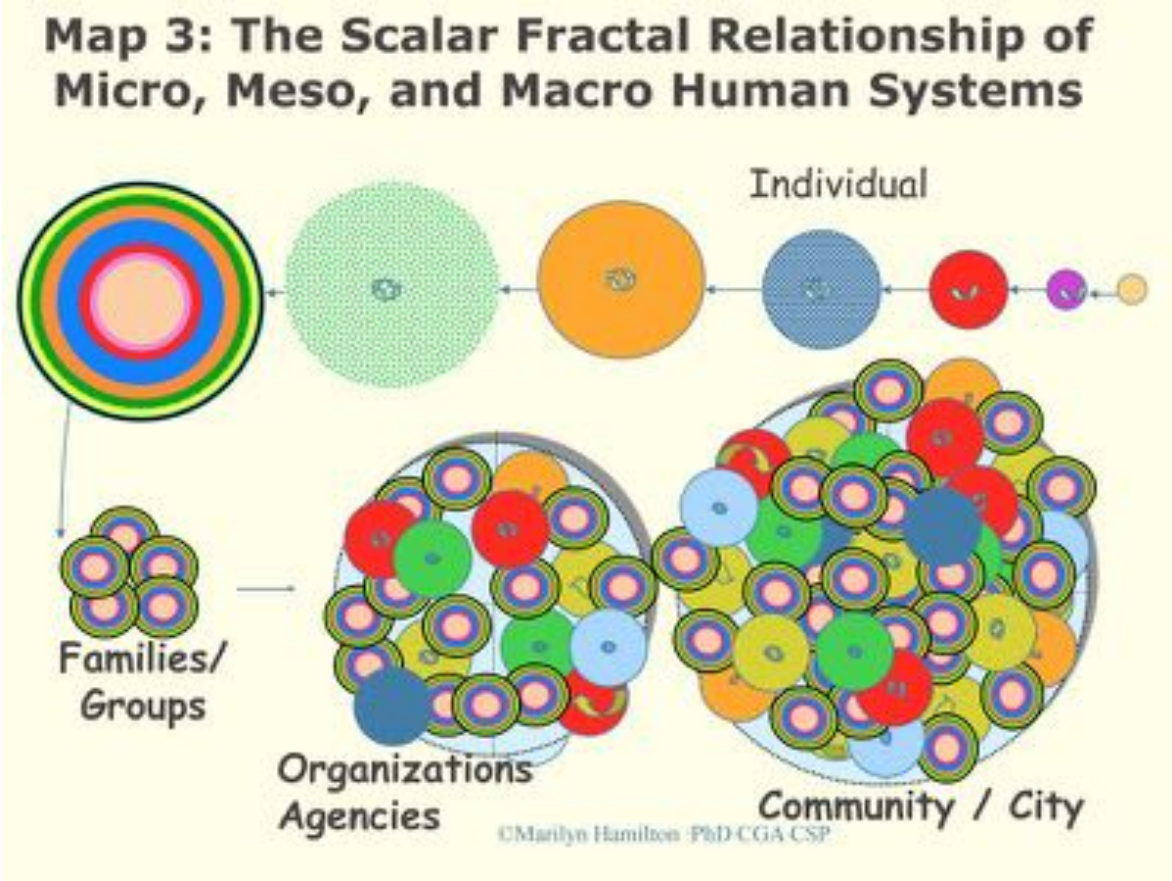



Source: American Psychological Association website

# Complexity Aspects Relating
# Micro – Meso – Exo – Macro
# Levels of Analysis –Example of City

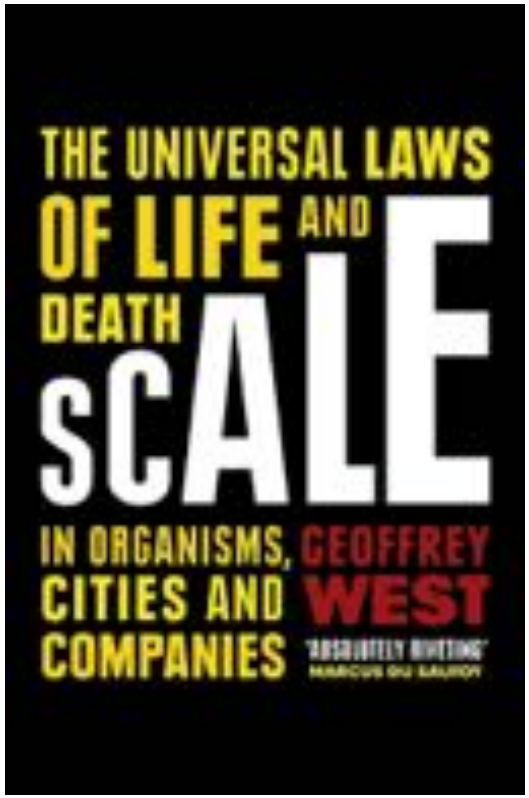



A holarchy, in the terminology of Arthur Koestler, is a connection between holons, where a holon is both a part and a whole. The term was coined in Koestler's 1967 book The Ghost in the Machine.




http://www.newsociety.com/Books/I/Integral-City

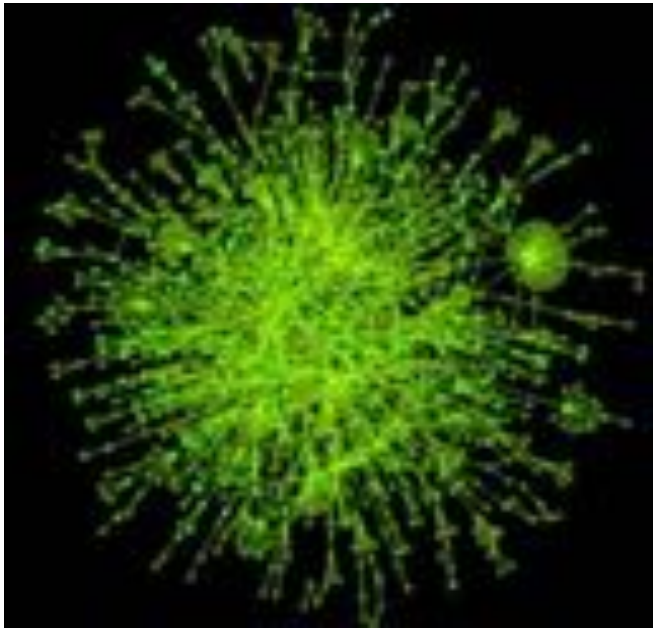
# SCALE: IS THERE ANY WAY TO MANAGE PROBLEMS OF SCALE?

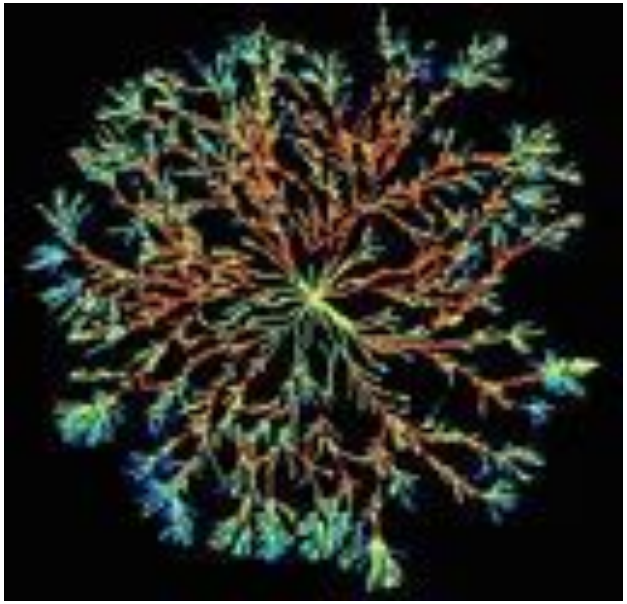



Scale: The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Life in Organisms, Cities, Economies, and Companies – Geoffrey West

https://www.ted.com/talks/geoffrey_west_the_surprising_math_of_cities_and_corporations#t-4624

# NETWORKS of Information processes





https://fineartamerica.com/featured/yeast-protein-interaction-map-hawoong-jeong-university-of-notre-dame.html ;
https://en.wikipedia.org/wiki/Opte_Project
https://en.wikipedia.org/wiki/Ben-Jacob%27s_bacteria

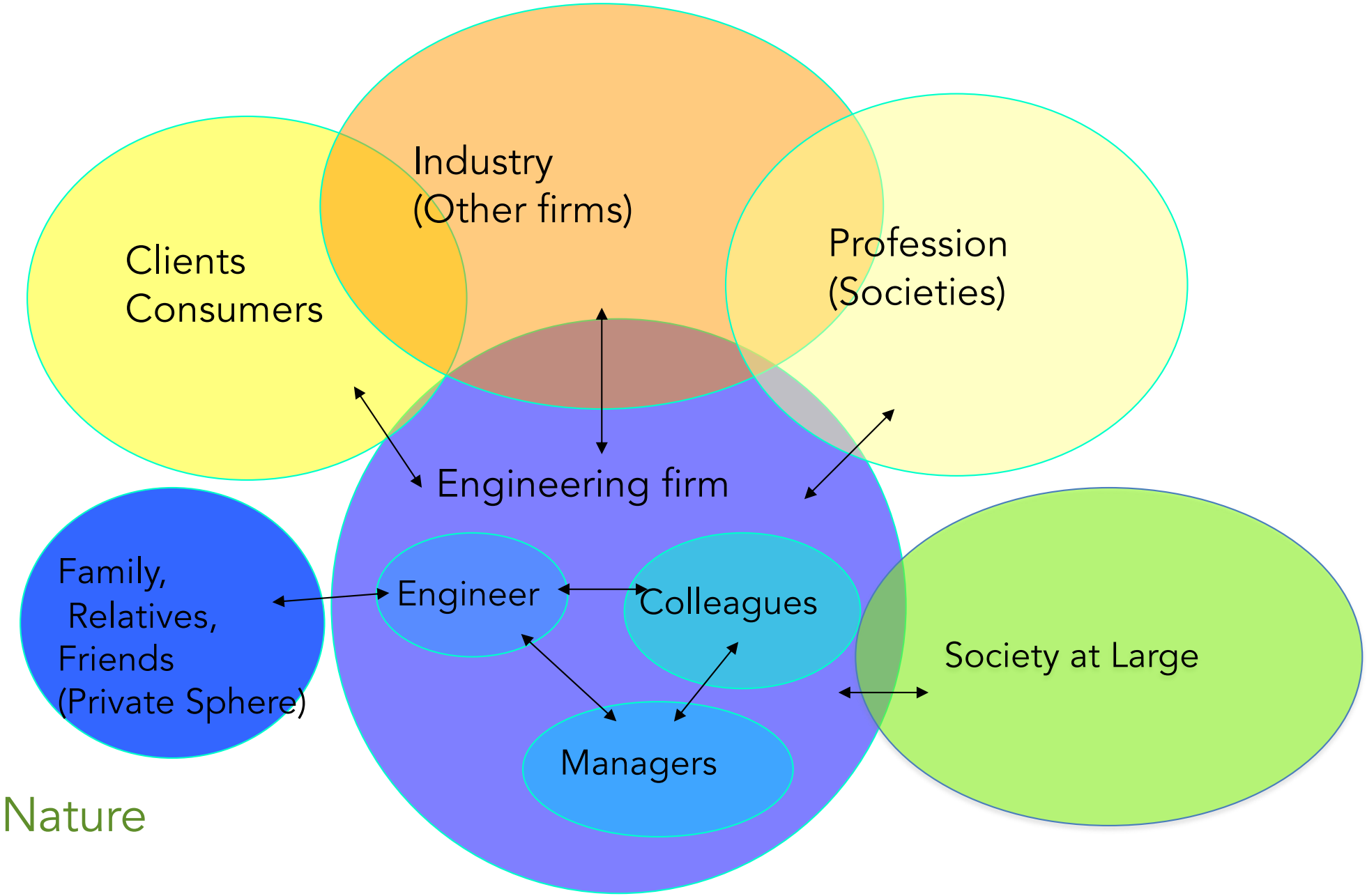
# Professional Ethics is About Relations

(reminder from DAY 1)

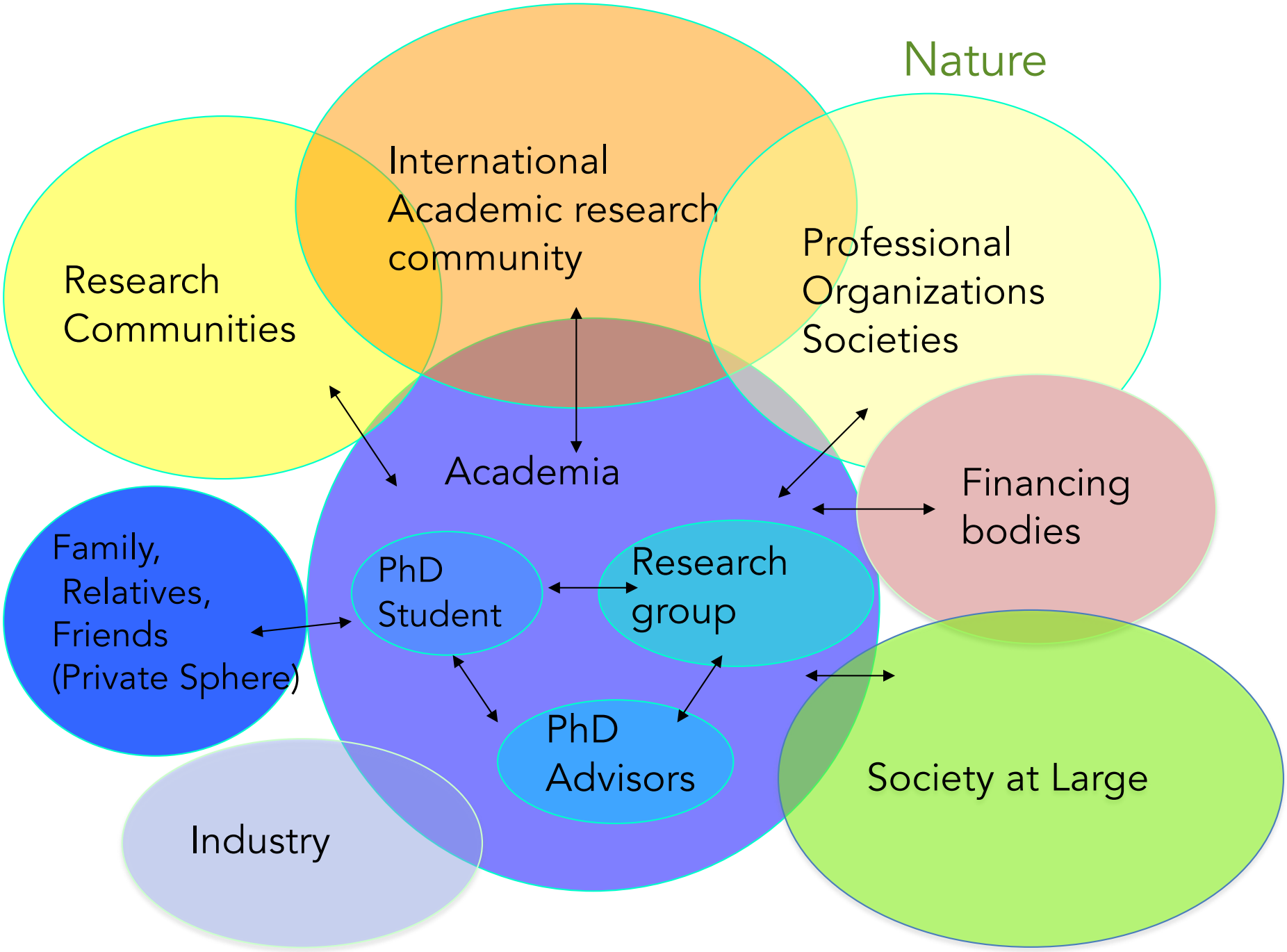
**. . .**between practicing professionals and

- colleagues & peers
- professional organizations
- employer/advisor
- clients/ users
- similar organizations nationally and internationally
- and other stakeholders

# STAKEHOLDERS IN AN INDUSTRIAL PROJECT



# STAKEHOLDERS IN AN ACADEMIC PROJECT



# CONCLUSIONS

*"With respect to system thinking, a T-shaped person is one who has technical depth in at least one aspect of the system's content, and a workable level of understanding of a fair number of the other system aspects. Many pure computer science graduates are strongly I-shaped, with a great deal of depth in software technology, but little understanding of the other disciplines involved in such areas as business, medicine, transportation, or Internet of Things. This leaves them poorly prepared to participate in the increasing numbers of projects involving multi-discipline system thinking."*

Boehm and KooImanojwong Mobasser

Research and Innovation are supporting research process and products of research that will contribute to the advancement of humanity and avert catastrophic events or in the worst case mitigate their consequences. They necessitate education of engineers with developed sensitivity to social aspects of engineering, including courses on research and engineering ethics and sustainable development.

# ZAKLJUČCI

"S obzirom na sustav razmišljanja, student koji posjeduje “T-profil” ima tehničku dubinu u najmanje jednom aspektu sadržaja i razinu preglednog razumijevanja ostalih aspekata sustava. Mnogi studenti informatike imaju izraziti “I-profil”, s dubinom u softverskoj tehnologiji, ali malo razumijevanja drugih disciplina uključenih u područjima kao što su Internet stvari. To ih ostavlja slabo pripremljenima zasudjelovanje u većem broju projekata koji uključuju multidisciplinarni sustav razmišljanja. ” Boehm i Koolmanojwong Mobasser

Istraživanje i inovacije podržavaju procese i rezulatate istraživanja koji će pridonijeti napretku čovječanstva i izbjeći katastrofalne događaje, ili u najgorem slučaju doprinijeti ublažavanju njihovih posljedica. Oni zahtijevaju obrazovanje inženjera s razvijenom osjetljivosti za društvene aspekte inženjeringa, uključujući tečajeve o istraživanju i inženjerske etike i održivog razvoja.

# REFERENCES

[1] The Lund Declaration, 8 July 2009.

http://www.vr.se/download/18.7dac901212646d84fd38000336/

[2] Von Schomberg, R. 2011. Towards Responsible Research and Innovation in the Information and Communication Technologies and Security Technologies Fields (November 13, 2011). http://dx.doi.org/10.2139/ssrn.2436399

[3] Von Schomberg, R. 2013. A Vision of Responsible Research and Innovation, in Responsible Innovation, First Edition. Eds. Richard Owen, John Bessant and Maggy Heintz. John Wiley & Sons, Ltd. A constitution for Europe.

[4] Owen, R., Macnaghten, P.M., Stilgoe, J. 2012. Responsible Research and Innovation: from Science in Society to Science for Society, with Society. Science and Public Policy 39 (6): 751/760.

# "Industrial Science"

"Industrial scientists do not, in general, "own" their research in the sense of undertaking projects of their own choosing and being free to publish their results entirely on their own initiative."

"The personal values and needs of customers, patients, and other users have to be taken into account."

"The trouble is that industrial scientists do not actually have a direct say in how these dilemmas are solved."

IS THAT CORRECT? WHAT ARE WE DOING ABOUT IT?

# Mode 1 and Mode 2 Research

Mode 2, post-academic, research is usually undertaken as a succession of “projects,” each justified in advance to a funding body whose members are usually not scientists.

Important feature of post-academic science is that it is largely the work of teams of scientists, often networked over a number of different institutions. Where, then, do the ethical responsibilities lie?

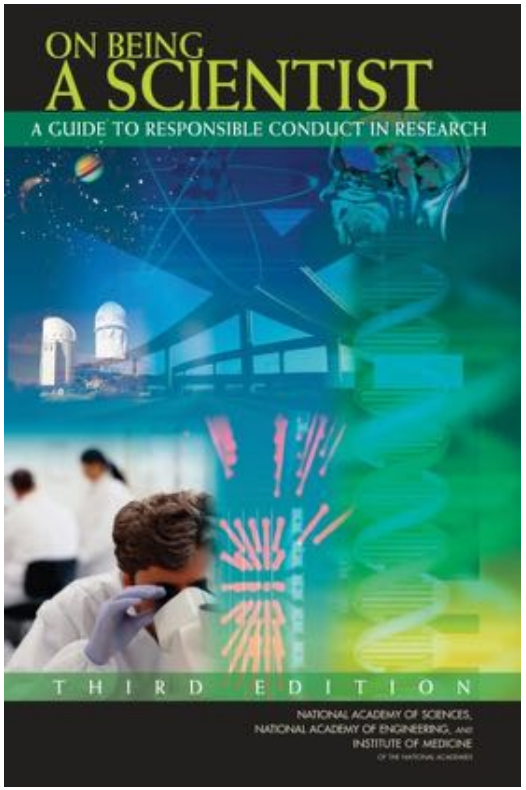
OPEN QUESTION: HOW DO WE INVOLVE ALL IMPORTANT STAKEHOLDERS AND HOW TO NEGOTIATE COMMON SOLUTIONS? (THINKING IN TERMS OF COMPLEX SOCIO-TECHNOLOGICAL NETWORKS)

# ESF PUBLICATIONS



- The European Science Foundations Code of Conduct for Research Integrity
- European Peer Review Guide – Integrating Policies and Practices into Coherent Procedures
- Fostering Research Integrity in Europe

http://www.esf.org/nc/coordinating-research/mo-fora/publications.html?tx_ccdamdl_cart%5Badd%5D=17719




ON BEING A SCIENTIST
A GUIDE TO RESPONSIBLE CONDUCT IN RESEARCH

Committee on Science, Engineering, and Public Policy
NATIONAL ACADEMY OF SCIENCES, NATIONAL ACADEMY OF ENGINEERING, AND INSTITUTE OF MEDICINE OF THE NATIONAL ACADEMIES
THE NATIONAL ACADEMIES PRESS
Washington, D.C.

http://www.nap.edu/catalog.php?record_id=12192

# MISCONDUCT IN RESEARCH

- Misconduct in research (such as fabrication, falsification, and plagiarism) damages the scientific enterprise, is a misuse of public funds, and undermines the trust of citizens in science.

  https://en.wikipedia.org/wiki/Paolo_Macchiarini

- Recognizing that the research misconduct affects all stakeholder communities and that, like science itself, the problem has a major international dimension, the OECD Global Science Forum sponsored an international consultation of government-designated officials and experts, on February 22-23, 2007, in Tokyo.

# SCIENTIFIC MISCONDUCT

- Scientific misconduct is the violation of the standard codes of scholarly conduct and ethical behavior in professional scientific research. A *Lancet* review on *Handling of Scientific Misconduct in Scandinavian countries* provides the following:
- Danish definition: "Intention or gross negligence leading to fabrication of the scientific message or a false credit or emphasis given to a scientist"
- Swedish definition: "Intention[al] distortion of the research process by fabrication of data, text, hypothesis, or methods from another researcher's manuscript form or publication; or distortion of the research process in other ways."

http://en.wikipedia.org/wiki/Scientific_misconduct

# DEVELOPING PEER REVIEW

http://journal.frontiersin.org/Journal/10.3389/fncom.2012.00079/full

Open evaluation: a vision for entirely transparent post-publication peer review and rating for science

Nikolaus Kriegeskorte*

Medical Research Council, Cognition and Brain Sciences Unit, Cambridge, UK

- See more at: http://journal.frontiersin.org/Journal/10.3389/fncom.2012.00079/full#sthash.2nhOvvq0.dpuf

# Peer Review Guidelines & Examples

http://www.elsevier.com/reviewers/reviewer-guidelines#youve-been-asked-to-review

http://www.mhhe.com/mayfieldpub/maner/resources/peerreview.htm

http://www.bmj.com/about-bmj/resources-reviewers/guidance-peer-reviewers BMJ Guidance for peer reviewers

http://www.peerageofscience.org/review/review-examples

# AUTOMATED PROOFREADER AND PLAGIARISM CHECKER

- http://www.grammarly.com/?q=plagiarism&utm_source=google&utm_medium=cpc&utm_campaign=SCM&utm_content=283499678 46&utm_term=&matchtype=&placement=www.univie.ac.at&network=d&gclid=CJSkgN7io70CFa3LtAod-FgAAQ

- GRAMMARLY is an automated proofreader and plagiarism checker. It corrects up to 10 times as many mistakes as other word processors.

**The transformation of “ivory tower” context-independent model of academy to socially-aware paradigm in increasingly information-rich knowledge-based societies (digitalized society).**

**The connects:**

**–ACADEMIA**

**–BUSINESS**

**–GOVERMENT**


https://inquiryumn.files.wordpress.com/2014/09/triple-helix.png

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

# Professional Codes of Ethics

- http://www.acm.org/constitution/code.html#sect1 ACM Code of Ethics and Professional Conduct
- http://www.computer.org/cms/Computer.org/Publications/code-of-ethics.pdf Software engineering code of ethics (IEEE-CS/ACM )
- http://www.asce.org/inside/codeofethics.cfm American Society of Civil Engineers Code of Ethics
- http://www.acm.org/about/se-code Software Engineering Code of Ethics and Professional Practice

# Educating Engineers for the Future

We are educating engineers that will solve *future problems*.

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

Choices are made all the time in the design and engineering and sensitivity to consequences of choices is needed – it involves moral judgment.

Ethics should be *proactive* (learning, anticipating) instead of *reactive* (punishing and prosecuting "ethics of scandals and affairs") activated only when something goes wrong.

# T-SHAPED ENGINEERS (Barry Boehm)

*"With respect to system thinking, a T-shaped person is one who has technical depth in at least one aspect of the system's content, and a workable level of understanding of a fair number of the other system aspects. Many pure computer science graduates are strongly I-shaped, with a great deal of depth in software technology, but little understanding of the other disciplines involved in such areas as business, medicine, transportation, or Internet of Things. This leaves them poorly prepared to participate in the increasing numbers of projects involving multi-discipline system thinking."* Boehm and KoolManojwong Mobasser

Research and Innovation are supporting research process and products of research that will contribute to the advancement of humanity and avert catastrophic events or in the worst case mitigate their consequences. They necessitate education of engineers with developed sensitivity to social aspects of engineering, including courses on research and engineering ethics and sustainable development.

# Engineering as Social Experimentation

“ All products of technology present some potential dangers, and thus engineering is an inherently risky activity. In order to underscore this fact and help in exploring its ethical implications, we suggest that engineering should be viewed as an experimental process. It is not, of course, an experiment conducted solely in a laboratory under controlled conditions. Rather, it is an experiment on a social scale involving human subjects.”

*Ethics in Engineering*, Martin, M.W., Schinzinger, McGraw-Hill, NY, 2005.

# Professional Codes of Ethics: The Goal

- Acquiring skill in practical ethical reasoning in a professional domain
- Developing the ethical autonomy, i.e. the ability and the habit to think rationally and critically about the ethical questions.

# Professional Codes of Ethics: The Role

- Importance of professional knowledge and role-specific professional obligations in resolving professional ethical conflicts
- General principles necessary to comprehend and apply professional codes of ethics
- Case based reasoning with applying and interpreting codes

# Association of Computer Machinery (ACM) Code of Conduct

1. General Moral Imperatives

1.1 Contribute to society and human well-being

1.2 Avoid harm to others

1.3 Be honest and trustworthy

1.4 Be fair and take action not to discriminate

1.5 Honor property rights including copyrights and patents

1.6 Give proper credit for intellectual property

1.7 Respect the privacy of others

1.8 Honor confidentiality

http://onlineethics.org/codes/ACMcode.html

# "WHISTLE BLOWING"

**"Whistle Blowing"** is a case when an individual employee feels unable to accept the actions of his/her company and go public about them, typically via the media.

It is almost always a dramatic event and was even more so before when the typical view was that an employee owed total loyalty to the employer.

Employees who blow the whistle on their employers are in the US protected by law. If they are fired or otherwise retaliated against for whistle blowing, they can sue the company.

http://sites.ieee.org/ssit/2013/06/24/the-ethics-of-whistle-blowing/ The Ethics of Whistle Blowing
http://assembly.coe.int/Main.asp?link=/Documents/AdoptedText/ta10/ERES1729.htm

Resolution 1729 (2010) Protection of “whistle-blowers” in Europe

# PRECAUTIONARY PRINCIPLE

When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.

# 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

http://cacm.acm.org/magazines/2015/12/194630-coupled-ethical-epistemic-analysis-in-teaching-ethics/abstract

# ETHICAL-EPISTEMIC* ANALYSIS

## How values and priorities affect knowledge production

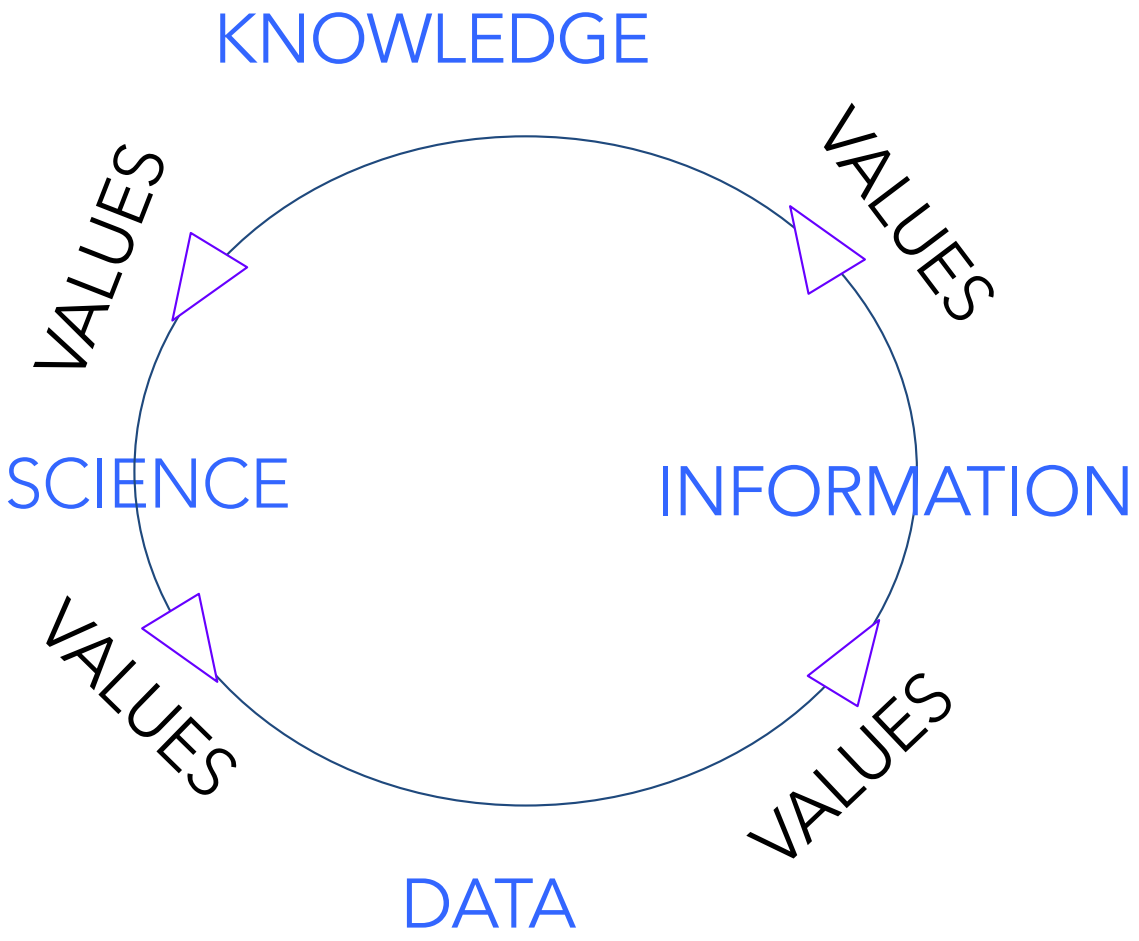
"Computer experts aren't just building and manipulating hardware, software, and code, they are building systems that help to achieve important social functions, systems that constitute social arrangements, relationships, institutions. computer experts can facilitate and constrain behavior, and materialize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



# 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.

# VALUES AND EMOTIONS

“The decisions that scientists and others need to make about what projects to pursue, what theories to accept, and what applications to enact will unavoidably have an emotional, value-laden aspect.”

“The best course is not to eliminate values and emotions, but to try to ensure that the best values are used in the most effective ways.”

Paul Thagard

# 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.

# VALUES IN RESEARCH – 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?

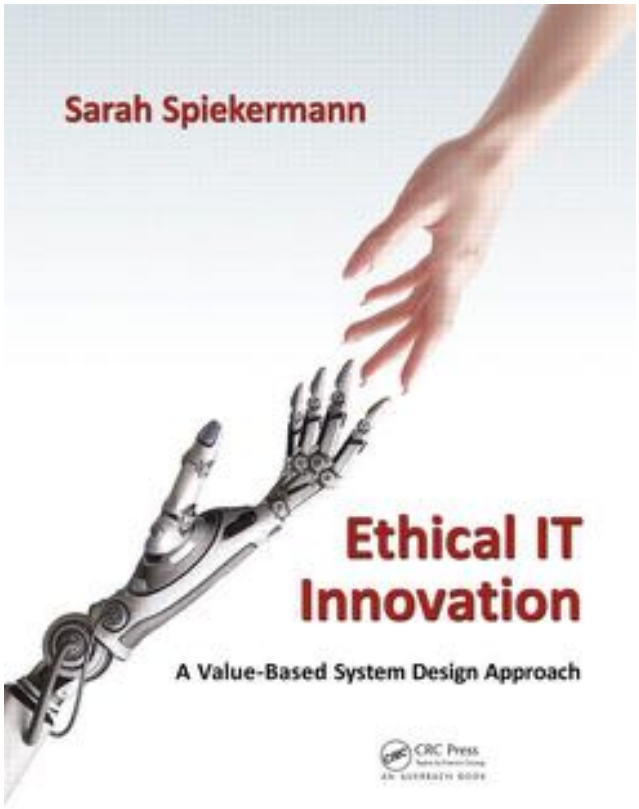
- How are ethical aspects of research taken care of?

# 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:

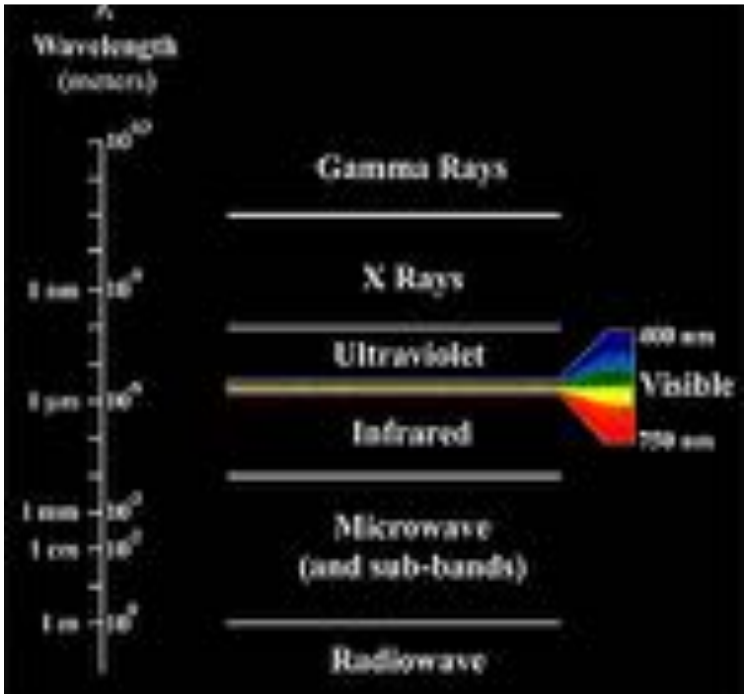
IEEE P7000
The first global standard process for addressing ethical concerns in system design

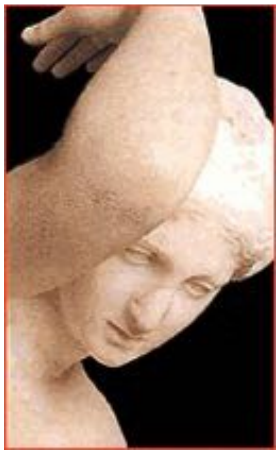
https://www.crcpress.com/Ethical-IT-Innovation-A-Value-Based-System-Design-Approach/Spiekermann/p/book/9781482226355#googlePreviewContainer

# CONCLUSIONS REGARDING COMPLEXITY

- Complexity of the real world problems – number of processes go on concurrently and of different levels of scale
- Ambiguity of theoretical representations and interpretations
- No absolute truth, but the commitment to the commonly accepted ”good enough” ”reasonably good” solutions

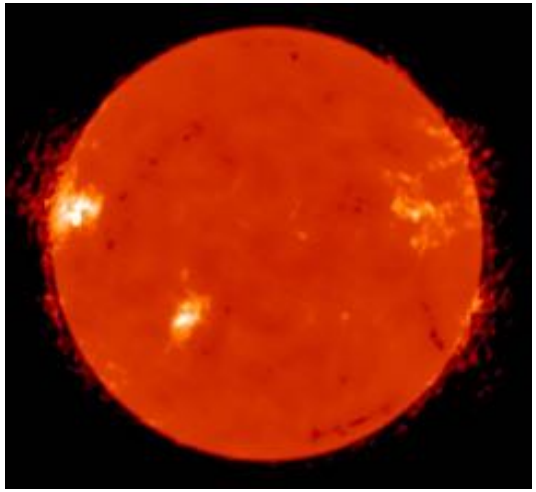
# Approaching problem from different perspectives - Seeing the world in different light



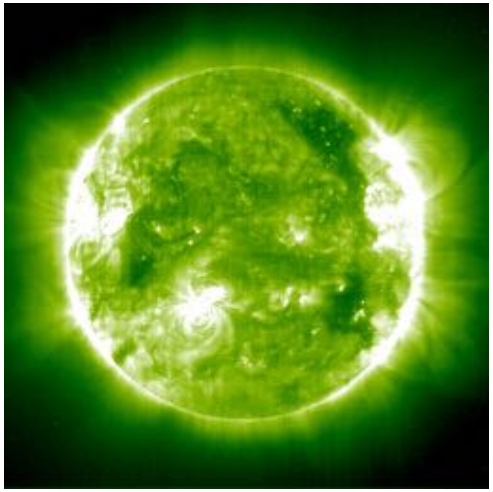



What if we could see in any wavelength of the electromagnetic spectrum, from gamma-rays to radio waves? How would the world appear to us?

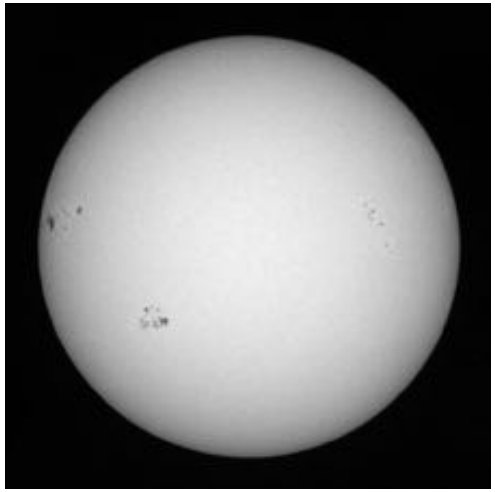
# IMAGES OF THE SUN



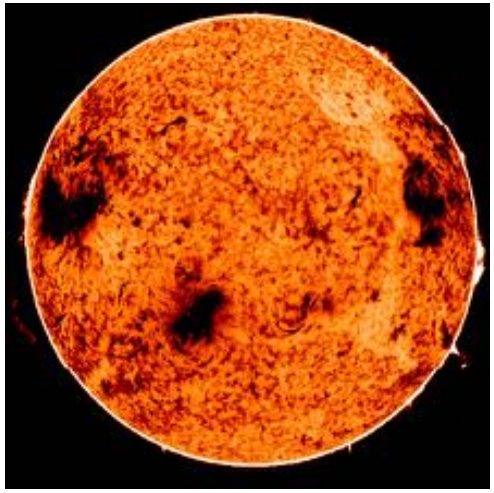
RADIO



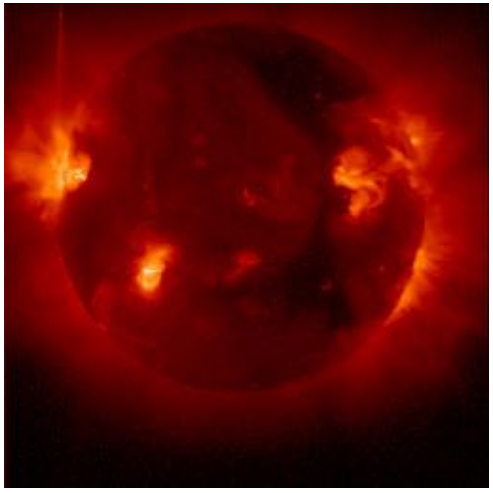
ULTRAVIOLET



VISIBLE

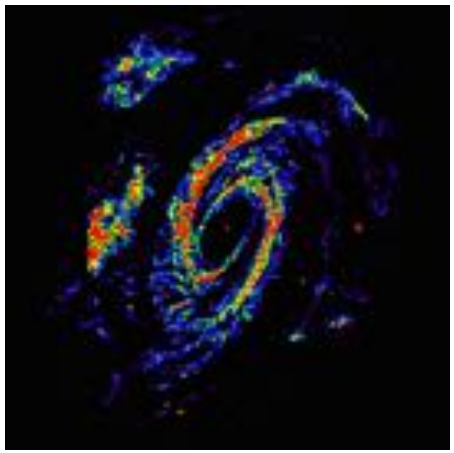


INFRARED



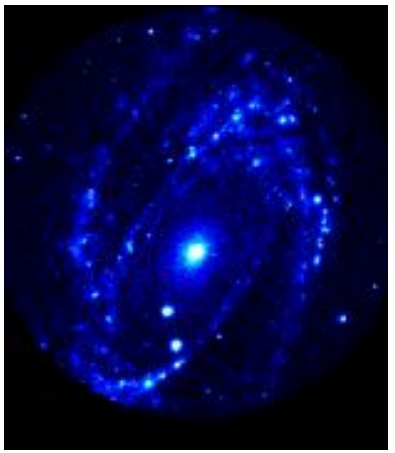
X-RAY

# IMAGES OF GALAXY M81

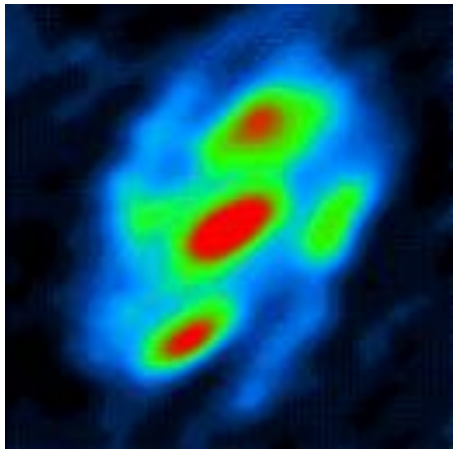


RADIO

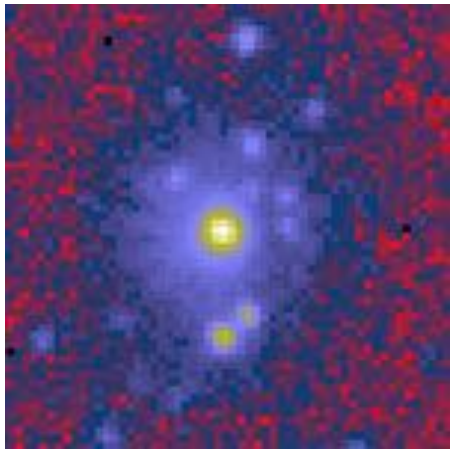
ULTRAVIOLET



VISIBLE



INFRARED



X-RAY

# LINKS

Basic material:

- http://www.idt.mdh.se/kurser/cd5590 Professional Ethics Course
- http://ethics.acusd.edu/presentations/Hinman/theory/relativism/
- http://ethics.acusd.edu/socialethics/
- Moral Philosophy Through The Ages, James Fieser, Mayfield Publishing Company, 2001

Additional resources:

- http://www.prs.heacademy.ac.uk/projects/ethics
- http://www.idt.mdh.se/kurser/cd5590/16_ITSEASY/links.html (contains Codes of Ethics)
- http://ethics.acusd.edu/relativism.html

# REFERENCES


The Lund Declaration, 8 July 2009.
http://www.vr.se/download/18.7dac901212646d84fd38000336

Von Schomberg, R. 2011. Towards Responsible Research and Innovation in the Information and Communication Technologies and Security Technologies Fields (November 13, 2011). http://dx.doi.org/10.2139/ssrn.2436399

Von Schomberg, R. 2013. A Vision of Responsible Research and Innovation, in Responsible Innovation, First Edition. Eds. Richard Owen, John Bessant and Maggy Heintz. John Wiley & Sons, Ltd. A constitution for Europe.

Owen, R., Macnaghten, P.M., Stilgoe, J. 2012. Responsible Research and Innovation: from Science in Society to Science for Society, with Society. Science and Public Policy 39 (6): 751/760.

SWEDISH RESEARCH COUNCIL EXPERT GROUP FOR ETHICS
http://www.vr.se/inenglish/ethics.4.69f66a93108e85f68d48000116.html
http://www.epn.se/sv/start/startsida/

# REFERENCES


Gordana Dodig-Crnkovic , Daniel Kade, Markus Wallmyr, Tobias Holstein and Alexander Almér. Transdisciplinarity seen through Information, Communication, Computation, (Inter-)Action and Cognition. INFORMATION STUDIES AND THE QUEST FOR TRANSDISCIPLINARITY, forthcoming book. World Scientific. Mark Burgin and Wolfgang Hofkirchner, Editors

Collen, A. (2002). Disciplinarity in the pursuit of knowledge. In G. Minati and E. Pessa (Eds.), Emergence in Complex Cognitive, Social, and Biological Systems (pp. 285-296). New York: Kluwer.

Julie Thompson Klein (2010), A taxonomy of interdisciplinarity. In: Robert Frodeman, Julie Thompson Klein & Carl Mitcham, eds.. The Oxford Handbook of Interdisciplinarity. New York: Oxford University Press.

Kroeze, J.H.: "Transdisciplinarity in IS – The next Frontier in the Computing Disciplines", Sprouts Working Papers on Information Systems 12/2, 2012, http://aisel.aisnet.org/cgi/viewcontent.cgi?article=1488&context=sprouts_all

Hirsch Hadorn G, et al. (2008a) Handbook of Transdisciplinary Research.
Vienna: Springer.

# REFERENCES

Andruid Kerne. 2005. Doing interface ecology: the practice of metadisciplinary. In ACM SIGGRAPH 2005 Electronic Art and Animation Catalog (SIGGRAPH '05). ACM, New York, NY, USA, 181-185. DOI=http://dx.doi.org/10.1145/1086057.1086144

Basarab Nicolescu, Manifesto of Transdisciplinarity, New York, SUNY Press, 2002

Basarab Nicolescu (ed.), Transdisciplinarity – Theory and practice, Hampton Press, Cresskill, New Jersey, USA, 2008

Antonio R. Damasio, Looking for Spinoza: Joy, Sorrow, and the Feeling Brain, San Diego, Harcourt, 2003.

Internet site of the International Center for Transdisciplinary Research (CIRET)
http://basarab.nicolescu.perso.sfr.fr/ciret/

Predavanje se temelji na slijedecem članku:

Dodig-Crnkovic, G., *Preparing Next Generation of Software Engineers for Future Societal Challenges and Opportunities*. ESEC/FSE 2015 SSE'15, September 01 2015, Bergamo, Italy

http://www.idt.mdh.se/~gdc/work/20150804-SSE.ESEC-FSE.pdf

i predavanju:

http://www.idt.mdh.se/~gdc/work/TEACHING-ETHICS-TO-ENGINEERS.pdf


# COMPUTER-RELATED RISKS & PRECAUTIONARY PRINCIPLE

# Computer-Related Risks

Problems involving:

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

Book: **Computer-Related Risks** by Peter Neumann
(Addison-Wesley 1994; ACM Press Series)

# Computer-Related Risks

- The Ariadne rocket, a common European space project exploded a few seconds after takeoff, due to a software error.

- The baggage-handling system of the Denver International Airport. Errors in the software that controls the system required postponement of the official opening (Oct. 1993). By June 1994 the $ 193 million system was still not functioning, but costing $ 1.1 million per day in interest and other costs. In early 1995 a manual baggage system was installed in order to open the airport.

# Computer-Related Risks in Technical Systems

- Some cancer patients in the USA have received fatal radiation overdoses from the Therac-25, a computer-controlled radiation-therapy machine.

- The Sizewell B nuclear power plant in England. Some years ago it was decided to test the subsystem which is used to close down the reactor if a dangerous situation occurs. The results were not comforting: the software failed almost half of them. They were not able to find the errors in the 100 000 lines of code. Instead, they reduced the overall expectation of the plant's performance from one failure every 10,000 years to one every 1,000 years.

# Computer-Related Incidents with Commercial Aircraft

China Airlines Airbus A300 in Taipei (*1998*)
The Korean Air Lines B747 CFIT Accident in Guam (*1997*)
The FedEx MD11 Accident on Landing at Newark (*1997*)
The Birgen Air B757 accident near Puerto Plata (*1996*)
News on the Aeroperu B757 accident (*1996*)
The Ariane 5 Failure (*1996*)
The T-43A Accident near Dubrovnik (*1996*)
Information About the Martinair B767 EFIS-loss Incident near Boston, MA
The American Airlines B757 Accident in Cali (*1995*)
The A320 Maintenance Incident at Gatwick (*1995*)
The A330 Flight-Test Accident in Toulouse (*1994*)
The Tokyo-London A340 FMGS Problem (*1994*)
The A300 Crash in Nagoya (*1994*)
The A320 Accident in Warsaw(*1993*)
The Air Inter A320 Accident near Strasbourg(*1992*)
The Sydney A320/DC10 Incident (*1991*)
The Lauda Air B767 Accident (*1991*)
The British Midland B737-400 Kegworth Accident (*1989*)
A B747 Control Incident (*1985*)
The Eastern Airlines L1011 Common Mode Engine Failure Incident (*1983*)
A Space Shuttle Control Incident (*1981*)
The American Airlines DC10 Takeoff Accident in Chicago (*1979*)


http://legacy.eos.ncsu.edu/eos/info/computer_ethics/

# PRECAUTIONARY PRINCIPLE

# PRECAUTIONARY PRINCIPLE

People have a duty to take anticipatory action to prevent harm.

The burden of proof of harmlessness of a new technology, process, activity, or chemical lies with the proponents, not with the general public.

# PRECAUTIONARY PRINCIPLE

activity, people have an obligation to examine "a full range of alternatives" including the alternative of doing nothing.

Decisions applying the precautionary principle must be open, informed, and democratic and must include affected parties

# PRECAUTIONARY PRINCIPLE

Maastricht Treaty adopted the principle as a fundamental element of environmental policy: Article III-233 of the draft Treaty establishing a constitution for Europe

http://ec.europa.eu/dgs/health_consumer/library/pub/pub07_en.pdf - Communication on the precautionary principle

# CODES OF ETHICS

# IEEE Code of Ethics

1. Accept responsibility in making engineering decisions consistent with the safety, health and welfare of the public, and to disclose promptly factors that might endanger the public or the environment;
2. Avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;
3. Be honest and realistic in stating claims or estimates based on available data;
4. Reject bribery in all its forms;

# IEEE Code of Ethics

5. Improve the understanding of technology, its appropriate application, and potential consequences;
6. Maintain and improve our technical competence and undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
7. Seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;

# IEEE Code of Ethics

8. Treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;
9. Avoid injuring others, their property, reputation, or employment by false or malicious action;
10. Assist colleagues and co-workers in their professional development and support them in following this code of ethics.

https://www.ieee.org/about/corporate/governance/p7-8.html