

Clarkson University, Potsdam, NY

November 11, 2005

Ethics in Simulation (SimEthics)

Tuncer Ören, Professor Emeritus

M&SNet - McLeod Modeling and Simulation Network of the SCS

AVP for Simulation of the SCS

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<http://www.site.uottawa.ca/~oren/>

Question

Why **future engineering professionals**

should be familiar with:

- professional ethics (in engineering) and
- professional ethics for simulationists?

- **Ethics** is an essential ingredient for sustainable civilizations and its importance is increasing.
- As **professionals** we affect the lives of others and as **citizens** we are affected by the behavior of others.
- **Simulation** is a very powerful enabling technology used in many areas of human activities; a fortiori in engineering activities.
- Hence, **ethics in simulation** concerns all of us who take our profession seriously.

Introduction

- ➔ Brief history of the author's involvement
 - Basic terminology
 - Categories of the origins of ethical behavior
 - Rationale for the need of ethical behavior in general and in M&S

M&S

- The wide scope of usage of simulation
- The importance of simulation applications

Ethical Behavior

- Some sources for codes of ethical professional behavior
- Aspects of M&S that overlap with some professional areas with codes of professional ethics
- The Code of Professional Ethics for Simulationists
- The professional societies which already adopted the Code

SimEthics: Brief history: How it started?

1999 July 2

- A symposium was organized in honor of the 60th birthday of Prof. Ir. Maurice S. Elzas at the Wageningen University, Wageningen, the Netherlands.

The Theme (selected by Prof. Elzas): Simulation and Ethics

- I was one of the few invited speakers (and had no prior publication on ethics) and presented:
“Responsibility, Ethics and Simulation”

2000 - The Symposium organizer, Dr. D. Kettenis, edited a special issue of the Transactions of the SCS, 17:4 (Dec. 2000)

2000 Article: Ören, T.I. (2000). Responsibility, Ethics and Simulation. Transactions of the SCS, San Diego, CA. 17:4 (Dec.), 165-170.

had some impacts:

(1) While it was not finished

Ören, T.I. (2000 - Invited contribution). Verantwortung, Ethik und Simulation. (In English: Responsibility, Ethics, and Simulation). In: R. Rimane (ed.) Gedanken zur Zeit. Translated from the original in English into German by: G. Horton. SCS Europe BVBA, Ghent, Belgium. pp. 213-224.

(2) After publication:

in 2001, 3 related events:

- Bruce Fairchild, the President of the SCS (2000-2002), after reading the article in the Transactions, motivated Tuncer Ören to develop a Code of Ethics.

- 2001 June, Delft, the Netherlands,
4th International Eurosim Congress

Maurice S. Elzas organized an Ethics Session

Tuncer Ören presented:

“Responsibility, Ethics, & Simulation: A Review of Issues”

Iva Smith was very active in the Session.

- 2001** - The Ethics Committee of the SCS is formed:
- Prof. Emeritus Tuncer I. **Ören** (Chair) – Ottawa, Canada
 - Prof. Emeritus Louis G. **Birta** – Ottawa, Canada
 - Prof. Emeritus Maurice S. **Elzas**, Wageningen, The Netherlands
 - Dr. Iva **Smit**, Netterden, The Netherlands

- 2002** - A **Code** of Professional Ethics for Simulationists was developed by the founding members of the Ethics Committee of the SCS.
- 2002** - The **Code** and its **Rationale** were presented at the SCSC 2002 (The Summer Computer Simulation Conference 2002, San Diego, CA) and were published in its Proceedings.

2002 - **SimSummit** (with the initiative and leadership of W. Waite) was held during July 18-19, 2002 with the representatives of major Modeling and Simulation institutions. Tuncer Ören participated as the representative of the McLeod Institute of Simulation Sciences (MISS).

- One of the resolutions of SimSummit was that **a Code of Professional Ethics should be one of the four pillars** - along with Science, Technology and Applications- for Modeling and Simulation **to be considered as a profession.**

SimEthics: Brief history:
End of the first phase &
Beginning of a more challenging phase:

2003 - At the Society for Computer Simulation International (SCS) Board of Directors Meeting in Montreal, July 24, 2003, the **SCS adopted a Code of Professional Ethics** for Simulationists, **effective January 1, 2004** .

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Ethics:

What?

How?

Origins of ethical behavior

Why it is needed?

Why it is needed in M&S activities?

Ethics – What?

ethics - Branch of philosophy which studies the principles of right or wrong in **human conduct**.
(moral philosophy or moral science)

ethic - **Greek** - êthikos, êthikê;
root: êthos: **manners, customs**

moral - **Latin** - moralis, moralitas: **manners, customs**

- A glossary: <http://onlineethics.org/glossary.html>

Ethics Updates

Glossary

©Lawrence M. Hinman

Absolutism. The belief that there is one and only one truth; those who espouse absolutism usually also believe that they *know* what this absolute truth is. In ethics, absolutism is usually contrasted to relativism.

Agnosticism. The conviction that one simply does not know whether God exists or not; it is often accompanied with a further conviction that one need not care whether God exists or not.

Altruism. A selfless concern for other people purely for their own sake. Altruism is usually contrasted with selfishness or egoism in ethics.

Arete. The Greek word for "excellence" or "virtue." For the Greeks, this was not limited to human beings. A guitar, for example, has its *arete* in producing harmonious music, just as a hammer has its excellence or virtue in pounding nails into wood well. So, too, the virtue of an Olympic swimmer is in swimming well, and the virtue of a national leader lies in motivating people to work for the common good.

Atheism. The belief that God does not exist. In the last two centuries, some of the most influential atheistic philosophers have been Karl Marx, Friedrich Nietzsche, Bertrand Russell, and Jean-Paul Sartre.

Autonomy. The ability to freely determine one's own course in life. Etymologically, it goes back to the Greek words for "self" and "law." This term is most strongly associated with Immanuel Kant, for whom it meant the ability to give the moral law to oneself.

Professional ethics,

i.e., the rules or standards governing the conduct of a person or the members of a profession.

(The terms medical ethics and business ethics are used similarly.)

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The respect for the rights of others:

- **is the essence of right conduct.**
- It is also a fundamental concept in civilized societies (human as well as software agents).
- It is essential for the regulation of the social dynamics in order to **sustain** the civilization.

Also:

No business –how lucrative it is – can be sustained if one loses the trust of the stakeholders.

“What you don’t want done to yourself, don’t do to others.” Confucius (551-479) BC)

- **Responsible:**

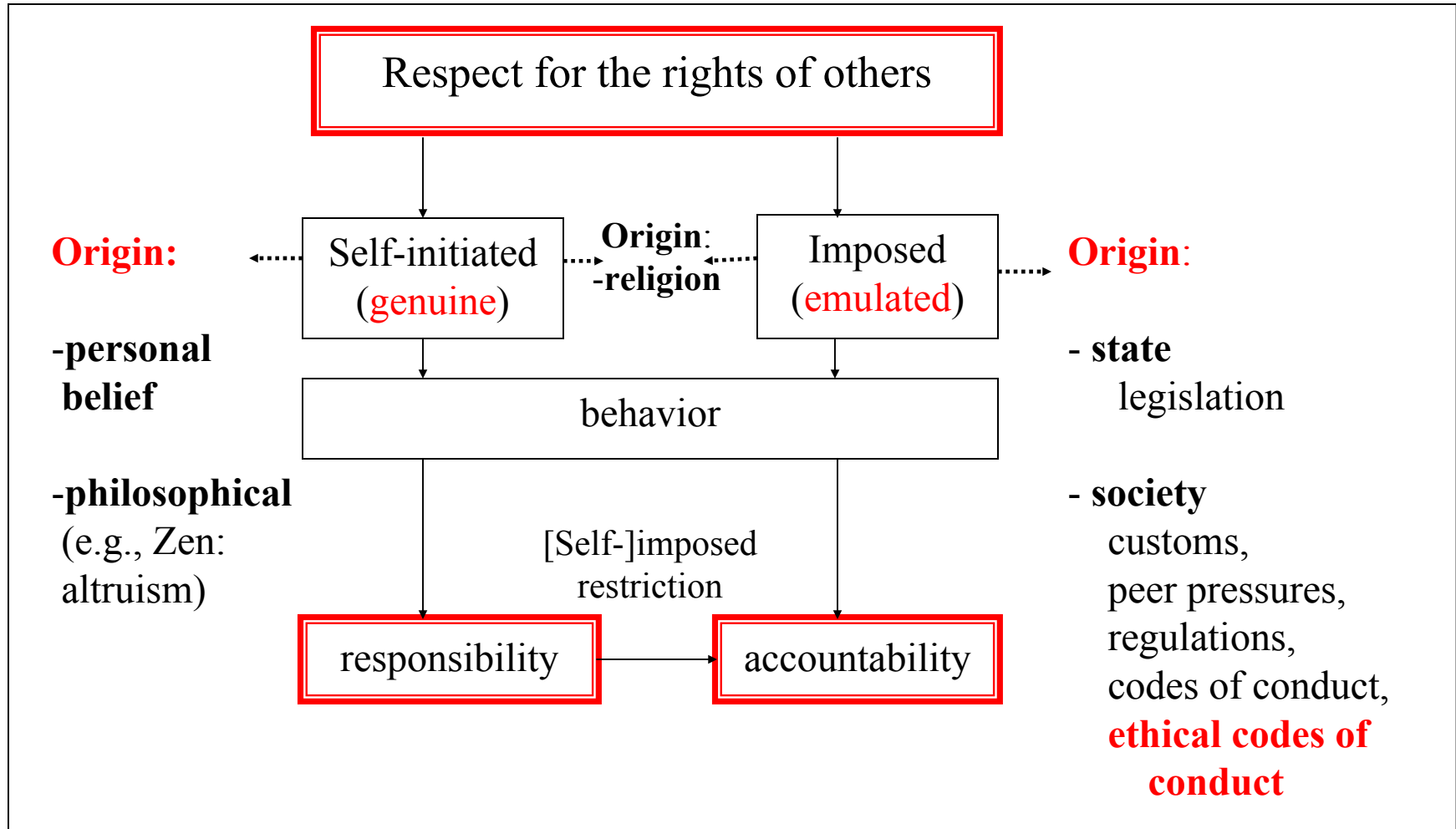
Ability to fulfil one's moral obligations;
it is an ideal of character, a virtue.

Only maturity may imply responsibility.

- **Accountable:**

Being **required** to answer for one's actions.

The origins for the respect for the rights of others:



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Ethics – Why?

“We all think electricity is entirely governed by natural laws, and yet we think it is rational to put up lightning conductors. Well, I should say that an ethic is, as it were, *a lightning conductor for human passions*, to enable them within a deterministic world to work in a way that produces a minimum of disaster.”

Bertrand Russell, 1942 (Spinoza's Ethics)

Why Ethics is needed?

If **our activities** have no (serious) implications to others, then it does not matter whether or not we should feel **responsible** towards them or we should be held **accountable**.

Why Ethics is needed in M&S activities?

If **simulation** has no (serious) implications to others, then it does not matter whether or not simulationists should feel **responsible** towards them or should be held **accountable**.

Therefore:

1. Consider simulation from a large perspective

- What is simulation?
- What are the types of usages of simulation?

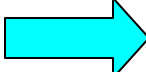
2. Ask: Do they have serious implications,
if not performed properly?

**(If simulation does not have serious implications,
we should not bother considering ethics in
simulation activities.)**

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M&S Associations (over 60):

<http://www.site.uottawa.ca/~oren/links-MS.htm>

Two recent references

for a comprehensive view of modeling and simulation:

Ören, T.I. (2005 – Invited Keynote Article). **Maturing Phase of the Modeling and Simulation Discipline**. In: Proceedings of: Asian Simulation Conference 2005 (The Sixth International Conference on System Simulation and Scientific Computing (ICSC'2005), 2005 October 24-27, Beijing, P.R. China.

Ören, T.I. (2005 - Invited Tutorial). **Toward the Body of Knowledge of Modeling and Simulation (M&SBOK)**, In: Proc. of I/ITSEC (Interservice/Industry Training, Simulation Conference). Nov. 28 - Dec. 1, Orlando, Florida.

M&S from **Different Perspectives**

“**Simulation,**” derived from Latin “*simulacre*”

has 3 images:

- **non-scientific view**
- **military perception**
- **scientific view**

- **Non-scientific view of simulation:**

“**Simulation**” means fake, counterfeit, or **imitation**
(used since 14th century)

Examples: simulated leather, simulated pearl

- **Military perception of simulation:**

Military perception of simulation can be summarized as “*All but war is simulation.*”

3 types of military simulation:

- **Live simulation** (real people use simulated – fake weapons in real environments)
- **Constructive simulation** (war gaming)
- **Virtual simulation** (use of virtual equipment – simulators, virtual simulators)

Possibilities for Enriched (Augmented) Reality:

	Real equipment	Virtual equipment
Real operator	- Live simulation (a human operator uses <i>virtual</i> guns)	Virtual simulation - Simulator - Virtual simulator
Virtual operator	- Automated vehicles (auto pilot, aircraft without pilot; vehicle without driver)	e.g., an AI aircraft (in dogfight)

- Scientific view of simulation

“**Simulation**” is goal-directed experimentation with dynamic models.

When the experimentation **cannot** or **should not** be done on the real system, one can perform it using a dynamic model; and hence *use simulation*.

“**Simulation**” is the contemporary *sine qua non* technique of Francis Bacon’s (1561-1626) scientific method which is based on experimentation. (as advocated in his *Novum Organum* published in 1620.)

“Until we attempt to simulate a system, we don’t realize how little we know about it”

Donald Knuth

Levels of Perception of Simulation:

Simulation can be perceived as:

- a computational activity
- a model-based activity
- a knowledge generation activity

Simulation has thousands of applications; and, *simulation studies/products **can affect people** as well as the **environment** in many ways.*

Simulation and Real System:

2 categories of simulation:

(with respect to **concurrency** of operations)

- **Stand-alone simulation**
(operations of the simulation and the system of interest are **independent**)
- **Integrated simulation**
(operations of the simulation and the system of interest are **interwoven**)

Usages of Simulation:

1. Stand-alone simulation activity: *the simulation program runs independently from the system of interest.*

Categories of usage:

1. Training to enhance *decision* and/or communication skills (gaming simulation)
2. Training to enhance *motor skills* (simulators, virtual simulators) (I/ITSEC conference – about 16 000 participants)
3. Decision support
4. Understanding
5. Education and Learning
5. Entertainment (simulation games, animation of dynamic systems)

Decision Support

Prediction of behavior or performance of the system of interest within the constraints inherent in the simulation model (e.g., granularity)

Evaluation of alternative models, parameters, experimental and/or operating conditions on model behavior or performance

Sensitivity analysis

Engineering design

Prototyping

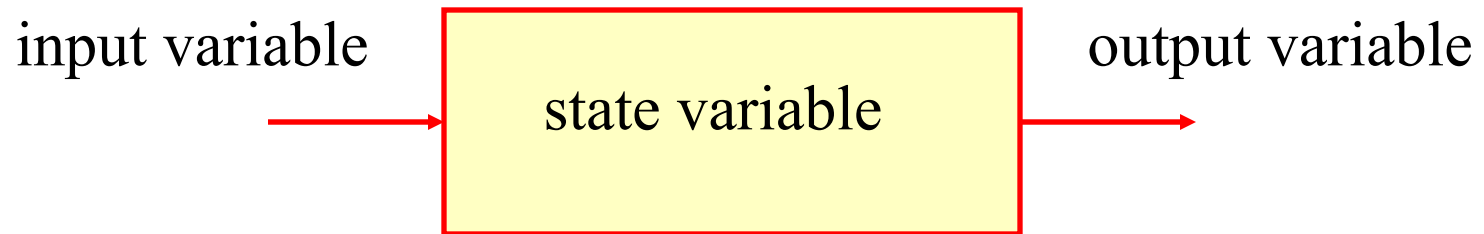
Planning

Acquisition

Proof of concept

From a systemic point of view, simulation can be used to find the values of **output, input, or state variables** of a system; provided that the values of the two other types of variables are known.

(W. Karplus, 1976)





Type of problem:	Given		Find
Analysis	input	state	Output
Design	input	output	State
Control	state	output	Input

Usages of Simulation:

2. Integrated simulation activity: *simulation program operates together with the system of interest.*

Two main purposes: to *support* or to *enrich* real system operation

Support of real system operation: the system of interest and the simulation program operate *alternately* to provide *predictive displays*. (e.g., submarine operation)

Enrichment of real system operation, the system of interest and the simulation program operate *simultaneously*.

Goals: - *on-line diagnosis*

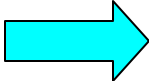
- *augmented reality* (enhanced reality) operation

(e.g., in pilot training: simulated AI aircraft in dogfight)

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Ören, T.I. (2002). Future of Modelling and Simulation: Some Development Areas. Proceedings of the 2002 Summer Computer Simulation Conference, pp. 3-8. (presentation).

Ören, T.I. (2002 - Invited Plenary Paper). Growing Importance of Modelling and Simulation: Professional and Ethical Implication . Proceedings of the Asian Simulation Conference / the 5th International Conference on System Simulation and Scientific Computing, Cheng, Zongji et al., eds., Nov. 3-6, 2002, Shanghai, China. International Academic Publishers / Beijing World Publishing Corp. Vol.1, pp. 22-26. (presentation).

Usage of simulation	Examples:	Implications of negative consequences, if simulation is not used properly
Training to enhance <i>motor and operational skills</i> (and associated decision making skills)	<ul style="list-style-type: none"> - virtual simulation (i.e., using virtual equipment and real people (human-in-the-loop) in a simulation study) - aircraft simulator for pilot training - augmented reality simulation (such as in-flight pilot training with additional artificial intelligence aircrafts) - virtual body for medicine - nuclear reactor simulator - power plant simulator 	<ul style="list-style-type: none"> - ill-prepared operators (civilian as well as military) for <i>regular operating conditions</i> - ill-prepared operators (civilian as well as military) for <i>rare emerging conditions</i>
	<ul style="list-style-type: none"> - simulators for the selection of operators (such as pilots) 	<ul style="list-style-type: none"> -recommending unfit personnel for jobs requiring high dexterity
	<ul style="list-style-type: none"> - live simulation (use of simulated weapons along with real equipment and people) 	<ul style="list-style-type: none"> - false sense of achievement

Usage of simulation	Examples:	Implications of negative consequences , if simulation is not used properly
Training to enhance <i>decision making skills</i>	<ul style="list-style-type: none"> - constructive simulation (war gaming simulation) - simulation for operations other than war (non-article 5 operations, in NATO terminology): peace support operations; conflict management (between individuals, groups, nations) - business gaming simulations 	<ul style="list-style-type: none"> - ill-prepared decision makers (civilian as well as military) for <i>regular operating conditions</i> - ill-prepared decision makers (civilian as well as military) for <i>rare emerging conditions</i>
	<ul style="list-style-type: none"> - agent-based simulations 	<ul style="list-style-type: none"> - “dehumanization” of decisions
Education	<ul style="list-style-type: none"> - simulation for the teaching/learning of dynamic systems (which may have trajectory and/or structural behavior): simulation of adaptive systems, time-varying systems, evolutionary systems, ... 	<ul style="list-style-type: none"> - missed opportunity to better learn the subject matter - misinformation

Usage of simulation	Examples:	Implications of negative consequences , if simulation is not used properly
Evaluating alternative courses of actions	<ul style="list-style-type: none"> - simulation in business - use of simulation to provide predictive displays (in economy, in other complex systems) - policy modelling and simulation - drug modelling and simulation 	<ul style="list-style-type: none"> - missed opportunity to gain insight in the subject matter - insufficient or incorrect advice - interpretation of results influenced by desired (political) outcome - models used beyond their scope of applicability - not enough evidence to evaluate results
Acquisition	-defense acquisition	- acquisition of equipment not fully fit for the purpose
Operational support	- operations management	<ul style="list-style-type: none"> - wrong recommendation or explanation - insufficient representation of reality

Usage of simulation	Examples:	Implications of negative consequences , if simulation is not used properly
Engineering design	<ul style="list-style-type: none"> - virtual ship (per se and as a platform to integrate several components) - earthquake simulation to design better structures: buildings, bridges, ... 	<ul style="list-style-type: none"> - equipment malfunctions - unreliable structures - neglect of engineering knowledge and regulations - numerical inaccuracies - incomplete models
Prototyping	<ul style="list-style-type: none"> - chip prototyping - engine prototyping 	<ul style="list-style-type: none"> - recall of thousands of defective units - deficient representation of novel technologies
Diagnosis	<ul style="list-style-type: none"> - on-line use of simulation to compare real-system's behavior and simulated behavior to detect anomalies in the functioning of an equipment 	<ul style="list-style-type: none"> - false alarms - inability to detect "faint" alarms

Usage of simulation	Examples:	Implications of negative consequences , if simulation is not used properly
Proof of concept	-simulation of safe disposal of nuclear fuel waste (for tens of thousands of years)	<ul style="list-style-type: none"> - burden to future generations - unwarranted extrapolation of present knowledge
Understanding	- scientific simulations to understand reality	<ul style="list-style-type: none"> - missed opportunity to have proper understanding - modelling and simulation used as ‘proof of concept’ rather than as ‘investigation of concept’

- From a pragmatic point of view, existence of several validation, verification and accreditation techniques and tools attest the importance of the implications of simulation.
- (See for example:
Department of Defence 1996, Verification,
Validation and Accreditation (VV&A) –
Recommended Practices Guide.
- *Allegiance to a well defined code of ethics would ease establishment of the credibility of simulationists as individual(s) or groups.*

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Simulation Predicted Storm's Havoc

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WASHINGTON, Sept. 9, 2005



(AP) As Katrina roared into the Gulf of Mexico, emergency planners pored over maps and charts of a hurricane simulation that projected 61,290 dead and 384,257 injured or sick in a catastrophic flood that would leave swaths of southeast Louisiana uninhabitable for more than a year.

A hurricane simulation that predicted much of New Orleans would be underwater proved to be true. **(AP)**

QUOTE
"We designed this to be a worst-case

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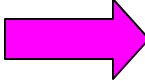
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Professional societies

- Need and often have regulations and codes to guide and regulate the conduct of their members.
- Some professional codes refer **only to ethical duties**.
- Some other codes cover **both ethical and purely professional issues** with or without referring to “ethics” in their title.
- The term “*professional ethics*” **implies** ethics and professional conduct.
- Hence, the term “*code of professional ethics*” is a conveniently short term to denote “*code of ethics and professional conduct*.”



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Ethics Updates

Search



Founded in 1994 and edited by Lawrence M. Hinman, University of San Diego

Ethics Updates is designed primarily to be used by ethics instructors and their students. It is intended to provide updates on current literature, both popular and professional, that relates to ethics.

Ethical Theory	Resources	Applied Ethics
Aristotle and Virtue Ethics	Ethics Videos	Abortion
Contemporary Anti-Theory	Ethics Reviews	Academic Integrity
Ethical Egoism	Ethics Forums	Animal Rights
Ethical Relativism	Case Studies for Discussion	Bioethics and Reproductive Technologies
Gender and Moral Theory	Philosophers on War, Terrorism, and Peace	Computer & IT Ethics
Introduction to Moral Theory	Guide to Writing Ethics Papers	Death Penalty & Punishment
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Pluralism & Meta-Ethical Concerns	The Ethics Calendar	Gender and Sexism

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Moral Exemplar:
Fred Cuny
1944-1995

Last Modified:
06/01/05 by nrm

[American Council of Engineering Companies Ethical Guidelines](#)
American Council of Engineering Companies Ethical Guidelines, adopted in October 1980.

[American Chemical Society Code of Conduct](#)
The ACS was one of the first scientific societies to have a code of ethics. ACS also provides to its members many more specific statements, such as on the environment and on conditions of employment, rather than one general code.

[Association of Computer Machinery \(ACM\) Code of Conduct](#)
This code was created recently by a task force with a strong representation of philosophers and sociologists who teach computer ethics.

[American Institute of Chemists](#)
Chemistry code of ethics. Approved by the AIC Board of Directors, April 29, 1983.

[American Mathematical Society \(AMS\) Ethical Guidelines](#)
These guidelines are rather detailed and include even such matters as revocation of advanced degrees in mathematics, when graduate work is subsequently found to have been plagiarized.

[American Physical Society \(APS\) Code of Conduct](#)
First adopted by the APS in 1991, this code deals only with research ethics.

[American Society of Civil Engineers \(ASCE\) Code of Ethics](#)
This code includes fundamental canons and rules of practice for consulting engineers. Last revised in 1996. *See the [ASCE Guidelines to Practice](#).*

[Codes From Student Organizations](#)
Student Pugwash USA Pledge, Pugwash Conferences, Humboldt Pledge, Hippocratic Oath for Scientists, Engineers, and Executives, Berkeley Pledge of Ethical Conduct.

[Code of Ethics of the Information Processing Society of Japan](#)
Adopted May 20, 1996, translated into English.

[Ethical Guidelines to Publication of Chemical Research \(ACS\)](#)
The editors of journals published by the ACS have developed a set of ethical guidelines for persons engaged in the publication of chemical research; specifically, for editors, authors, and manuscript reviewers. They are also available in a [pdf version](#) on the ACS website.

[Guidelines for Engineers Dissenting on Ethical Grounds](#)
These guidelines provide general advice to engineers, including engineers who are not members of the Society.

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Association of Computer Machinery (ACM) Code of Conduct

Anderson, R.E., Johnson, D.G., Gotterbam, D., Perrolle, J. 1993.

"Using the New ACM code of Ethics in Decision Making."

Communications of the ACM 36(2):98-107

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- [2. More Specific Professional Responsibilities](#)
- [3. Organizational Leadership Imperatives](#)
- [4. Compliance With the Code](#)

1. General Moral Imperatives

As an ACM member I will . . .

1.1 Contribute to society and human well-being

This principle concerning the quality of life of all people affirms an obligation to protect fundamental human rights and to respect the diversity of all cultures. An essential aim of computing professionals is to minimize negative consequences of computing systems, including threats to health and safety. When designing or implementing systems, computing professionals must attempt to ensure that the products of

onlineethics.org

The Online Ethics Center For Engineering and Science
at Case Western Reserve University

search text version help email

Engineering
Practice

Responsible
Research

Moral
Exemplars

Diverse
Workplace

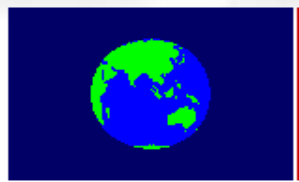
Computers
& Software

Natural
Sciences

IEEE (Institute of Electrical and Electronics Engineers) Code of Ethics

We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

1. to 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. to avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;
3. to be honest and realistic in stating claims or estimates based on available data;
4. to reject bribery in all its forms;
5. to improve the understanding of technology, its appropriate application, and potential consequences;
6. to maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
7. to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;
8. to treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;
9. to avoid injuring others, their property, reputation, or employment by false or malicious action;



Codes of Conduct/Practice/Ethics from Around the World

This list started as a collection of codes of conduct, codes of practice, or codes of ethics from around the world, as part of an IFIP study of codes led by [Dr. Jacques Berleur](#), [Univ. Notre-Dame de la Paix](#), Namur, Belgium. Since then codes from many different sources have been added, and continue to be added. If you do locate a code, please send e-mail to [J.A.N. Lee](#) at [Virginia Tech](#), so that we can add it to this page.

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- [Computer Society Codes from Around the World](#)
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Introduction

- **Brief history** of the author's involvement
- **Basic terminology**
- Categories of the **origins of ethical behavior**
- **Rationale for the need** of ethical behavior in general and in M&S

M&S

- The wide **scope of usage** of simulation
- The **importance of simulation** applications

Ethical Behavior

- Some **sources for codes of ethical professional** behavior

 **Aspects of M&S** that overlap with some professional areas with codes of professional ethics

- The **Code of Professional Ethics** for Simulationists
- The **professional societies** which already adopted the Code

- M&S is *computer-based*; hence, several aspects of ethical considerations of **computerization, software engineering, Internet, and artificial intelligence** are also applicable to modelling and simulation.

- For *scientific and engineering* applications, modelling and simulation entails considerations of codes of ethics in **science and engineering**.
- Modelling and simulation is used extensively in *research*; hence the principles of responsible conduct in research are applicable to avoid fabrication, falsification, and plagiarism (data, text, and ideas) and other misconduct.

- When modelling and simulation is *business*, most of the ethical issues in business are also applicable to the “**simulation business.**”
- In *defense applications*, additional business ethics for defense industry –such as The Defense Industry Initiative – is desirable.

Introduction

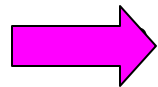
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- Two sites:

<http://www.scs.org/ethics/>

http://www.site.uottawa.ca/~oren/SCS_Ethics/ethics.htm

Code of ethics for simulationists

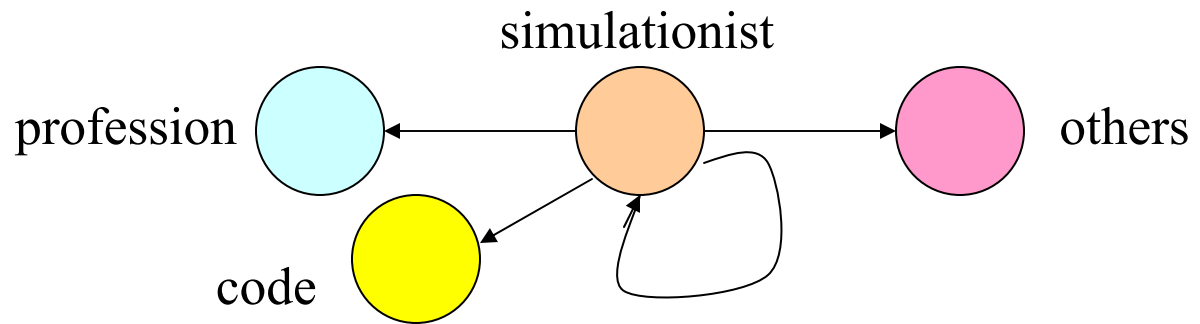
<http://www.site.uottawa.ca/~oren/pubs/2002/03-Code.pdf>

<http://www.msiac.dmsso.mil/journal/code53.html>

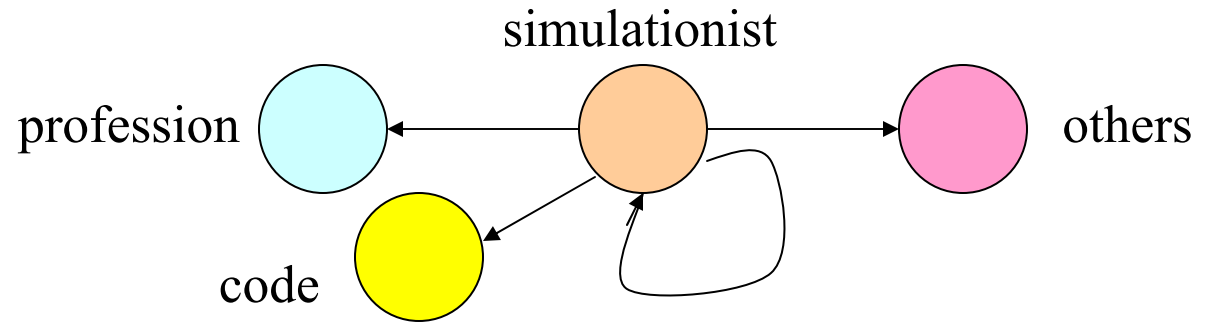
Rationale:

http://www.site.uottawa.ca/~oren/pubs/D84_Rationale.pdf

Responsibilities of simulationists to:



5 Areas of the Code:



1. Personal development and the profession ■ (7) □
2. Professional competence (8) □
3. Trustworthiness (4) □
4. Property rights and due credit (4) □
5. Compliance with the code (4) □

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1. Personal development and the profession:

As a simulationist I will:

- 1.1 Acquire and maintain **professional competence** and **attitude**.
- 1.2 **Treat fairly** employees, clients, users, colleagues, and employers.
- 1.3 **Encourage** and **support** new entrants to the profession.

1. Personal development and the profession:

As a simulationist I will:

- 1.4 **Support** fellow practitioners and members of other professions who are engaged in modelling and simulation.
- 1.5 **Assists** colleagues to achieve reliable results.
- 1.6 **Promote** the reliable and credible **use** of modelling and simulation.
- 1.7 **Promote** the modelling and simulation **profession**; e.g., advance public knowledge and appreciation of modelling and simulation and clarify and counter false or misleading statements.

2. Professional competence:

As a simulationist I will:

- 2.1 Assure product and/or service **quality** by the use of proper methodologies and technologies.
- 2.2 Seek, utilize, and provide critical **professional review**.
- 2.3 Recommend and stipulate proper and achievable **goals** for any project.
- 2.4 **Document** simulation studies and/or systems comprehensibly and accurately to authorized parties.

2. Professional competence:

As a simulationist I will:

- 2.5 Provide full disclosure of system **design assumptions** and **known limitations** and **problems** to authorized parties.
- 2.6 Be explicit and unequivocal about the **conditions of applicability** of specific models and associated simulation results.
- 2.7 Caution against acceptance of modelling and simulation results when there is insufficient evidence of thorough **validation and verification**.
- 2.8 Assure thorough and unbiased interpretations and evaluations of the **results** of modelling and simulation studies.

3. Trustworthiness:

As a simulationist I will:

- 3.1 Be honest about any circumstances that might lead to **conflict of interest**.
- 3.2 Honor contracts, agreements, and assigned **responsibilities and accountabilities**.
- 3.3 Help develop an **organizational environment** that is supportive of ethical behavior.
- 3.4 Support studies which will **not harm humans** (current and future generations) **as well as environment**.

4. Property rights and due credit:

As a simulationist I will:

- 4.1 Give full **acknowledgement** to the contributions of others.
- 4.2 Give **proper credit** for intellectual property.
- 4.3 Honor **property rights** including copyrights and patents.
- 4.4 Honor **privacy rights** of individuals and organizations as well as confidentiality of the relevant data and knowledge.

5. Compliance with the code:

As a simulationist I will:

- 5.1 **Adhere to this code** and **encourage** other simulationists to adhere to it.
- 5.2 Treat **violations of this code** as inconsistent with being a simulationist.
- 5.3 **Seek advice** from professional colleagues when faced with an ethical dilemma in modelling and simulation activities.
- 5.4 **Advise any professional society** which supports this code of desirable updates.

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The Code is adopted by (In order of adoption):

- SCS** - Society for Modeling and Simulation International
- MISS*** - Mcleod Institute of Simulation Sciences
- M&SNet*** - McLeod Modeling and Simulation Network
- SISO** - Simulation Interoperability Standards Organization
- SISO Canada**
- AMSC*** - Alabama Modeling and Simulation Council

* To see: Members and Member Organizations,
please refer to Web sites of the SimEthic:

<http://www.scs.org/ethics/>

http://www.site.uottawa.ca/~oren/SCS_Ethics/ethics.htm

inter-national	MISS	McLEOD INSTITUTE OF SIMULATION SCIENCES	Dr. Agostino Bruzzone
USA	ACIMS	Arizona Center for Integrative Modeling and Simulation	Dr. Hessam S. Sarjoughian
Italy	MISS: Genoa Center	Genoa Center of the MISS	Dr. Agostino Bruzzone
Canada	MISS: Ottawa Center	OC-MISS, Ottawa Center of the MISS	Dr. Gabriel Wainer
USA	AMSL	The Auburn Modeling and Simulation Laboratory	Dr. John (Drew) A. Hamilton
France	LSIS	Laboratoire des Sciences de l'Information et des Systèmes (Information and Systems Sciences Laboratory)	Dr. Norbert Giambiasi
Korea	SMS	Systems Modeling Simulation Laboratory at KAIST (Korea Advanced Institute of Science and Technology)	Dr. Tag Gon Kim
USA	IST	Institute for Simulation & Training (University of Central Florida)	Dr. Randall Shumaker
USA	SENDLAB	Secure Network Systems Design Lab (Stevens Institute of Technology)	Dr. Sumit Ghosh
USA	BioSystems Group	(UCSF - University of California San Francisco)	Dr. C. Anthony Hunt
Spain	MSDS	Modelado y Simulación de Sistemas Dinámicos (Grupo Temático Español de CEA-IFAC), (Modeling & Simulation of Dynamic Systems (CEA-IFAC Spanish Thematic Group))	Dr. Miquel Angel Piera
USA	VMASC	Virginia, Modeling, Analysis & Simulation Center	Dr. Roland Mielke
France	VERSIM	VERs une théorie de SIMulation (towards a simulation theory). VERSIM is part of the French research group I3 of the French CNRS (National Center of Scientific Research).	Dr. Lucile Torres

Where to go from here?

- 'Would you tell me, please, which way I ought to go from here?'
- 'That depends a good deal on where you want to get to,' said the Cat.
- 'I don't much care where--' said Alice.
- 'Then it doesn't matter which way you go,' said the Cat.
- '--so long as I get SOMEWHERE,' Alice added as an explanation.
- 'Oh, you're sure to do that,' said the Cat, 'if you only walk long enough.'

(Lewis Carroll, Alice in Wonderland, 1872)

A Normative View as a Conclusion:

Hope that in our continuing journey to professionalism **you** would **support**:

- The view that M&S is so important that there is a **need** for ethical professional conduct.
- **This** specific **Code** of Professional Ethics.
- **The adoption** of **this Code** by your professional society.
- Contribute to the widespread **acceptance** and **practice** of the Code.

We have seen: Ethics in Simulation

1. Brief history
2. Ethics: What? Why? Origins of Ethical Behavior
3. Why Ethics is needed [in M&S activities]?
4. Scope and importance of M&S
5. Codes of Professional Ethics in Other Areas
6. Code of Ethics for Simulationists
7. Organizations which adopted Code of Ethics for Simulationists
8. Where to go from here?

Thank you and

Good Luck in Your Careers!