

**Cross-disciplinarity in Engineering Education 3rd CeTUSS  
Workshop**

CEMUS and IEEE Nordic Education Society Chapter

**Professional Ethics  
in Software Engineering Curricula**

**Gordana DODIG-CRNKOVIC  
Ivica CRNKOVIC**

*Department of Computer Science and Electronics,  
Mälardalen University, Västerås, Sweden*

*gordana.dodig-crnkovic@mdh.se; ivica.crnkovic@mdh.se*

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# Swedish Computing Curricula

Swedish Computer Science and Engineering education follows broadly an international model, expressed in the American *ACM/IEEE Computing Curriculum*

<http://www.computer.org/education/cc2001/index.htm>

Typical general knowledge subjects that are widely represented are Theory of Science (Philosophy of Science) and Research Methodology.

However, the education in Professional Ethics, that is a compulsory part of *ACM/IEEE Computing Curriculum* is as a rule absent.

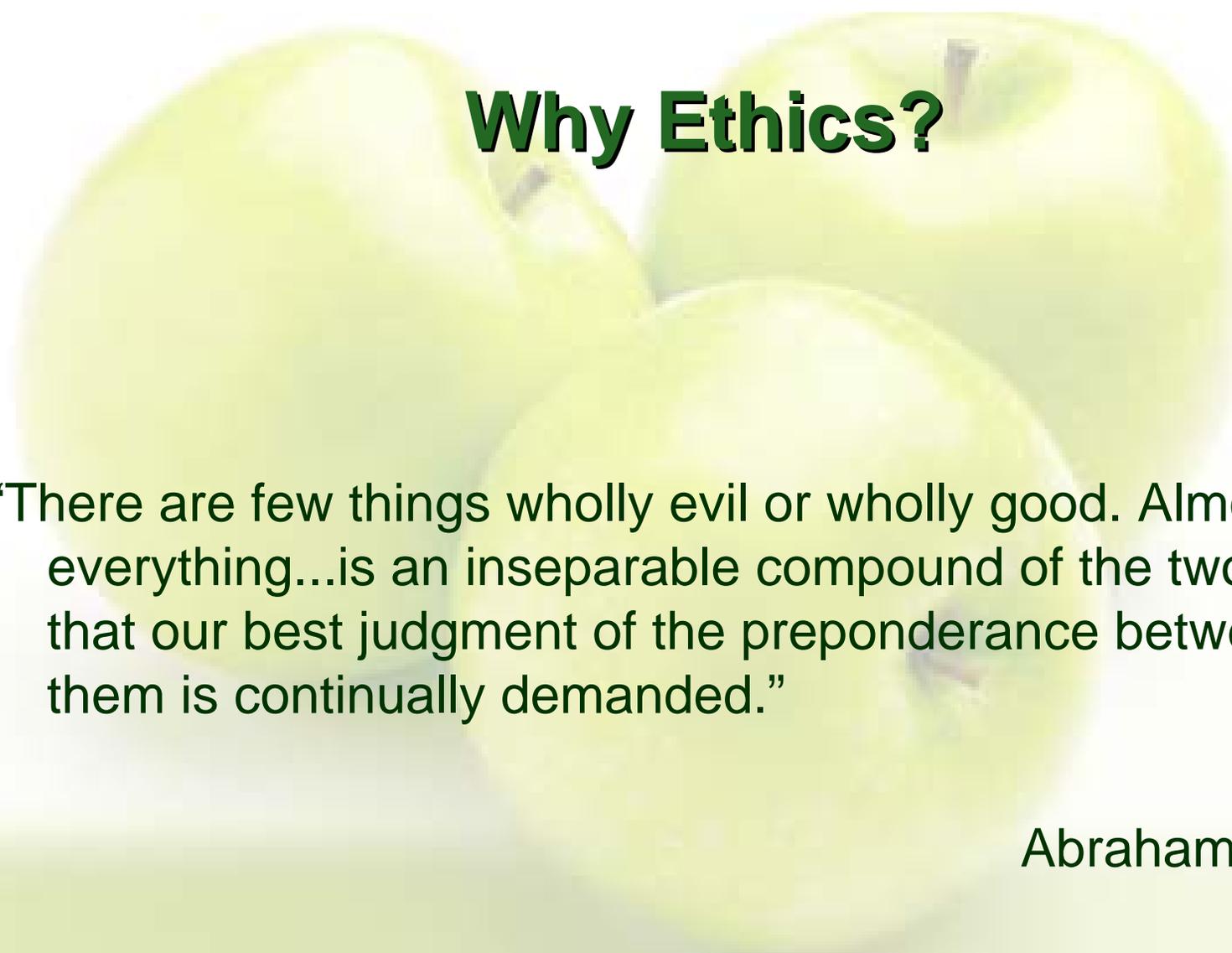
# Computing Curricula ACM/IEEE

- Social context of computing
- Methods and tools of analysis of ethical argument
- Professional and ethical responsibilities
- Risks and liabilities of safety-critical systems
- Intellectual property
- Privacy and civil liberties
- Social implications of the Internet
- Computer crime
- Philosophical foundations of ethics

# The Increasing General Public Awareness on Ethical Aspects of Technology

The high level of media attention given to computer-related disasters in technical systems has increased interest in Computer Ethics:

- The explosion of Ariane V in 1996
- The Therac-25 computerized radiation machine overdoses

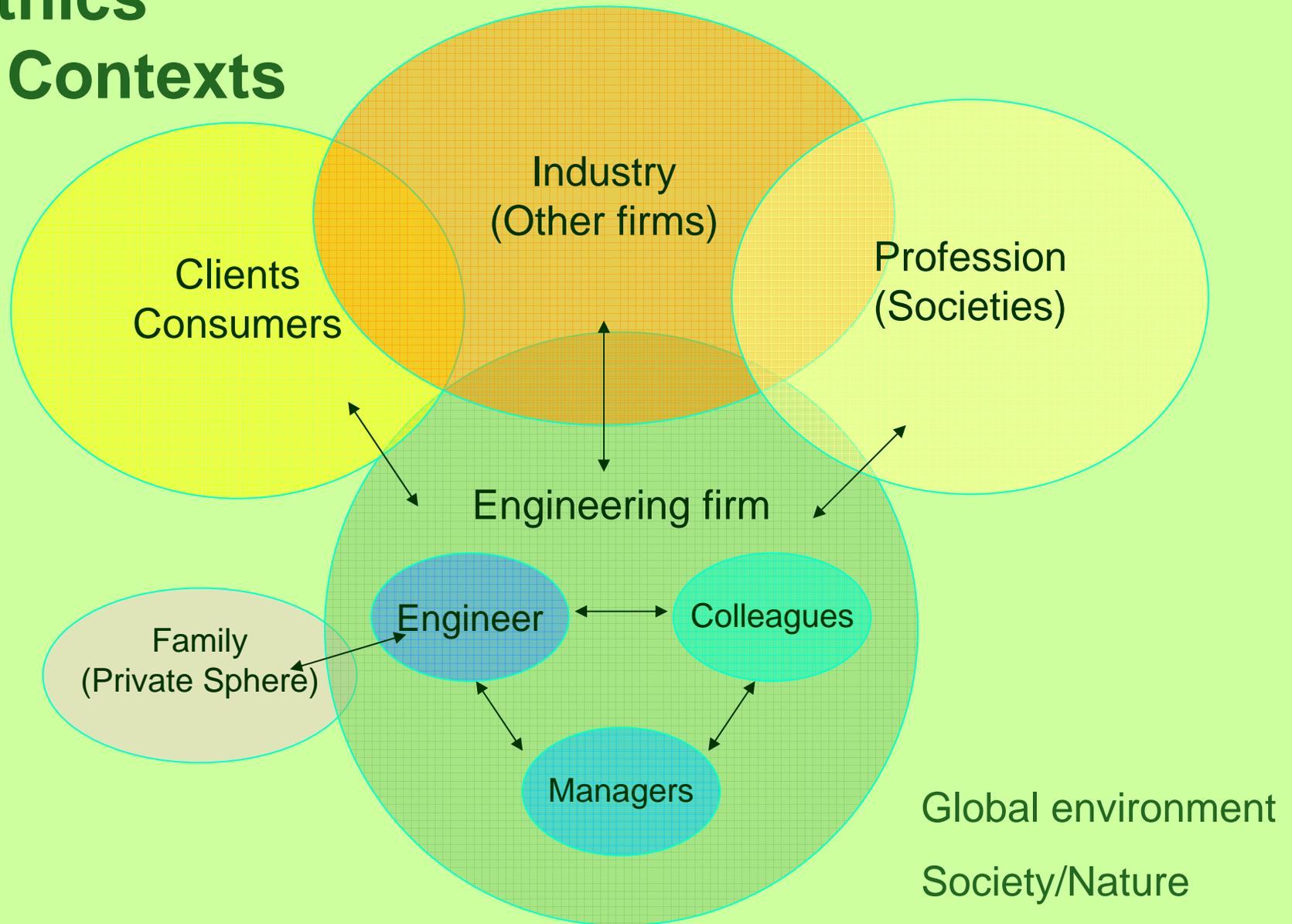
Three green apples are arranged in a cluster, with one in the foreground and two behind it. The apples are bright green and have a slight shadow on the surface. The background is a soft, out-of-focus light green.

# Why Ethics?

“There are few things wholly evil or wholly good. Almost everything...is an inseparable compound of the two, so that our best judgment of the preponderance between them is continually demanded.”

Abraham Lincoln

# Ethics Contexts



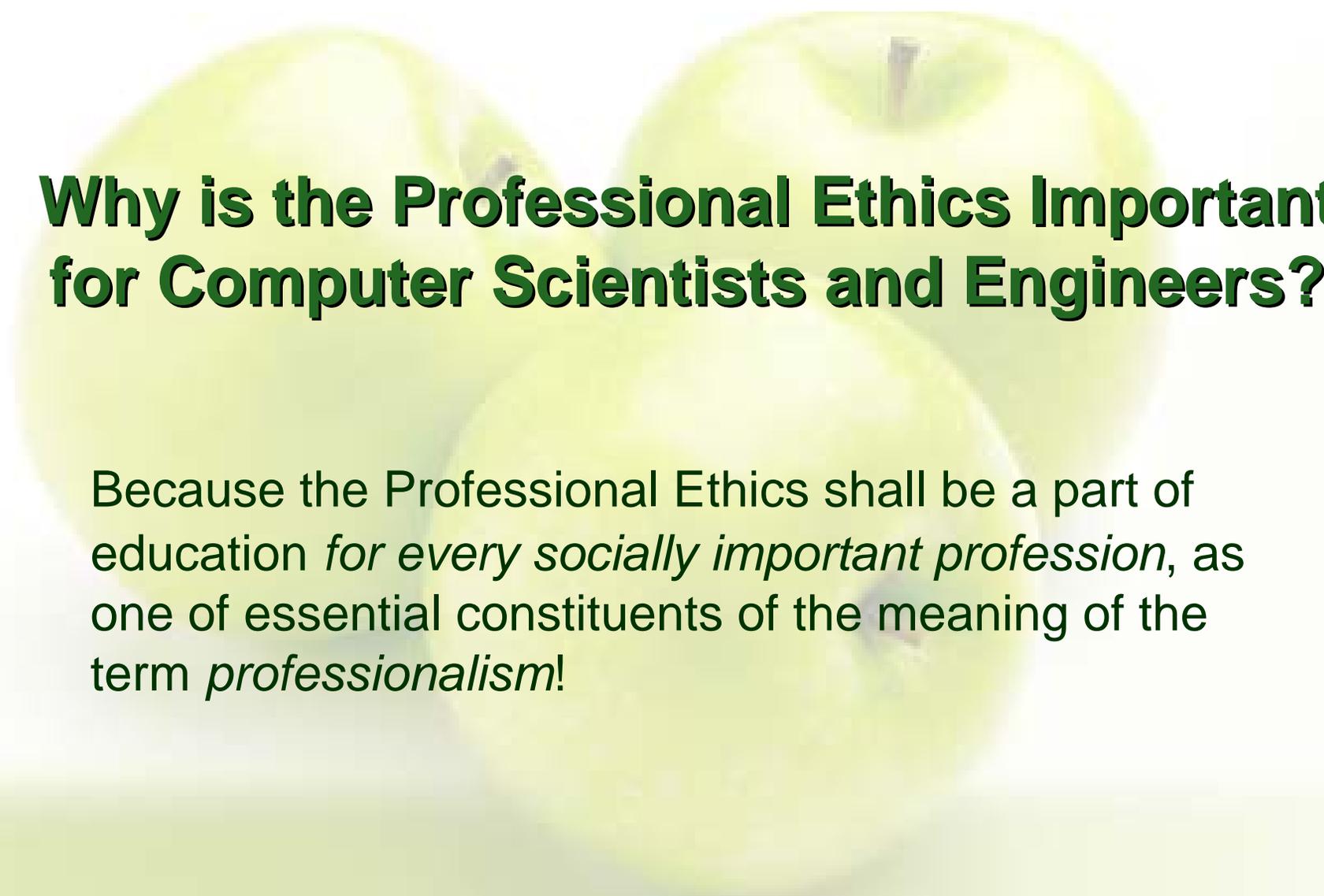
# Engineering as Social Experimentation

“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 MW and Schinzinger R,  
McGraw-Hill, 1996

# **Social Importance of Engineering**

Engineering has a direct and vital effect on the quality of life of people. Accordingly, the services provided by engineers must be dedicated to the protection of the public safety, health and welfare.

Three green apples are arranged in a cluster, slightly overlapping. They are the background for the text on this slide. The apples are bright green with some yellowing at the top, suggesting ripeness. The lighting is soft, creating gentle shadows and highlights on their smooth surfaces.

# Why is the Professional Ethics Important for Computer Scientists and Engineers?

Because the Professional Ethics shall be a part of education *for every socially important profession*, as one of essential constituents of the meaning of the term *professionalism!*

# Codes of Professional Ethics

A code of professional ethics appears when an *occupation* organizes itself into a *profession*. It is central to advising individual professionals how to conduct themselves, to judging their conduct, and to understanding of a profession.

# Teaching Professional Ethics to Computer Science Students

The most important goal is to develop the *ethical autonomy*,  
i.e. the ability and the habit to think rationally and  
critically about the ethical questions.

# Professional Ethics in Science and Engineering Course at Mälardalen University

- What Is Ethics?
- Ethics vs. Morals
- Ethics: A Pluralistic Approach to Moral Theory
- Is Computer Ethics Unique in Relation to Other Fields of Ethics?
- Codes of Ethics and Professional Conduct
- Engineering as Social Experimentation
- A Framework for Ethical Decision Making
- Types of Ethics Inquiry

**Table 1 Professional Ethics Course Syllabus**

<b>Professional Ethics in Science and Engineering</b>	
Lecture 1	Getting Started. Course Preliminaries. Identifying Moral Issues
Lecture 2	<b>METHODS AND TOOLS OF ANALYSIS OF ETHICAL ARGUMENTS</b> Philosophical Foundations of Ethics Ethical Relativism, Absolutism and Pluralism
Lecture 3	The Ethics of Conscience. Ethical Egoism. The Ethics of Duty. The Ethics of Respect
Lecture 4	The Ethics of Consequences: Utilitarianism The Ethics of Rights. The Ethics of Justice
Lecture 5	The Ethics of Character. Ethics and Gender
Lecture 6	<b>SAFETY, SECURITY - Guest lecture</b>
Lecture 7	<b>PRIVACY AND CIVIL LIBERTIES</b> In-class activity: CASE STUDIES
Lecture 8	<b>ENVIRONMENTAL ETHICS. In-class activity: CASE STUDIES</b>
Lecture 9	<b>SOCIAL CONTEXT OF THE PROFESSION - Guest lecture</b>
Workshop 1	<b>PROFESSIONAL AND ETHICAL RESPONSIBILITIES: CODES OF ETHICS</b> In-class activity: CASE STUDIES
Lecture 10	<b>RISKS IN ENGINEERING AND SCIENCE</b> Risks and liabilities of safety-critical systems. PRECAUTIONARY PRINCIPLE
Lecture 11	<b>INDUSTRIAL EXPERIENCES- Guest lecture</b>
Workshop 2	<b>INTELLECTUAL PROPERTY. Internet. Computer Crime.</b> In-class activity: CASE STUDIES
Workshop 3	In-class activity: ORAL PRESENTATIONS
Workshop 4	<b>COURSE WRAP-UP</b>

# Professional Ethics in Science and Engineering Course at Mälardalen University

- The examination forms for the course were the writing of a research paper on an ethical topic of interest and an oral presentation of a chosen topic (such as safety and security, intellectual property, environmental ethics, privacy etc.) followed by an in-class discussion led by the students responsible for the actual presentation.

# Professional Ethics Course Evaluation

- First three years experiences very positive
- Students actively participating into discussions, case studies and research on chosen topics
- Interest even in general ethical concerns of other fields like medical ethics or arms control
- Even predominantly technical-minded students are able to assimilate and use philosophical concepts introduced by the theoretical part of the course
- See more under:

[http://www.idt.mdh.se/kurser/cd5590/03\\_11/CourseEvaluationCharts.pdf](http://www.idt.mdh.se/kurser/cd5590/03_11/CourseEvaluationCharts.pdf)

# Professional Ethics Course Evaluation

- Two industrial PhD students have included specific chapters on ethical aspects of their work in their PhD respective Licentiate Theses as a consequence of taking part in the Ethics course. They have related technological issues such as product integration and component-based design to stakeholders' attitudes and decisions based on the ethical premises of the engineering in particular activities in the software development process.

# Professional Ethics Course Evaluation

- Three other students have published articles on their field of interest in international journals and at CEPE and E-CAP conferences which attracted the interest of the computing and philosophy community to ethical issues related to Software Engineering.

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**Next year the extended version of the course will be given as a part of doctoral education for all MDH PhD students.**

**MDH Professional Ethics Course Home Page:**

**<http://www.idt.mdh.se/kurser/cd5590>**