



A Call for a New Engineering Ethic
George D. Catalano, State University of New York at Binghamton

TRAGEDY IN THE GULF



Tragedy in the Gulf



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Gulf Oil Spill

- “The U.S. hasn’t reconciled the idea that engineers can render miracles—cloud-piercing towers, low-cost instantaneous digital communication, deep-sea drilling—with the idea that each fresh miracle hurls us into unfamiliar territory.”

Gulf Oil Spill

- "...Otherwise, the Gulf of Mexico always will be remembered as the place where engineering prestige dipped to a new low in an age known for disasters as much as for progress."

June 2, 2010, *Engineering New Record*

Advancing Technology and Science

- Perhaps now is an appropriate time to ask the following question:
 - Has our understanding of our ethical responsibilities both as a profession and as individual practitioners kept pace with those advancements?
- I suggest that it has not, and as a result, offer a new engineering ethic.

New Ethic

- Integrate new understandings of the workings of the Universe from such disparate fields as:
 - quantum mechanics;
 - eco-philosophy; and
 - ideas from the emerging science of complex systems

Quantum Mechanics

- According to the Stanford Encyclopedia of Philosophy:
 - “Quantum mechanics is, at least at first glance and at least in part, a mathematical machine for predicting the behaviors of microscopic particles — or, at least, of the measuring instruments we use to explore those behaviors — and in that capacity, it is spectacularly successful: in terms of power and precision, head and shoulders above any theory we have ever had.”

Quantum Mechanics

- From quantum mechanics we shall use the notions of:
 - Potentialities,
 - Uncertainty,
 - Connectedness;
 - Importance of experience.

Quantum Mechanics

- We are not interested in the mathematical details but rather what kind of world does the science of quantum mechanics describe.
- This question, however, is extremely controversial; “there is very little agreement, among physicists and among philosophers, about what the world *is like* according to quantum mechanics.”

Quantum Mechanics

- Limit our consideration of the implications of quantum mechanics to two principles:
 - Rather than a Universe described as being deterministic, in a quantum world the Universe can best be described as a rich tapestry of potentialities; and
 - Rather than a collection of disparate objects, the Universe is more accurately described as one, connected system.

Eco-philosophy

- From eco-philosophy, we shall utilize the ideas of
 - Evolving, dynamic Universe; and
 - Important laws of differentiation, communion and subjectivity.

Eco-philosophy

- Berry offers us the following contemplation: what would our ethical responsibilities be if we considered the Universe as a “communion of subjects” rather than a “collection of objects.”
- Swimme and Berry suggest a Universe whose unfolding is governed by a set of immutable principles, chief among them being differentiation, subjectivity and communion.

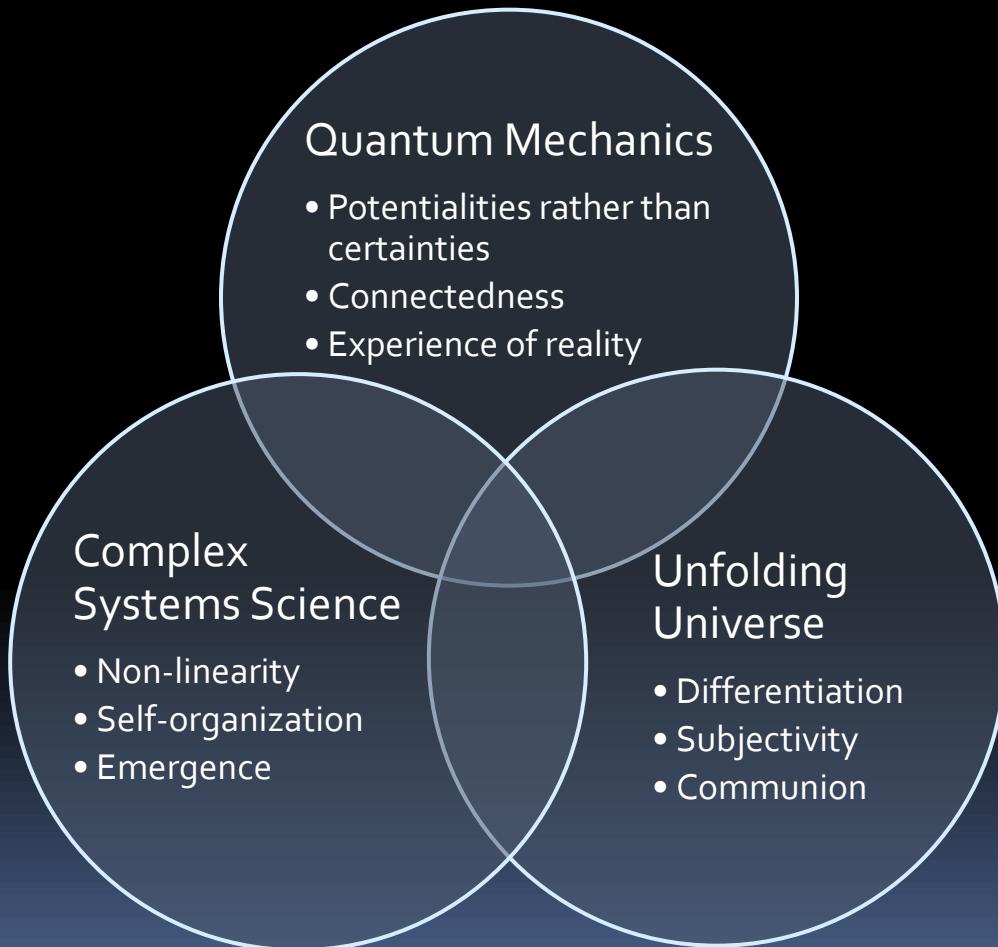
Complex Systems

- Lastly from complex system science, we shall incorporate the concepts of
 - Non-linearity,
 - Self-organization, and
 - Emergence.

Complex Systems

- Two properties set a complex system apart from one that is merely complicated
 - Emergence is the appearance of behavior that could not be anticipated from knowledge of the parts of the system alone.
 - Self-organization means that there is no external controller or planner engineering the appearance of these emergent features. They appear spontaneously.

A UNION OF IDEAS: COMPLEX SYSTEMS, QUANTUM MECHANICS AND THE UNFOLDING UNIVERSE



Existing Engineering Ethic

- First consider as a model the National Society of Professional Engineers (NSPE) :

“Engineers, in the fulfillment of their professional duties, shall hold paramount the safety, health, and welfare of the **public**.”

New Ethic

- Engineers, in the fulfillment of their professional duties, shall

Recognize the Universe as being filled with infinite potentialities and that decisions that limit the various life-forms from reaching their unique potentials must be carefully considered;

Recognize the Universe as complete and connected throughout;

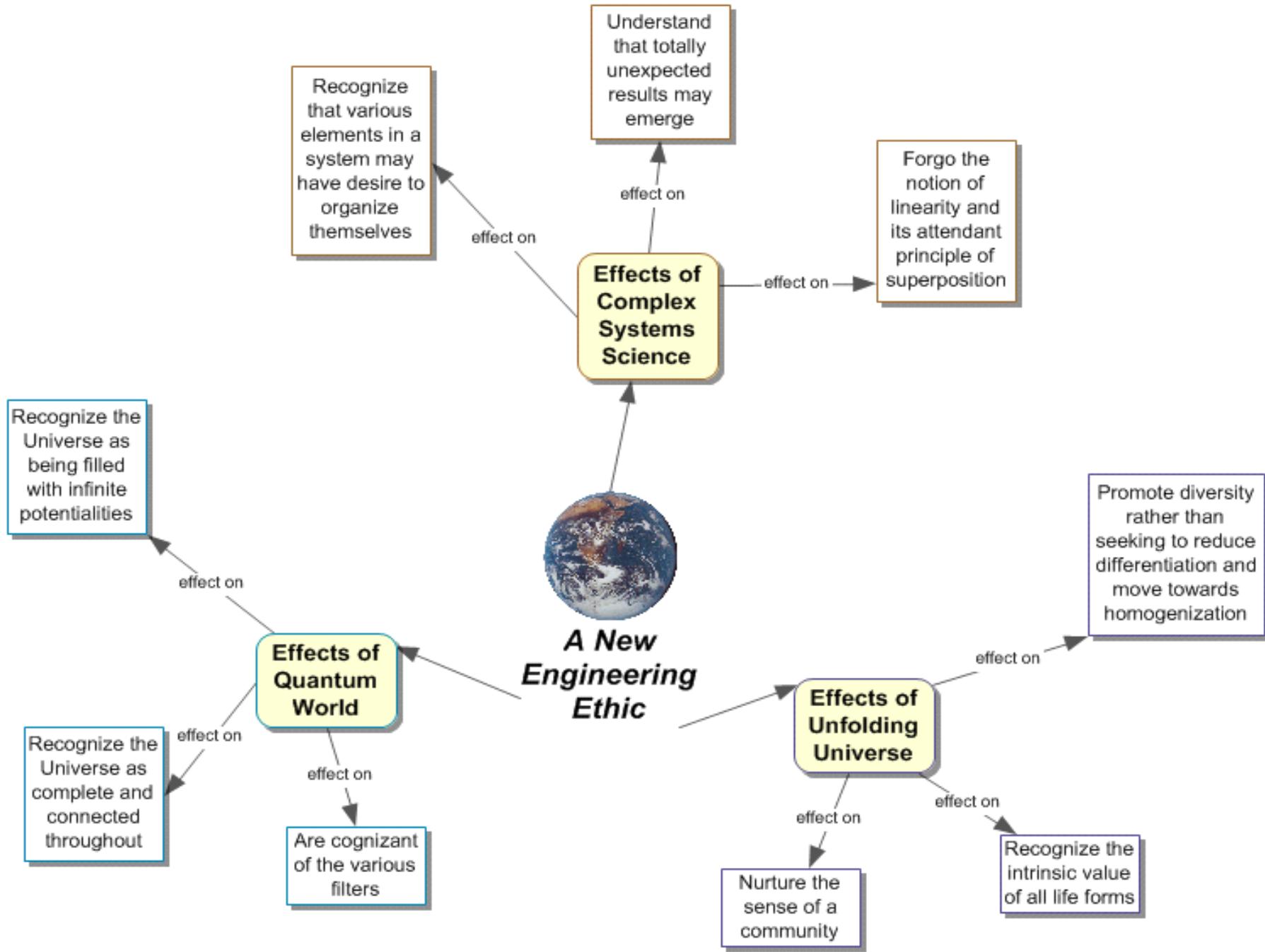
Be cognizant of the various filters through which each of us experiences what we claim to be our reality;

New Ethic

- Forgo the notion of linearity and its attendant principle of superposition, that is, the whole being simply the sum of its parts;
- Understand that a totally unexpected results may emerge from systems no matter how carefully and tightly controlled the systems and the inputs might seem;
- Recognize that various elements in a system may have desire to organize themselves in ways that cannot be anticipated form the outside;

New Ethic

- Promote diversity rather than seeking to reduce differentiation and move towards homogenization;
- Recognize the intrinsic value of all life forms rather than seeking to establish a hierarchy of life forms both across and within species; and
- Nurture the sense of a community rather than seeking to destroy those communities, societies or cultures.



Closing Reflections

- *Reflection1.*

- Have we considered the totality of life forms, their intrinsic worth and their desire to fulfill their individual and unique potentialities in the formulation of our design response?
- And what of the local communities and their culture and their very way of life?

Closing Reflections

- *Reflection 2.*
 - Have we considered the connections between the quality of the marine environment in the Gulf and its impact on the oceans worldwide?
 - What will happen to the millions of gallons of oil that contaminate the Gulf waters? Will they simply go 'away'? Where is 'away' anyway?
 - Are the oceans the equivalents of what we have constructed for our waste removal and disposal on land? Are the oceans equivalent to landfills?

Closing Reflections

- *Reflection 3.*
 - Can we at long last acknowledge in engineering that we do not live in a linear and deterministic Universe in which past, present and future exist with certainty, much like scenes frozen for all time on video tapes or burned on DVDs and that the principle of superposition does not work?

Closing Reflections

- *Reflection 4.*

- Lastly can we reflect upon the importance of the example the Universe sets for us?
- We have identified the laws of differentiation, of subjectivity and of communion and found their existence in this place we experience our lives. Let us reflect upon the opposites.

Final Thoughts

- Thank you for your consideration of my ideas.
- We can and must do better than we have in the past.
- My intent today is to start a dialog.

Asking for Your Reactions

- Apply the new ethic to the following situation..today's attendees.
 - What would it be like today with differentiation & subjectivity only?
 - Differentiation and community?
 - Subjectivity and Community?