Tutorial:

Ethics in Modeling and Simulation (SimEthics)

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AVP for Ethics of the SCS
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http://www.site.uottawa.ca/~oren/
• **Simulation** is a very powerful enabling technology used in many areas of human activities.

• **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.

• **Ethics in simulation** concerns all of us who take our occupation / profession seriously.
1. Introduction
   1.1 Brief history of the author’s involvement
   1.2 Basic terminology
   1.3 Sources of ethical behavior
   1.4 Why ethics is needed in general and in M&S activities?

2. M&S
   2.1 The wide scope of usage of simulation
   2.2 Importance of M&S:
      What can go wrong if M&S is not done properly or ignored?
   2.3 Stakeholders

3. Ethical Behavior
   3.1 Codes of ethical professional behavior
   3.2 Aspects of M&S that overlap with some professional areas with codes of professional ethics
   3.3 Code of Professional Ethics for Simulation Professionals
   3.4 Professional societies which adopted the Code of SimEthics
   3.5 Where to go from here?
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)

had some impacts:

(1) An early version was translated in German:

(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:

1. Introduction
   1.1 Brief history of the author’s involvement
   1.2 Basic terminology
   1.3 Sources of ethical behavior
   1.4 Why ethics is needed in general and in M&S activities?

2. M&S
   2.1 The wide scope of usage of simulation
   2.2 Importance of M&S:
      What can go wrong if M&S is not done properly or ignored?
   2.3 Stakeholders

3. Ethical Behavior
   3.1 Codes of ethical professional behavior
   3.2 Aspects of M&S that overlap with some professional areas with codes of professional ethics
   3.3 Code of Professional Ethics for Simulation Professionals
   3.4 Professional societies which adopted the Code of SimEthics
   3.5 Where to go from here?
**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

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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

is 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.)
1. Introduction
   1.1 Brief history of the author’s involvement
   1.2 Basic terminology
   1.3 Sources of ethical behavior
   1.4 Why ethics is needed in general and in M&S activities?

2. M&S
   2.1 The wide scope of usage of simulation
   2.2 Importance of M&S:
       What can go wrong if M&S is not done properly or ignored?
   2.3 Stakeholders

3. Ethical Behavior
   3.1 Codes of ethical professional behavior
   3.2 Aspects of M&S that overlap with some professional areas with codes of professional ethics
   3.3 Code of Professional Ethics for Simulation Professionals
   3.4 Professional societies which adopted the Code of SimEthics
   3.5 Where to go from here?
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 looses 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:

- **Self-initiated (genuine)**
  - **Personal belief**
  - **Philosophical** (e.g., Zen: altruism)

- **Imposed (emulated)**
  - **Origin:**
    - **Religion**
  - **[Self-]Imposed restriction**

- **Behavior**
  - **Responsibility**
  - **Accountability**

- **Origin:**
  - **State legislation**
  - **Society**
    - Customs, peer pressures, regulations, codes of conduct, ethical codes of conduct
1. Introduction
   1.1 Brief history of the author’s involvement
   1.2 Basic terminology
   1.3 Sources of ethical behavior
   1.4 Why ethics is needed in general and in M&S activities?

2. M&S
   2.1 The wide scope of usage of simulation
   2.2 Importance of M&S:
       What can go wrong if M&S is not done properly or ignored?
   2.3 Stakeholders

3. Ethical Behavior
   3.1 Codes of ethical professional behavior
   3.2 Aspects of M&S that overlap with some professional areas with codes of professional ethics
   3.3 Code of Professional Ethics for Simulation Professionals
   3.4 Professional societies which adopted the Code of SimEthics
   3.5 Where to go from here?
“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.)
1. Introduction
   1.1 Brief history of the author’s involvement
   1.2 Basic terminology
   1.3 Sources of ethical behavior
   1.4 Why ethics is needed in general and in M&S activities?

2. M&S
   2.1 The wide scope of usage of simulation
   2.2 Importance of M&S: What can go wrong if M&S is not done properly or ignored?
   2.3 Stakeholders

3. Ethical Behavior
   3.1 Codes of ethical professional behavior
   3.2 Aspects of M&S that overlap with some professional areas with codes of professional ethics
   3.3 Code of Professional Ethics for Simulation Professionals
   3.4 Professional societies which adopted the Code of SimEthics
   3.5 Where to go from here?
Military perception of simulation (from the point of view of training) can be summarized as “All but war is simulation.”

3 types of military simulation (used in three types of training):

- For live training: Live simulation (real people use simulated (imitation) weapons and real/or simulated equipment in real environments)
- For constructive training: Constructive simulation (gaming simulation - war gaming)
- For virtual training: Virtual simulation (use of virtual equipment –simulators, virtual simulators)
Military training applications of modeling and simulation are very important! e.g., I/ITSEC has about 16000 participants!

However, we are not alone.
• There are over 60 M&S Associations
  http://www.site.uottawa.ca/~oren/links-MS.htm
  that promote use of simulation in many different areas.
• Some of these other types of use of simulation are also applicable to important military problems!
Two recent references for a comprehensive view of modeling and simulation:


M&S from **Different Perspectives**

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

has 3 images:

- military perception
- non-scientific view
- scientific view
- Non-scientific view of simulation:

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

Examples: simulated leather, simulated pearl
Simulation is used for:

- **Training:**
  Three types of training (live, constructive, virtual)
  - to enhance *decision* and/or *communication skills* (gaming simulations)
  - to enhance *motor skills* (simulators, virtual simulators)
- **Decision support**
- **Understanding**
- **Education and Learning**
- **Entertainment**
  (simulation games, animation of dynamic systems)
- **Enrich real system operations** (augmented reality)
Use of M&S for **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** (*simulation-based acquisition*)

**Proof of concept**

**Predictive displays** to support real system operations

**On-line diagnosis**
1. Introduction
   1.1 Brief history of the author’s involvement
   1.2 Basic terminology
   1.3 Sources of ethical behavior
   1.4 Why ethics is needed in general and in M&S activities?

2. M&S
   2.1 The wide scope of usage of simulation
   2.2 Importance of M&S:
      What can go wrong if M&S is not done properly or ignored?
   2.3 Stakeholders

3. Ethical Behavior
   3.1 Codes of ethical professional behavior
   3.2 Aspects of M&S that overlap with some professional areas with
codes of professional ethics
   3.3 Code of Professional Ethics for Simulation Professionals
   3.4 Professional societies which adopted the Code of SimEthics
   3.5 Where to go from here?
Two recent references:


<table>
<thead>
<tr>
<th>Usage of simulation</th>
<th>Examples:</th>
<th>Implications of negative consequences, if simulation is not used properly</th>
</tr>
</thead>
</table>
| **Training to enhance motor and operational skills** (and associated decision making skills) | - 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  
- simulators for the selection of operators (such as pilots)  
- live simulation (use of simulated weapons along with real equipment and people) | - ill-prepared operators (civilian as well as military) for regular operating conditions  
- ill-prepared operators (civilian as well as military) for rare emerging conditions  
- recommending unfit personnel for jobs requiring high dexterity  
- false sense of achievement |
<table>
<thead>
<tr>
<th>Usage of simulation</th>
<th>Examples:</th>
<th>Implications of negative consequences, if simulation is not used properly</th>
</tr>
</thead>
</table>
| **Training to enhance decision making skills** | - 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  
- agent-based simulations | - **ill-prepared** decision makers (civilian as well as military) for **regular operating conditions**  
- **ill-prepared** decision makers (civilian as well as military) for **rare emerging conditions** |
| **Education** | - 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, … | - “dehumanization” of decisions  
- **missed opportunity** to better learn the subject matter  
- misinformation |
<table>
<thead>
<tr>
<th>Usage of simulation</th>
<th>Examples:</th>
<th>Implications of negative consequences, if simulation is not used properly</th>
</tr>
</thead>
</table>
| Evaluating alternative courses of actions | - simulation in business  
- use of simulation to provide predictive displays (in economy, in other complex systems)  
- policy modelling and simulation  
- drug modelling and simulation | - 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                                                   | - wrong recommendation or explanation  
- insufficient representation of reality                                                                  |
<table>
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<tr>
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<th>Examples:</th>
<th>Implications of negative consequences, if simulation is not used properly</th>
</tr>
</thead>
</table>
| **Engineering design** | - virtual ship (per se and as a platform to integrate several components)  
- earthquake simulation to design better structures: buildings, bridges, … | - equipment malfunctions  
- unreliable structures  
- neglect of engineering knowledge and regulations  
- numerical inaccuracies  
- incomplete models |
| **Prototyping** | - chip prototyping  
- engine prototyping | - recall of thousands of defective units  
- deficient representation of novel technologies |
| **Diagnosis** | - on-line use of simulation to compare real-system’s behavior and simulated behavior to detect anomalies in the functioning of an equipment | - false alarms  
- inability to detect “faint” alarms |
<table>
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<tr>
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<th>Examples:</th>
<th>Implications of negative consequences, if simulation is not used properly</th>
</tr>
</thead>
</table>
| **Proof of concept** | - simulation of safe disposal of nuclear fuel waste (for tens of thousands of years) | - burden to future generations  
- unwarranted extrapolation of present knowledge |
| **Understanding** | - scientific simulations to understand reality | - 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:

DoD Instruction 5000.61, "DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A)," 05/13/2003.)

• Allegiance to a well defined code of ethics would ease establishment of the credibility of simulationists as individual(s) or groups.
Simulation Predicted Storm's Havoc

Washington, Sept. 9, 2005

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

As Katrina roared into the Gulf of Mexico, emergency planners pored over maps and charts of a hurricane simulation that projected 61,230 dead and 364,257 injured or sick in a catastrophic flood that would leave swaths of southeast Louisiana uninhabitable for more than a year.

These planners were not involved in the frantic preparations for Katrina. By coincidence, they were working on a yearlong project to prepare federal and state officials for a Category 3 hurricane striking New Orleans.

QUOTE

"We designed this to be a worst-case scenario."
1. Introduction
   1.1 Brief history of the author’s involvement
   1.2 Basic terminology
   1.3 Sources of ethical behavior
   1.4 Why ethics is needed in general and in M&S activities?

2. M&S
   2.1 The wide scope of usage of simulation
   2.2 Importance of M&S:
       What can go wrong if M&S is not done properly or ignored?
   2.3 Stakeholders

3. Ethical Behavior
   3.1 Codes of ethical professional behavior
   3.2 Aspects of M&S that overlap with some professional areas with
codes of professional ethics
   3.3 Code of Professional Ethics for Simulation Professionals
   3.4 Professional societies which adopted the Code of SimEthics
   3.5 Where to go from here?
Stakeholders in M&S:

- Sponsors
- Customers / users
- Those affected by the results
- Managers / administrators
- Technical staff
- (Pre / post) Support staff
1. Introduction
   1.1 Brief history of the author’s involvement
   1.2 Basic terminology
   1.3 Sources of ethical behavior
   1.4 Why ethics is needed in general and in M&S activities?

2. M&S
   2.1 The wide scope of usage of simulation
   2.2 Importance of M&S:
       What can go wrong if M&S is not done properly or ignored?
   2.3 Stakeholders

3. Ethical Behavior
   3.1 Codes of ethical professional behavior
   3.2 Aspects of M&S that overlap with some professional areas with codes of professional ethics
   3.3 Code of Professional Ethics for Simulation Professionals
   3.4 Professional societies which adopted the Code of SimEthics
   3.5 Where to go from here?
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.”
Publication

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ISSN: 1383-1957 (Paper) 1572-6439 (Online)
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Issues in bold contain content you are entitled to view.

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Number 2 / June 2004  (13 - 140)
Number 1 / March 2004  (1 - 71)

Volume 5
Number 4 / December 2003  (181 - 242)
Number 3 / September 2003  (131 - 180)

Firstpage
Previous page
Next page
Last page

Linking Options

About This Journal
Editorial Board
Manuscript Submission

Quick Search
Search within this publication...
For: 

Search Title/Abstract Only
Search Author
Search Fulltext
Search DOI

Search
Codes of Ethics and Conduct

Below is a sampling of ethical codes from professional societies for engineers and scientists. Some differ widely in their content, because of their origins and their specific purposes. Others are similar in the topics they cover and the general ethical standards they articulate, but differ in language and in the specific ethical problems or abuses they address.

We invite professional societies in engineering and science to send us the latest revision of their codes or ethical guidelines for posting on these pages. Please send such codes and guidelines electronically with permission to post it.

Codes Maintained by the OEC
Codes in Spanish Maintained by the OEC
Codes Maintained by others
Codes in Spanish Maintained by others
Essays on Ethical Standards

Codes Maintained by The Online Ethics Center

American Council of Engineering Companies Ethical Guidelines
American Council of Engineering Companies Ethical Guidelines, adopted in October 1980.
American Chemical Society Code of Conduct
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 engineering managers, who find themselves in conflict with
Association of Computer Machinery (ACM) Code of Conduct

"Using the New ACM code of Ethics in Decision Making."
Communications of the ACM 36(2):98-107

1. General Moral Imperatives
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
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.

Index:

- Recent Developments
- Computer Society Codes from Around the World
- USA Codes
  - Computer Related Organizations
  - Other professional organizations
- Corporate Codes
- Codes from organizations outside the USA
- Policies and Codes Regarding Computer Usage from Universities and other sites
- Faculty Ethics
- School Systems
- Miscellaneous Notes
- Other Disciplines
- Recommendations for Developing Codes
1. Introduction
   1.1 Brief history of the author’s involvement
   1.2 Basic terminology
   1.3 Sources of ethical behavior
   1.4 Why ethics is needed in general and in M&S activities?
2. M&S
   2.1 The wide scope of usage of simulation
   2.2 Importance of M&S:
      Why can go wrong if M&S is not done properly or ignored?
   2.3 Stakeholders
3. Ethical Behavior
   3.1 Codes of ethical professional behavior
   3.2 Aspects of M&S that overlap with some professional areas with
codes of professional ethics
   3.3 Code of Professional Ethics for Simulation Professionals
   3.4 Professional societies which adopted the Code of SimEthics
   3.5 Where to go from here?
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.
1. Introduction
   1.1 Brief history of the author’s involvement
   1.2 Basic terminology
   1.3 Sources of ethical behavior
   1.4 Why ethics is needed in general and in M&S activities?

2. M&S
   2.1 The wide scope of usage of simulation
   2.2 Importance of M&S:
       What can go wrong if M&S is not done properly or ignored?
   2.3 Stakeholders

3. Ethical Behavior
   3.1 Codes of ethical professional behavior
   3.2 Aspects of M&S that overlap with some professional areas with codes of professional ethics
   3.3 Code of Professional Ethics for Simulation Professionals
   3.4 Professional societies which adopted the Code of SimEthics
   3.5 Where to go from here?
Two sites:
http://www.scs.org/ethics/
http://www.site.uottawa.ca/~oren/SCS_Ethics/ethics.htm

Code of ethics for simulationists
http://www.msiac.dmoso.mil/journal/code53.html

Rationale:
http://www.site.uottawa.ca/~oren/pubs/D84_Rationale.pdf
Responsibilities of simulationists to:

- profession
- code
- others
5 Areas of the Code:

1. Personal development and the profession  
2. Professional competence  
3. Trustworthiness  
4. Property rights and due credit  
5. Compliance with the code

27
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.
1. Introduction
   1.1 Brief history of the author’s involvement
   1.2 Basic terminology
   1.3 Sources of ethical behavior
   1.4 Why ethics is needed in general and in M&S activities?
2. M&S
   2.1 The wide scope of usage of simulation
   2.2 Importance of M&S:
      What can go wrong if M&S is not done properly or ignored?
   2.3 Stakeholders
3. Ethical Behavior
   3.1 Codes of ethical professional behavior
   3.2 Aspects of M&S that overlap with some professional areas with codes of professional ethics
   3.3 Code of Professional Ethics for Simulation Professionals
   3.4 Professional societies which adopted the Code of SimEthics
   3.5 Where to go from here?
The Code is adopted by (In order of adoption):

SCS - Society for Modeling and Simulation International
MISS* - Mcleod Institute of Simulation Sciences
M&SNNet* - 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
<table>
<thead>
<tr>
<th>International</th>
<th>MISS</th>
<th>MCELLEN INSTITUTE OF SIMULATION SCIENCES</th>
<th>Dr. Agostino Bruzzone</th>
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<tr>
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<td>Modelado y Simulación de Sistemas Dinámicos (Grupo Temático Español de CEA-IFAC), (Modeling &amp; Simulation of Dynamic Systems (CEA-IFAC Spanish Thematic Group))</td>
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<td>Dr. Roland Mielke</td>
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<tr>
<td>France</td>
<td>VERSIM</td>
<td>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).</td>
<td>Dr. Lucile Torres</td>
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• `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 your 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.
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   3.5 Where to go from here? (More discussions at SimSummit)
Your views to:
Dr. Tuncer Ören
oren@site.uottawa.ca
would be appreciated by him and by many other stakeholders.
Thank you for your attention!