

## Reflections on Morality, Ethics, and Bioethics Decisions

George Bugliarello

Polytechnic Institute of New York University

Address all correspondence to George Bugliarello, 6 MetroTech Center, Brooklyn, NY, 11201; Tel.: 718-260-3330; Fax: 718-260-3974; gbugliar@poly.edu.

---

**ABSTRACT:** From the presumed biological evolutionary origins of a urmorality, there eventually developed a conscious set of morality concepts and rules that became less immediate and more abstract, and increasingly shaped by social factors. Today the concepts and precepts of morality have come to form a complex system in which each specialized professional ethics respond with a certain degree of latitude to conditions within its own domain. The *raison d'être* of morality is the connection between actions and their possible outcomes, which embodies the concept of risk. The risk considerations underpinning an ethical decision can ultimately lead to better decisions. They can also lead to a better understanding of the evolutionary underpinnings and trajectory of our morality, from that of ancestral species to its present complex construct of ethics rules and beliefs. Determination of possible scenarios, their probabilities, and their consequences, as an essential component of a rational assessment of risk, presents difficulties, especially in connection with a new process or a new technology. These inherent complexities in reaching and carrying out an ethical decision can be made more tractable by developing methodologies that can help to learn how to think about difficult issues. For example, a biosoma-environmental paradigm can help insure that in making ethics decisions all necessary components of a rational risk assessment are considered. Rationality, however, is not the only base for ethical decisions. Factors such as emotion, instinct, and tradition, specific to a situation, a societal group or subgroup, or to a profession, can exert a powerful influence on ethics decisions, especially in the realm of health and psychology. An understanding of the interplay between these factors and rational assessment of the risks should be at the base of any ethical decision.

---

**KEYWORDS:** morality, bioethics, evolution, decisions, biosoma, risk assessment

## I. INTRODUCTION

The professional ethics of medicine, biological research, and bioengineering can be viewed as one of the last steps in a chain that may have its origin in what could be called urmorality—a yet far from fully fathomable set of rules that seem to govern the behavior of several animal species and that evolved to aspects of morality common to all humans, and from these to the morality of specific social groups (cultural, religious, etc.)<sup>1</sup> (Fig. 1). Thus, from the presumed biological evolutionary origins of an urmorality, there eventually developed a conscious set of morality concepts and rules that became less immediate and more abstract, and increasingly shaped by social factors. These evolutionary structures could perhaps be viewed as an analogy to the structure of time proposed by the French historian Braudel,<sup>2</sup> or, more directly, as hypothetical manifestations of that structure.

Each of the steps in the development of morality influences, whether we are conscious of it or not, our actions. The progression along the chain

from urmorality to professional ethics is increasingly accompanied by conflicts along these steps. For example, the urmorality allows some species to engage in cannibalism and incest, but the morality of some primitive social groups does not—and for certain these practices are abhorrent to the morality of evolved human societies. However, a situational ethics makes allowances in certain situations for departures from the prevailing societal morality, as in the well-known example of cannibalism among survivors of an airplane crash in the high Andes. While the urmorality and the general morality of our species are the bedrock, i.e., the ultimate foundation of societal and specialized moralities, conflicts also arise within different societal moralities, i.e., between different professions with their own ethics, such as that of the lawyer who defends a client versus that of the scientist in the pursuit of truth, of the medical doctor's observance of the Hippocratic oath not to harm the patient, or of the engineer in the endeavor to meet fundamental physical human needs (e.g., Refs. 3 and 4). They all interpret and respond in different ways to the overriding moral-

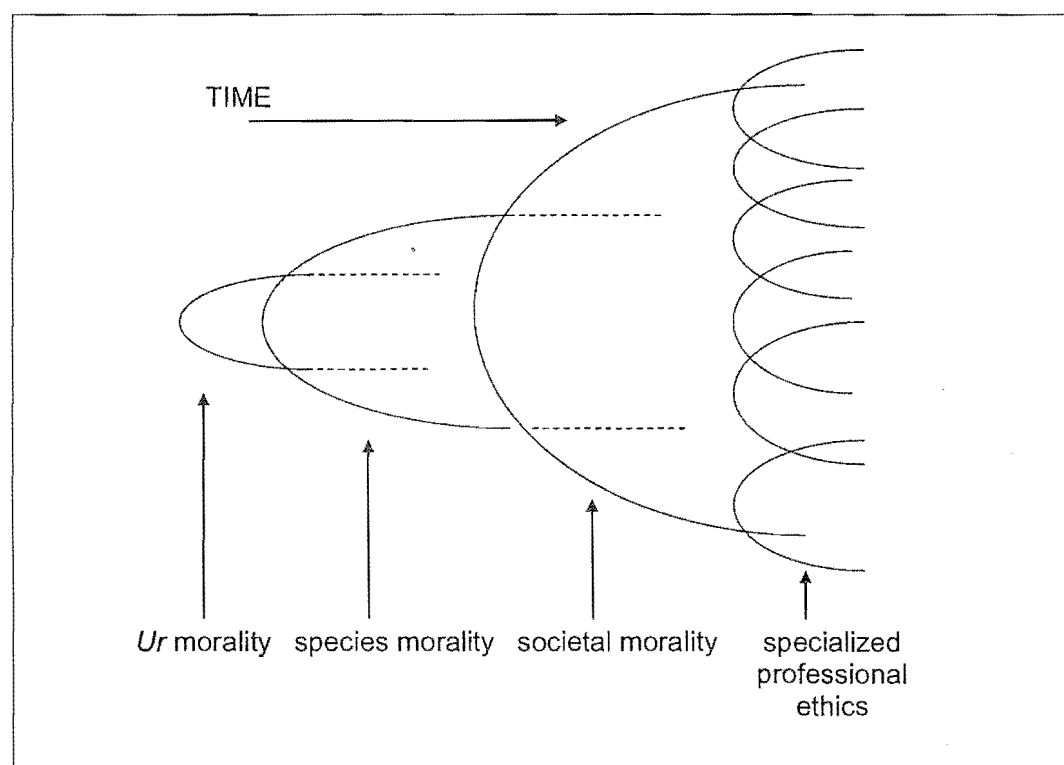


FIGURE 1. Hypothetical evolutionary specialization of ethics.

ity of the society in which these professions are embedded. Hence, for instance, the current conflict between different segments of American society about the treatment of war prisoners—a conflict that spans also issues of law—the conflicts between unfettered research and commercialism or those in making clinical data widely available (e.g., Ref. 5).

## II. MORALITY AS A COMPLEX SYSTEM

The concepts and rules of morality have come to form today a complex system, a system of systems, as defined by Mesarovich. Its performance, that is, its capability to provide a guide for our actions, depends on the prevailing conditions under which each subsystem functions<sup>6</sup>—in this case, e.g., each of the different social and professional ethics, as each operates within bounds that give it freedom to respond to the conditions of its domain. Avoiding an abyss of moral chaos depends on a constructive interaction among specialized ethics to elevate the set of their moral principles to those of society as a whole. This process is characterized by intense feedback and is constantly evolving. It is paced by the advances in each specialized field, and it forces a constant re-examination of their premises—a fundamental challenge in bioethics, as in the ethics of other professions.

Morality manifests itself in the realm of action through specific ethics precepts that, together with laws, are intended to guide human action. Here too there can be conflicts, as morality covers in principle the whole field of action, but laws only part (Fig. 1). There can be conflicts between laws and morality when laws are deemed to be immoral and to violate the morality (ethics) of a group. There are also gray areas that neither morality nor laws cover, and in which the distinction between good and bad is ambiguous, as in the case of a physician having to choose between the Scylla of the good of a patient and the Charybdis of a patient's unwillingness to pursue the course that could lead to that good, as in some of the dilemmas popularized by the *House* program on television. With these limitations and caveats, laws and ethics determine the allowable or desirable actions. In turn, the outcomes of possible actions shape ethics and laws. The shaping is the result of feedback from actual events or is anticipatory of events that might occur.

## III. MORALITY AND RISK

The connection between actions and their possible outcomes, which is the *raison d'être* of morality, embodies the concept of risk. The risk associated with an action is frequently viewed as a function of the scenario of possible occurrences, of the predictability of those occurrences, and of their consequences. Each of these aspects, therefore, plays a role in determining moral conduct. This, however, presents difficulties that vary from situation to situation, bringing at times great complexity to decisions about what is a moral course of action.

In an invention, whether of a device or of a procedure, the scenario of possible occurrences is not always well predicted or predictable, since it depends on chance, as well as on imagination and experience. An example is, in the vernacular, the well-known  $n+1$  problem, in which  $n$  is the number of scenarios that one envisions and 1 is a scenario that is not or could not be envisioned in advance. (The procedure might be an actual physical intervention, for instance surgery, or a psychological intervention, such as informing a patient of an event in his or her family that could aggravate his or her condition.)

The probability of failure, in turn, cannot always be determined from experience of recurring occurrences. If there are no precedents on which to base the assessment of probability and the device or process has no analogy to other situations of which there is experience, as in the case of a device based on an entirely new concept, the likelihood of a failure cannot be assessed statistically. The alternative is to resort to an epistemological process to identify each component of the device or process and to attempt to determine how it could fail, on the basis of physical and biological knowledge, and of a study of the interaction among its different components. To assess, subsequently, the possible consequences of a failure calls again on knowledge and imagination.

The conditions under which an ethics decision is made are not always fully appreciated. The decision may be influenced by biological factors such as our physical and emotional status, societal factors (such as societal influences of which the decision maker may not even be fully conscious), machine factors (e.g., undue confidence or lack of confi-

dence in a device or a computer prediction), and environmental factors (such as temperature, noise, and light). While we may understand some of the influences of psychological stress in decision making, we do not clearly understand, for instance, the influence of environmental stresses such as ambient temperature.

The three components of a risk assessment—scenarios, probabilities, and consequences—need to be integrated using judgment in order to make possible an overall determination of the risks involved in the product or procedure and hence of the moral responsibility associated with a chosen course of action. It is not clear, for example, at what state in the development of a device or procedure such an assessment might first have been made and influenced an ethics decision, or how different such a decision could be in other cases and cultures. Symptomatic, for instance, are cultural/religious differences in the acceptance of evolution.<sup>7</sup> Even with the greatest bona fide, an assessment may not escape biases in scientific opinion, as well as social and professional pressures. In some cases, what might be useful in assessing bias and determining a moral course of action is the fundamental distinction between three kinds of truths: factual (based on data and scientific hypotheses), formal (based on logical or mathematical theorems and on the results to which they might lead, without an experimental confirmation), and on what have been called artistic truth (which may play a role in serendipity).<sup>8</sup>

History has many examples of the difficulty in assessing risk when a new technology or a new process is created. This is true of all fields of engineering, medicine, and bioengineering. Suffice it to think, in the fight against yellow fever, of the search for the scenario of how the inoculation occurred. In the early times of X-ray diagnostics, ignorance of the effects—the consequences—of radiation on the body led to the loss of fingers of radiologists who used their hands to position patients behind an active radiosopic screen. Other examples are the death of some patients in the early stages of genetic therapy, or the risk associated with the Agent Orange in the Viet Nam conflict. In each of these cases, inability or impossibility to initially assess risk led to moral positions and ethical decisions based on serendipity—e.g., about doses. Today's

uncertainties include determination of the health risks associated with wireless communications (cell phones), nanotechnology, noise, and genetically engineered foods and diets, and the psychological concerns connected with some procedures to enhance homeland security. Thus, a recurring ethics question is whether it is ethical to pursue or encourage or allow a given course of action without full knowledge of its consequences—is it better to risk in the hope of a desirable outcome?

Inevitably, situations such as these will continue to be encountered as the realm of interactions of medicine, biology, and engineering expands. An immediate correlate is the need for rapid and reliable medical and engineering forensics to assess the risks as closely in time as possible to the first recognized incident or malfunction and, where feasible, even to anticipate them by melding forensics, forecasting, and risk assessment.

Besides the assessment of risk, several other factors may play a role in reaching an ethics decision: assessment of the cost effectiveness of a course of action that might stem from the decision; possible consideration of how the decision might be played out; and the implications for individuals such as a patient and those connected with the patient, for society (e.g., societal costs), and for the environment (acceptable environmental risk, etc.).

These inherent complexities in reaching and carrying out an ethical decision can be made more tractable by developing methodologies that can help to learn and teach how to think about difficult ethical issues (e.g., Ref. 9). One of such methodologies is the use of a biosoma-environmental paradigm to address all the necessary components of a risk assessment.<sup>10</sup> The paradigm provides a reminder of the need to systematically address the biological risks (e.g., the risks to the person, such as infections, trauma, and reduction of functionality), the social risks to the community, the machine risks (that is, the technological risks due, e.g., to failures of design and manufacture), and the environmental risk (e.g., in the use of nanoparticles), as well as the risks arising from the interaction of all these components (e.g., in a biomachine device).

The paradigm can be expressed through a matrix of scenarios, probabilities of their occurrence, and their consequences, for each component of the

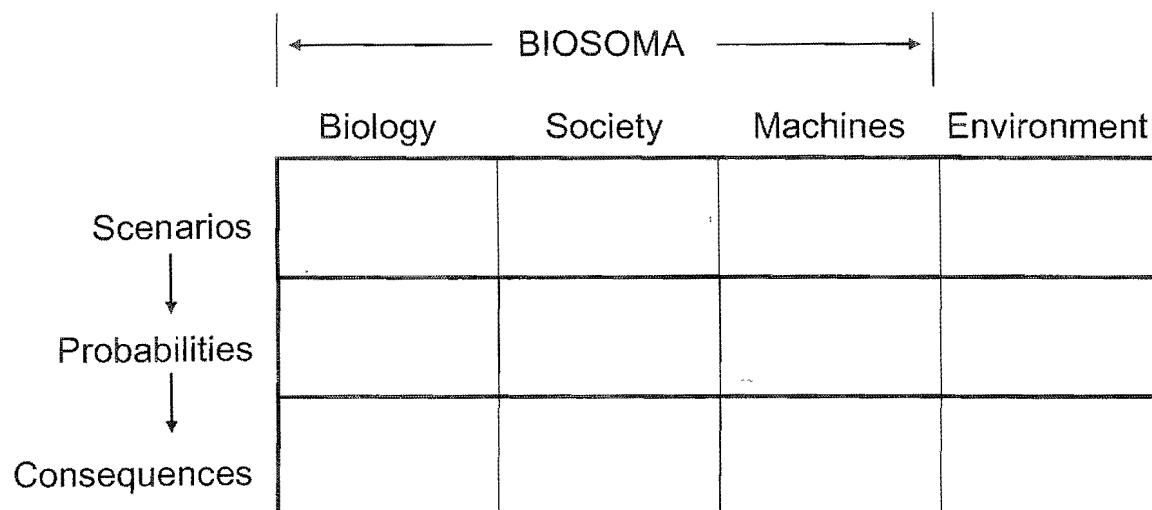


FIGURE 2. The biosoma-environmental paradigm for risk assessment.

biosoma, and for the environment (Fig. 2). Further examples of possible consequences are physical and financial costs to a patient and to society, the need to change approaches to health care delivery, and the development of new knowledge—a positive development that may pose ethical dilemmas when juxtaposed to a Hippocratic aversion to using an intervention to gain that knowledge, if it does not benefit the patient. The biosoma paradigm simply codifies and makes explicit the choice of scenarios, probabilities, and consequences that any rational ethics decision needs to consider. The matrix can also help in making evident the rationale (or not) of laws and regulations and the areas where ethics may need to reach beyond them. Methodologies and insights that complement the biosoma-environmental ones also arise, as has been the case since Socrates and Aristotle, from viewing ethics as part of philosophy, just as mathematics did since Pythagoras. It could also be said, by analogy to the progression of mathematics from empirical origins, that ethics, once conceived, began to have a life of its own.<sup>11</sup>

#### IV. CONCLUSION

The systematic development of the ability to rationally assess the risk considerations underpinning an ethical decision can ultimately lead to better decisions. It can also lead to a better understanding of the evolutionary underpinnings and trajectory of

our morality, from the still presumed umorality of ancestral species to its present complex construct of ethics, rules, and beliefs. Rationality, however, is not the only base for ethical decisions. As pointed out earlier, other factors—emotions, instincts, traditions—specific to a situation, a social group, or subgroup, or to a profession, can exert a powerful influence on ethics decisions. Thus, a critical challenge to bioethics is the determination of the boundary between rationality and these other factors.

#### REFERENCES

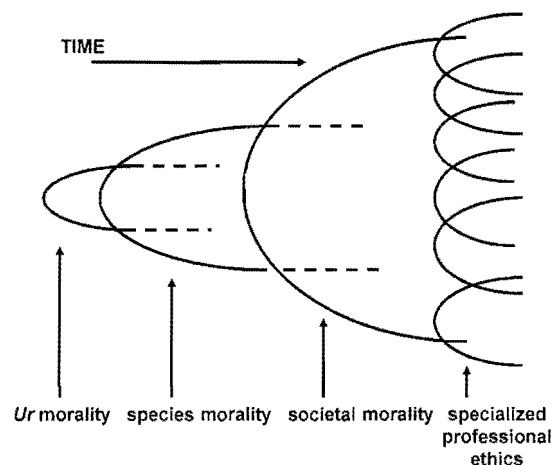
1. Bugliarello G. Biomedical engineering ethics: Specificity versus the absolute, *Int J Med Implants Devices*. 2008;3:75–80.
2. Cunliffe B. *Europe between the oceans. Themes and variations: 9000 BC–AD 1000*. New Haven, CT: Yale University Press; 2008.
3. Wulf WA and Jones A. A call to serve. *Science*. 2008;322:1025.
4. Bauer CE. Ethical and social responsibility of engineers. *World Engineering Congress*, Brasilia, 2008 Dec 3.
5. Kaiser J. Making clinical data widely available. *Science*. 2008;322: 217–8.
6. Mesarovich MD. Crosslevel causality in complex, multilevel systems biology. Case Western Reserve University; 2008 (unpublished).
7. Hameed S. Bracing for Islamic creationism. *Science*. 2008;322:1637–8.
8. Bunge M. Moderate mathematical fictionism.

- in Agazzi E, Darvas G, editors. *Philosophy of mathematics today*. Dordrecht: Kluwer; 1997. p. 51-71.
9. Miller G. Students learn how not what to think about difficult issues. *Science*. 2008;322: 186-187.
10. Bugliarello G. The biosoma paradigm and environmental engineering. *Env Eng Sci*. 2007;24(3):245-256.
11. Agazzi E, Darvas G, editors. *Philosophy of mathematics today*. Dordrecht: Kluwer; 1997.

## Reflections on Morality, Ethics, and Bioethics Decisions

George Bugliarello  
Polytechnic Institute of NYU

### Hypothetical Evolutional Specialization of Ethics



x  
x  
x  
x  
x  
x

### **Ethics of Different Societal Segments**

- Treatment of war prisoners
- Unfettered research vs commercialism
- Availability of clinical data
- Privacy

### **Ethics of Different Professions**

Law  
Medicine  
Engineering  
Education  
The military  
Business

.....

## **Morality as a Complex System**

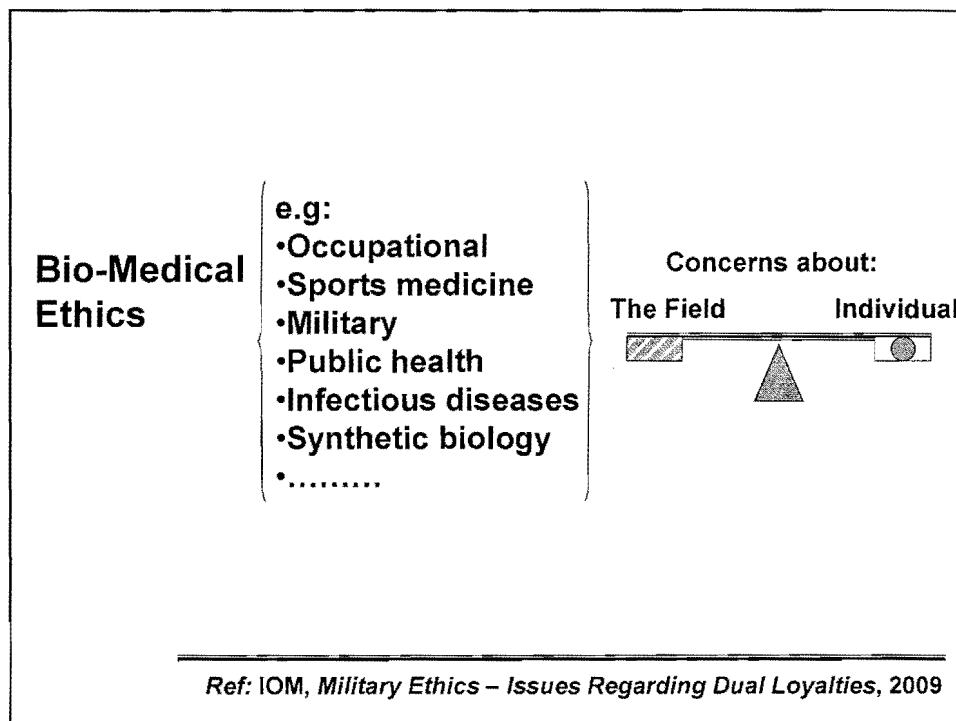
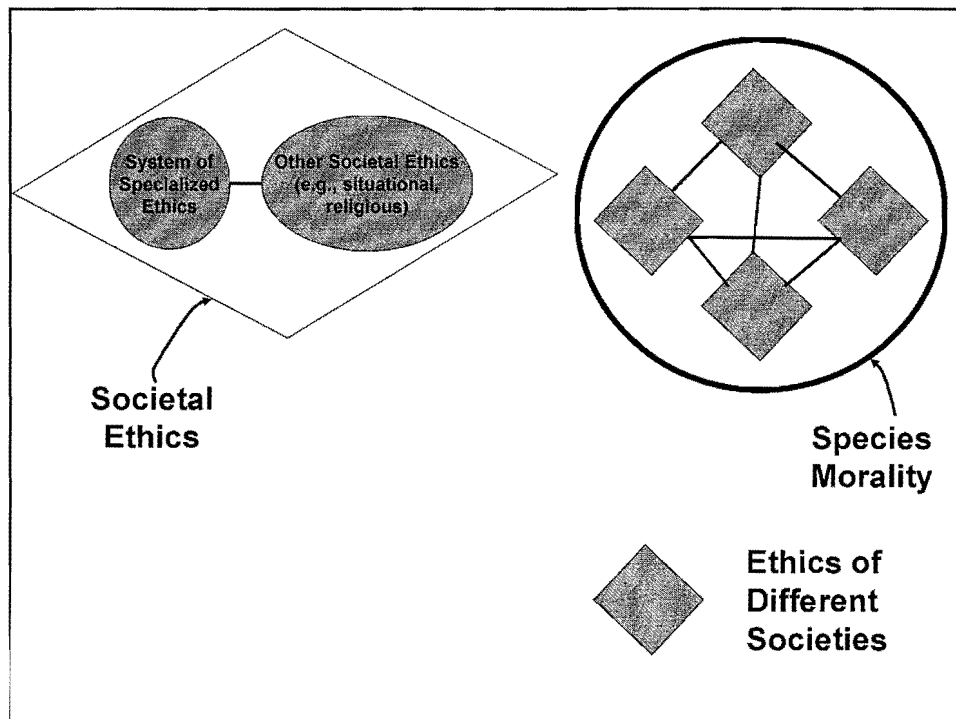
**("System of Systems")**



**(capability to provide a guide for our actions)**

- the conditions under which each system (e.g., a given professional ethic) performs
- constructive interactions among the systems





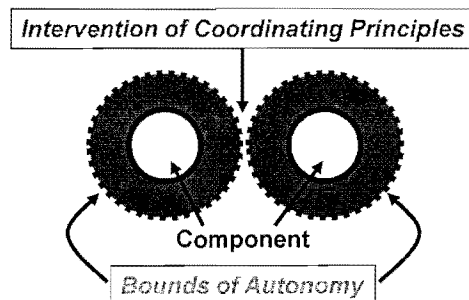
## Bioethics

### The Fundamental Dilemma

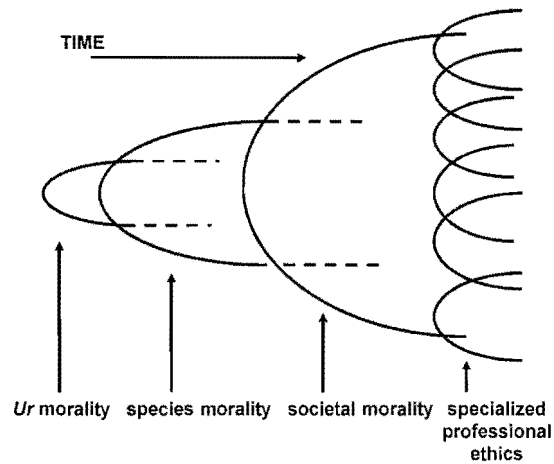
- “Balkanization” vs
- Basic philosophical principles?
  - Kant, Freud, ...

## The Two Coordinating Principles of Mesarovich’s Complex System of Systems

- Bounded autonomy of each component
- Coordinating principle and mechanisms

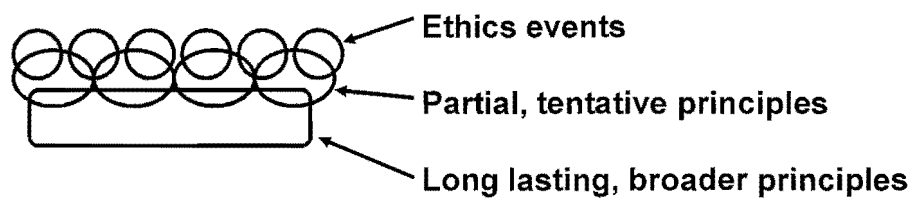


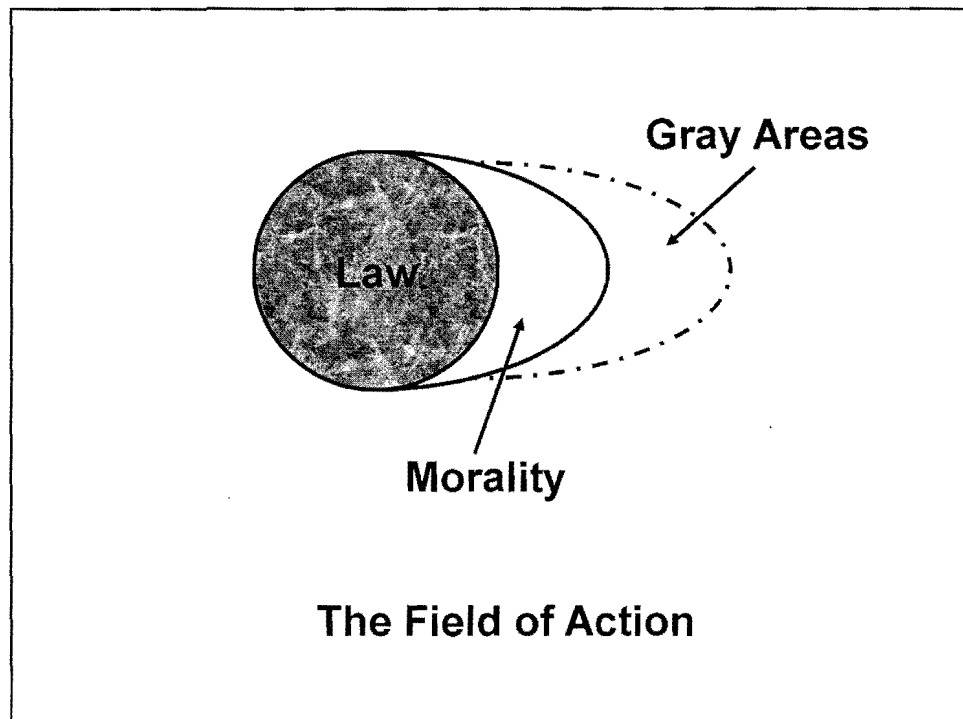
## Hypothetical Evolutional Specialization of Ethics



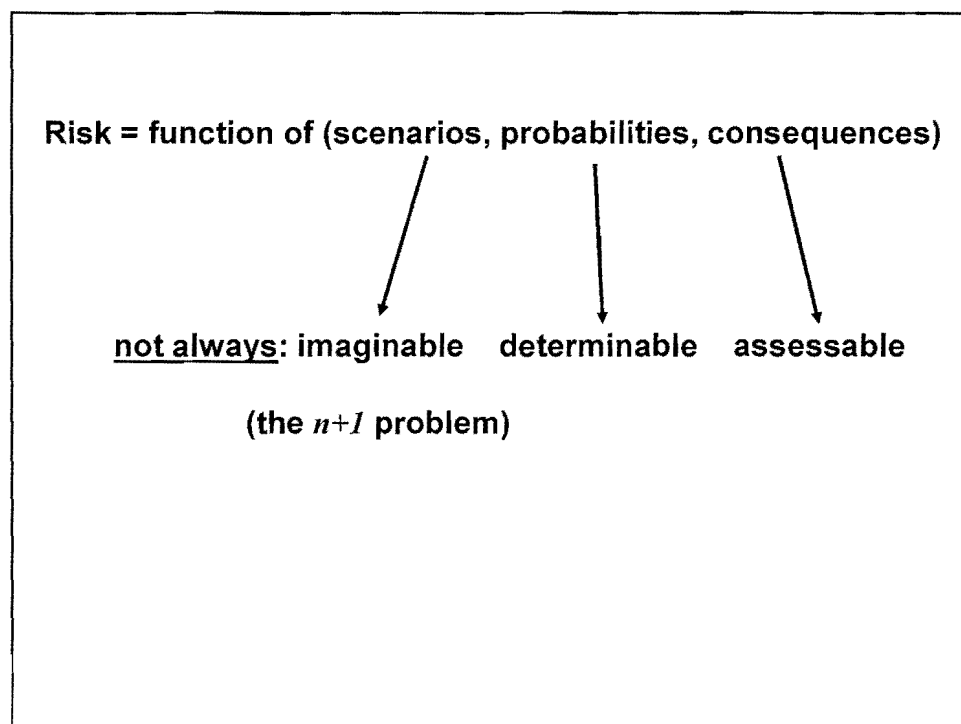
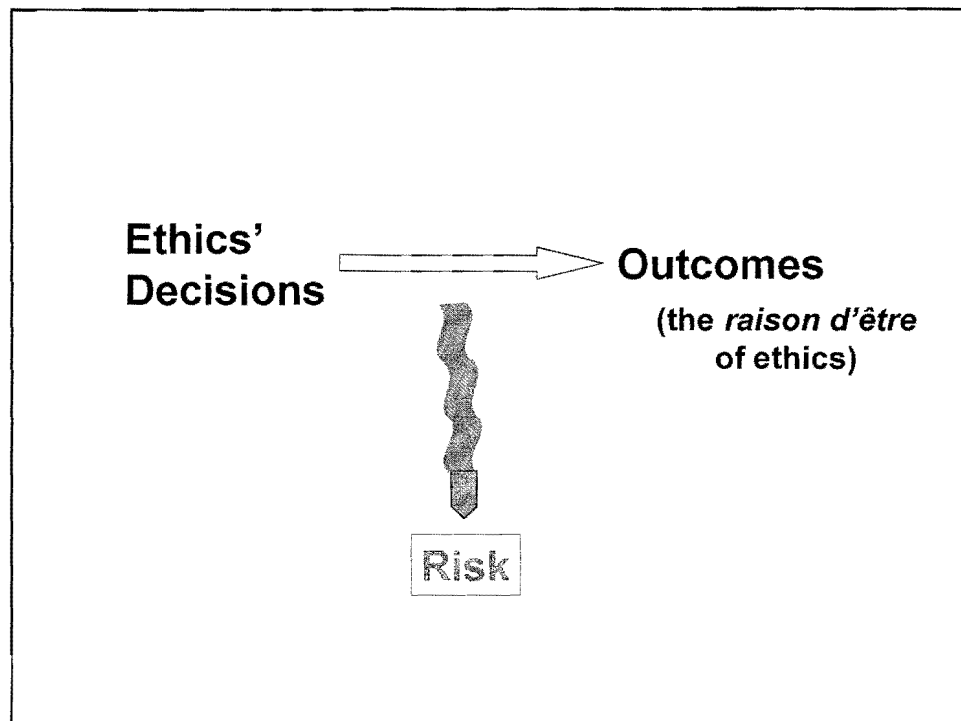
## The Synthesis of Ethics

(Analogy to Braudel's History's Synthesis)





## Ethics & Risk

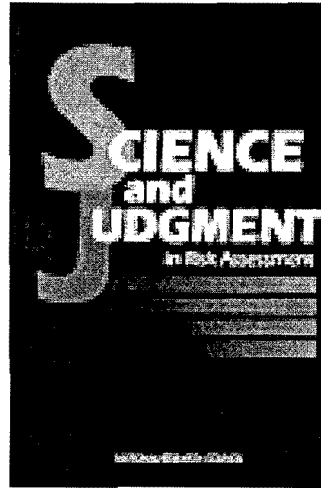


## **Factors in Ethics Decisions**

- Rational assessment of risk
- *But also* influence of
  - emotions
  - instincts
  - traditions
- The problems of
  - self-deception
  - public skepticism about the reliability of scientific predictions
  - truth

## **Overall Determination of Risk of a Biomedical Product or Procedure:**

- At what stage in their development?
- How different in different situations or cultures?
  - e.g., bias in scientific opinions



*Science and Judgment in Risk Assessment*

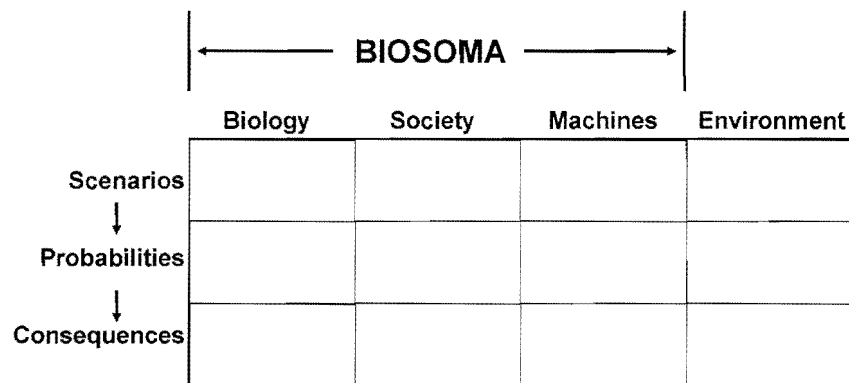
Committee on Risk Assessment of  
Hazardous Air Pollutants,  
Commission on Life Sciences,  
National Research Council, 1994

## The Three Kinds of Truths:

- Factual (based on data and scientific hypotheses)
- Formal (based on logical or mathematical theorems without experimental confirmation)
- Artistic (may play a role in serendipity)



## The Biosoma-Environmental Matrix for Risk Assessment



## Conclusions

- Bioethics is a last step in the long evolution that has shaped morality
- Morality has become an ever more complex system that needs to harmonize its various components