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# Graduate Ethics Curricula for Future Geospatial Technology Professionals

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# GIS Profession: A Nascent Field



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- U.S. Department of Labor highlights “geographic/geospatial technology” as key high-growth field for 21<sup>st</sup> century
- \$3.3 billion global market (Daratech, 2006)
- Ethical issues loom large in public perception of the field
  - ✓ Surveillance and privacy
  - ✓ Social inequalities
  - ✓ Intellectual property rights
  - ✓ Citizen science, local activism



# The Rise of Professional Ethics Education



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- Need to prepare GIS professionals for these challenges
- UCGIS GIS&T\* Body of Knowledge includes units on ethics among its 329 definitive topics  
*\*University Consortium for Geographic Information Science, Geographic Information Science & Technology*
- Recommended component at undergraduate, graduate, and professional levels
- Needed as part of professional certification process (e.g., GIS Certification Institute)



# Codes of Ethics, Rules of Conduct



## CODE OF ETHICS

### *The GIS Certification Institute*

This Code of Ethics is intended to provide guidelines for GIS (geographic information system) professionals. It should help professionals make appropriate and ethical choices. It should provide a basis for evaluating their work from an ethical point of view. By heeding this code, GIS professionals will help to preserve and enhance public trust in the discipline.

This code is based on the ethical principle of always treating others with respect and never merely as means to an end: i.e., *deontology*. It requires us to consider the impact of our actions on other persons and to modify our actions to reflect the respect and concern we have for them. It emphasizes our obligations to other persons, to our colleagues and the profession, to our employers, and to society as a whole. Those obligations provide the organizing structure for these guidelines.

The text of this code draws on the work of many professional societies. It is not surprising that many codes of ethics have a similar structure and provide similar guidelines to their professionals, because they are based upon a similar concept of morality. A few of the guidelines that are unique to the GIS profession include the encouragement to make data and findings widely available, to document data and products, to be actively involved in data retention and security, to show respect for copyright and other intellectual property rights, and to display concern for the sensitive data about individuals discovered through geospatial or database manipulations. Longer statements expand on or provide examples for the GIS profession.

A positive tone is taken throughout the text of this code. GIS professionals commit themselves to ethical behavior rather than merely seeking to avoid specific acts. The problems with listing acts to be avoided are: 1) there are usually reasonable exceptions to any avoidance rule and 2) there is implicit approval of any act not on the list. Instead, this code provides a list of many positive actions. These explicit actions illustrate respect for others and help strengthen both an understanding of this ethos and a commitment to it.

## RULES OF CONDUCT

### *The GIS Certification Institute*

#### *Rules of Conduct for Certified GIS Professionals (GISPs)*

##### **Introduction**

The Code of Ethics presents a set of objectives toward which we, as professionals, must continually strive. The Rules of Conduct is a set of implementing laws of professional practice that seek to express the primary examples of ethical behavior consistent with the Code of Ethics. Both the Code and the Rules govern ethical professional practice standards, and violations of each may be brought before the GISC as an ethics issue.

The GIS professional should not interpret the lack of a specific context or act from the Rules of Conduct as permission to behave in any particular manner. For example, part of the Code of Ethics is the need to deliver an hour's work for an hour's pay. This is not simply a mandate for the office. It also means that you cannot ethically go to a conference and claim education points for the period of time when you were not actually participating in conference activities.

The Code and Rules represent a way of living a professional life, not simply how you are to behave at work. Achieving the GISP certification is an initial hurdle to jump in order to be recognized as a professional. Living the ethical life of a professional is a never ending test that will present numerous challenges for which the Code and Rules offer a guide to decision making.

The Rules of Conduct have been arranged under the headings used in the Code of Ethics as a means of indicating a primary association. The intent is to aid the user in identifying those rules that may be most applicable in a given context. Many rules, however, may be applicable in a variety of settings and situations beyond those with which they have a primary association. Any rule may ultimately be useful in resolving a specific question of ethical conduct.

# NSF Project Goals



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- Initial special topics, graduate seminars at OSU, PSU, Minnesota
- Transition to permanent offerings
  - ✓ GEOG 864, Professionalism in GIS&T (PSU)
  - ✓ GEO 567, Responsible GIS Practice: Ethics for Future Geo Professionals (OSU)
  - ✓ GEOG 8291, GIS Ethics: Accuracy & Responsibility (UMn)
- Develop model curricula and associated courseware
- Disseminate open educational resources



# Learning Outcomes of Courses



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- Examine one's own ideas of individual and professional responsibility
- Recognize ethical implications of geospatial technologies and applications
- Develop stronger and more sophisticated moral reasoning skills
- Understand the "moral ecologies" of the various institutions and organizations making up the geospatial enterprise
- Feel free to talk about ethics in the workplace

# Pedagogical Approach



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- Intro readings: philosophy, moral reasoning
- Review and discuss in-depth papers; group discussion and activities (e.g., role play)
- Examine various codes of ethics
- Interview training and analysis
- Interaction w/ working professionals via interviews
- Examine case studies
- Prepare and present original case studies



## Case Study Examples



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- **Mapping Muslim Neighborhoods:** A police department's plan to map potential terrorist enclaves brings charges of racial profiling.
- **Caribou Routes:** A GIS analyst is asked to exclude pertinent data from maps prepared for a public hearing.
- **Cell Phone Tracking:** Researchers track mobile phone users' movements (w/o their knowledge) to derive predictive models of human mobility.
- **Submarine Crash:** Inaccurate nav chart leads to deadly accident.

# Case Method: Assessing Student Learning



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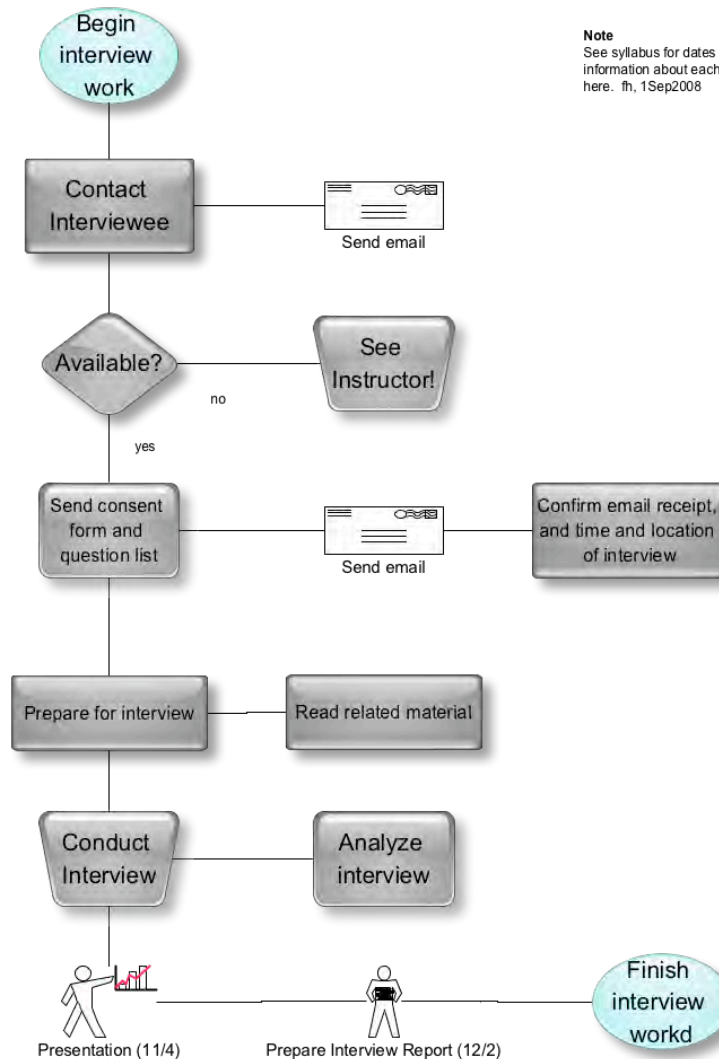
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- **Ethical sensitivity:** Ability to identify and discriminate among ethical issues
- **Ethical knowledge:** Familiarity with codes and rules
- **Ethical creativity:** Ability to see “beyond the dilemma” (*not all black & white*)
- **Judgment:** Increased likelihood that students will act appropriately (*cannot be determined in class*)

# Interviews of Professionals

GEOG 8291 Fall 2008 - GIS Professional Ethics

## GIS Professional Interviews Workflow (Suggested)



- Each student does 1 interview
- Develop original case from interview
- Opens door for discussion of successful or failed approaches



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## Ethics Education for Geospatial Professionals

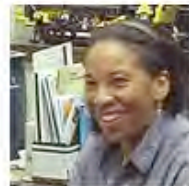
gisprofessionalethics.org

[About this Project](#) | [Case Studies](#) | [Codes of Ethics](#) | [Syllabi](#) | [Interview Protocols](#) | [References](#)

### Summary

The National Science Foundation provided support needed to develop and institute graduate seminars at Penn State, Oregon State, and the University of Minnesota that rigorously explore ethical implications of geographic information science and technology (GIS&T). Open educational resources designed and produced by a team of professional ethicists and GIS&T educators are available from the **Products** section of this site.

### Annotated bibliography, evaluation instruments



**Dawn Wright (PI)** is Professor of Geography at Oregon State University. She directs OSU's GIScience Certificate program.



**David DiBiase (Co-PI and project manager)** is Senior Lecturer of Geography and Director of Penn State's Dutton e-Education Institute. He manages Penn State's online professional Certificate and Masters degree programs in GIS.



**Francis Harvey (Co-PI)** is Associate Professor of Geography at the University of Minnesota. He will supervise ethics seminars for Minnesota's professional Master of GIS degree program.



**Michael Solem** is Educational Affairs Director at the Association of American Geographers (AAG). Michael is responsible for project evaluation.



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# Extra Slides

# UCGIS Model Curricula Vision



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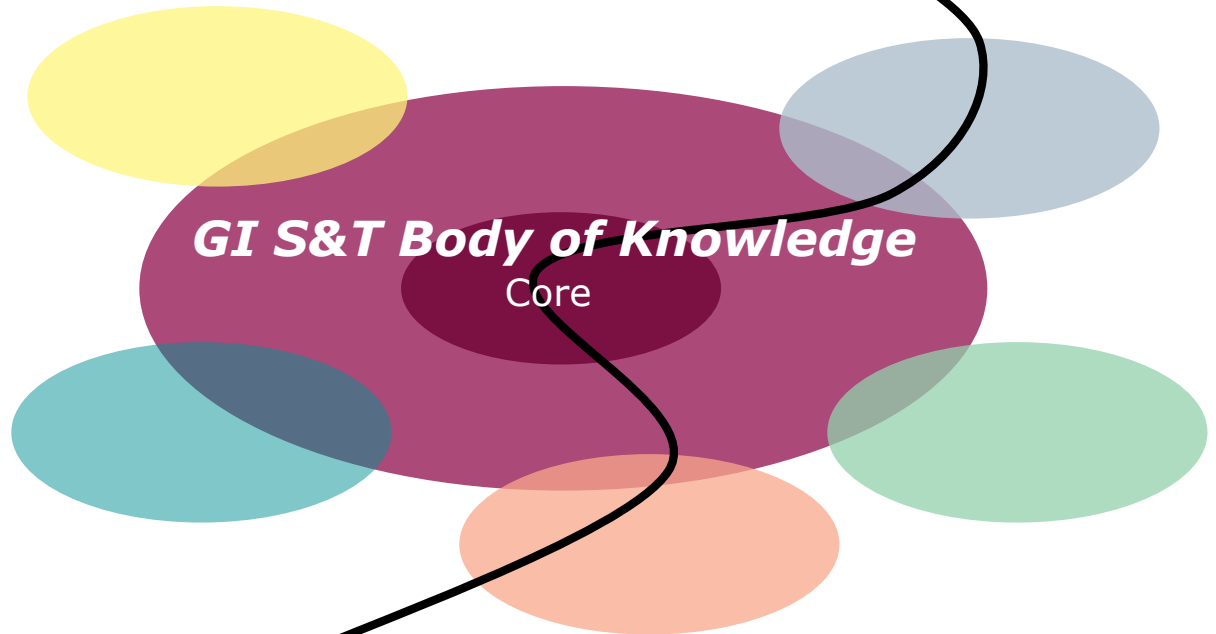


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**Outcomes**



Supporting  
Topics  
and  
Integrative  
Experiences



**Learner**



# BoK Knowledge Areas



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**AM. Analytical Methods**

**CF. Conceptual Foundations**

**CV. Cartography and Visualization**

**DA. Design Aspects**

**DM. Data Modeling**

**DN. Data Manipulation**

**GC. Geocomputation**

**GD. Geospatial Data**

**GS. GI S&T and Society**

**OI. Organizational and Institutional Aspects**

# BoK Knowledge Areas and Units



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## Knowledge Area AM. Analytical Methods

Unit AM1 Academic and analytical origins  
Unit AM2 Query operations and query languages

### Unit AM3 Geometric measures

### Unit AM4 Basic analytical operations

### Unit AM5 Basic analytical methods

Unit AM6 Analysis of surfaces  
Unit AM7 Spatial statistics  
Unit AM8 Geostatistics  
Unit AM9 Spatial regression and econometrics  
Unit AM10 Data mining  
Unit AM11 Network analysis  
Unit AM12 Optimization and location-allocation modeling

## Knowledge Area CF. Conceptual Foundations

Unit CF1 Philosophical foundations  
Unit CF2 Cognitive and social foundations  
**Unit CF3 Domains of geographic information**  
**Unit CF4 Elements of geographic information**  
Unit CF5 Relationships  
Unit CF6 Imperfections in geographic information

## Knowledge Area CV. Cartography and Visualization

Unit CV1 History and trends  
**Unit CV2 Data considerations**  
**Unit CV3 Principles of map design**  
Unit CV4 Graphic representation techniques  
Unit CV5 Map production  
**Unit CV6 Map use and evaluation**

## Knowledge Area DA. Design Aspects

Unit DA1 The scope of GI S&T system design  
Unit DA2 Project definition  
Unit DA3 Resource planning  
**Unit DA4 Database design**  
Unit DA5 Analysis design  
Unit DA6 Application design  
Unit DA7 System implementation

## Knowledge Area DM. Data Modeling

Unit DM1 Basic storage and retrieval structures  
**Unit DM2 Database management systems**  
**Unit DM3 Tessellation data models**  
**Unit DM4 Vector and object data models**  
Unit DM5 Modeling 3D, temporal, and uncertain phenomena

## Knowledge Area DN. Data Manipulation

### Unit DN1 Representation transformation

### Unit DN2 Generalization and aggregation

Unit DN3 Transaction management of geospatial data

## Knowledge Area GC. Geocomputation

Unit GC1 Emergence of geocomputation  
Unit GC2 Computational aspects and neurocomputing  
Unit GC3 Cellular Automata (CA) models  
Unit GC4 Heuristics  
Unit GC5 Genetic algorithms (GA)  
Unit GC6 Agent-based models  
Unit GC7 Simulation modeling  
Unit GC8 Uncertainty  
Unit GC9 Fuzzy sets

## Knowledge Area GD. Geospatial Data

### Unit GD1 Earth geometry

Unit GD2 Land partitioning systems

### Unit GD3 Georeferencing systems

### Unit GD4 Datums

### Unit GD5 Map projections

### Unit GD6 Data quality

### Unit GD7 Land surveying and GPS

Unit GD8 Digitizing

Unit GD9 Field data collection

### Unit GD10 Aerial imaging and photogrammetry

### Unit GD11 Satellite and shipboard remote sensing

### Unit GD12 Metadata, standards, and infrastructures

## Knowledge Area GS. GI S&T and Society

Unit GS1 Legal aspects

Unit GS2 Economic aspects

Unit GS3 Use of geospatial information in the public sector

Unit GS4 Geospatial information as property

Unit GS5 Dissemination of geospatial information

### Unit GS6 Ethical aspects

Unit GS7 Critical GIS

## Knowledge Area OI. Organizational and Institutional Aspects

Unit OI1 Origins of GI S&T

Unit OI2 Managing the GI system operations and infrastructure

Unit OI3 Organizational structures and procedures

Unit OI4 GI S&T workforce themes

### Unit OI5 Institutional and inter-institutional aspects

### Unit OI6 Coordinating organizations (national and international)

# Ethics in the *Body of Knowledge*



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## Unit GS6 Ethical aspects

Ethics provide frameworks that help individuals and organizations make decisions when confronted with choices that have moral implications. Most professional organizations develop codes of ethics to help their members do the right thing, preserve their good reputation in the community, and help their members develop as a community.

### Topic GS6-1 Ethics and geospatial information

- Describe a variety of philosophical frameworks upon which codes of professional ethics may be based
- Discuss the ethical implications of a local government's decision to charge fees for its data
- Describe a scenario in which you would find it necessary to report misconduct by a colleague or friend
- Describe the individuals or groups to which GI S&T professionals have ethical obligations

### Topic GS6-2 Codes of ethics for geospatial professionals

- Compare and contrast the ethical guidelines promoted by the GIS Certification Institute (GISCI) and the American Society for Photogrammetry and Remote Sensing (ASPRS)
- Describe the sanctions imposed by ASPRS and GISCI on individuals whose professional actions violate the Codes of Ethics
- Explain how one or more obligations in the GIS Code of Ethics may conflict with organizations' proprietary interests
- Propose a resolution to a conflict between an obligation in the GIS Code of Ethics and organizations' proprietary interests

# Ethics in the *Body of Knowledge*



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## Unit GS7 Critical GIS

Many of the educational objectives used to define topics in this knowledge area, and in the Body of Knowledge 2006 as a whole, challenge educators and students to think critically about GI S&T. Since the 1990s, scholars have criticized GI S&T from a wide range of perspectives. Common among these critiques are questioned assumptions about the purported benefits of GI S&T and attention to its unexamined risks. By promoting reflective practice among current and aspiring GI S&T professionals, an understanding of the range of critical perspectives increases the likelihood that GI S&T will fulfill its potential to benefit all stakeholders. Philosophical, psychological, and social underpinnings of these critiques are considered in Knowledge Area CF: Conceptual Foundations.

### Topic GS7-2 Ethical critiques

- Defend or refute the argument that the GI S&T professionals are culpable for applications that result in civilian casualties in warfare
- Defend or refute the argument that the "digital divide" that characterizes access to GI S&T perpetuates inequities among developed and developing nations, among socio-economic groups, and between individuals, community organizations, and public agencies and private firms
- Discuss the ethical implications of the use of GI S&T as a surveillance technology

# Textbook Example



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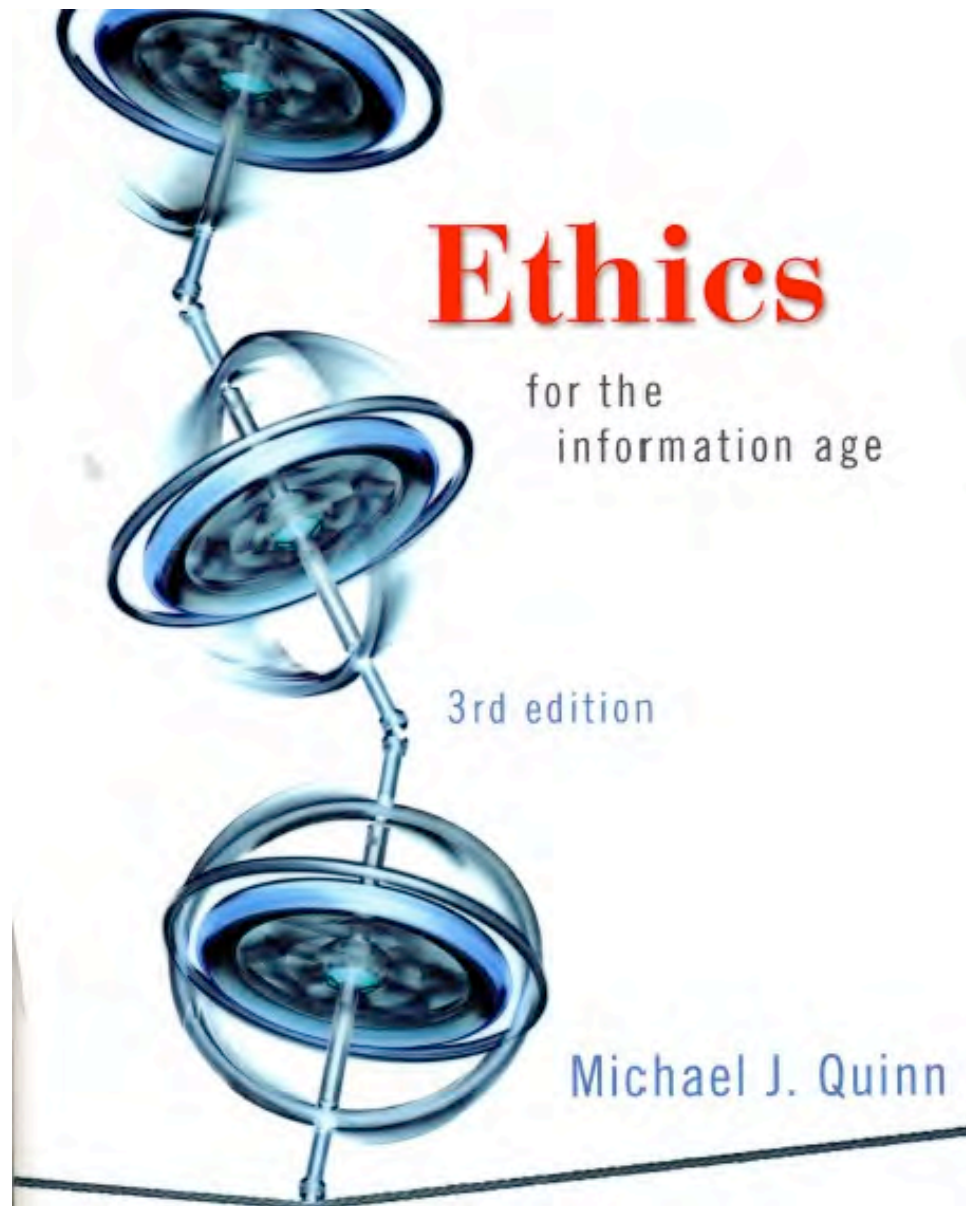
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# What is Legal May Not be Ethical



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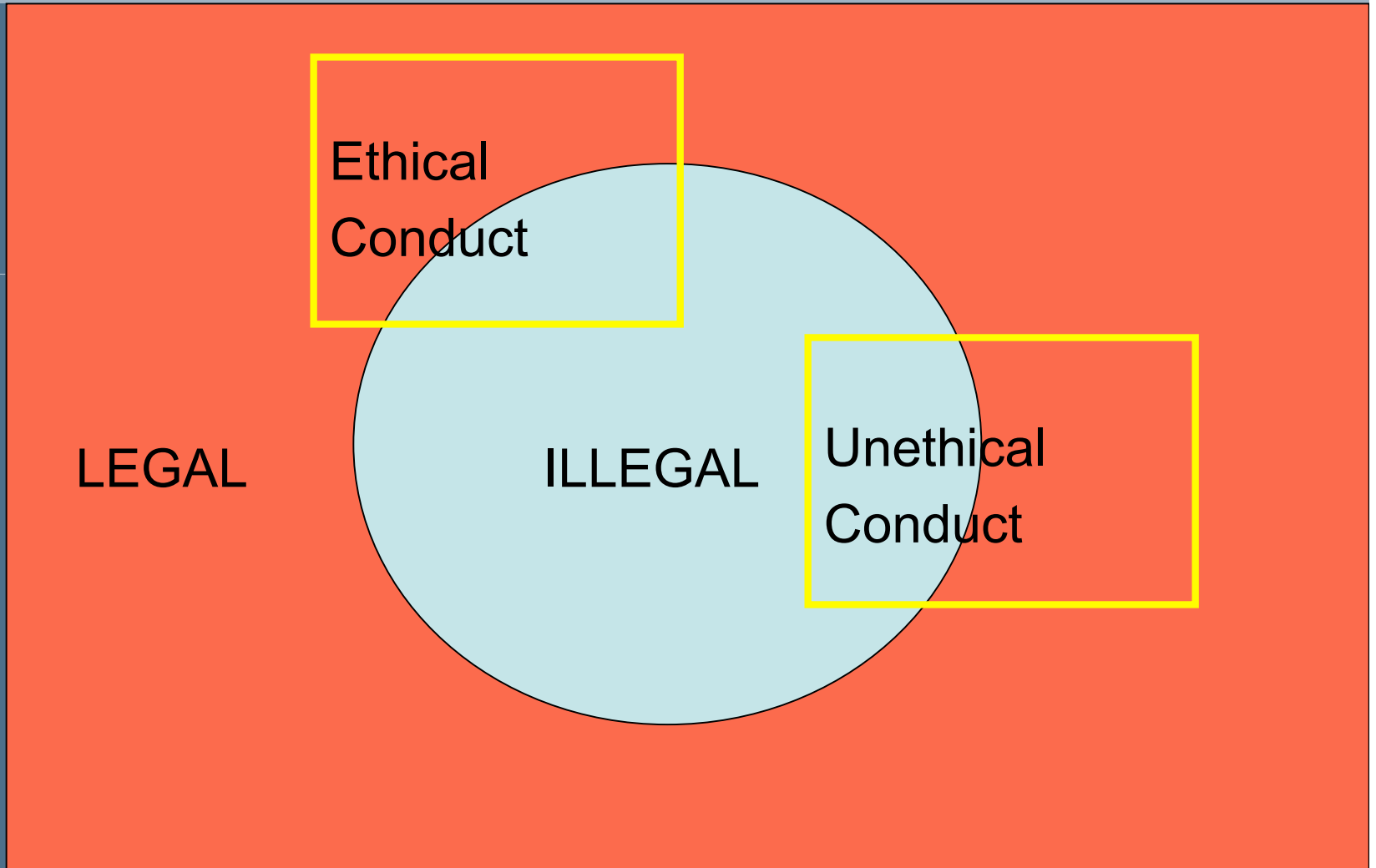
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Onsrud, H., 1995. Identifying unethical conduct in the use of GIS, *Cartography and Geographic Information Systems*, 22(1): 90-97.