It is the theory that decides what we can observe. -- Albert Einstein

http://xkcd.com/638/
spm 9550: Observer Dependence

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Lecture goals

• Give a definition of Observer Dependency
• Understand
  • that each observer has her own world view that determines what and how observations are made
  • how observer dependence interacts with Emergence
  • how observer dependence affects the process of model creation.
Observer dependency

• In a complex adaptive system, the observer cannot be fully separated from the system.
• The observers worldviews affect the way the system is perceived
World views

• is the fundamental cognitive orientation of an individual or society encompassing:
  • Natural philosophy
  • Fundamental existential and normative postulates
  • Values
  • Emotions
  • Ethics

• describes a consistent (to a varying degree) and integral sense of existence
• provides a framework for generating, sustaining, and applying knowledge.

http://en.wikipedia.org/wiki/World_view
World views evolve

- Path dependent development of each persons world-views
  - Your genes
  - Your parents
  - Your education
  - Your interests

- World views are also Adaptive
  - You live, you learn
  - This course has an adaptation of your world views as an explicit goal!
Formalisms as world views

• Remember Mikulecky ?
Complexity is ...

- ...the property of a real world system that is manifest in the inability of any one formalism being adequate to capture all its properties.
- It requires that we find distinctly different ways of interacting with systems.
- Distinctly different in the sense that when we make successful models, the formal systems needed to describe each distinct aspect are not derivable from each other.

Formalisms as world views

- Each observer has her own formalism
- In a scientific setting these can be understood as specific practices, tools, and concepts within a scientific domain

- Concepts and their relations represent
  - a task
  - a procedure for dealing with those concepts and relations.
Objectivity

- "[A]n objective account is one which attempts to capture the nature of the object studied in a way that does not depend on any features of the particular subject who studies it.
- The object has certain properties or behaves in a certain way even if the subject (you as a person) does not see it.

- An objective account is, in this sense, impartial, one which could ideally be accepted by any subject, because it does not draw on any assumptions, prejudices, or values of particular subjects.

- This feature of objective accounts means that disputes can be contained to the object studied." (Gaukroger, 2001, p. 10785).
Problems with objectivity

• Selections and choices made in research are subjective:
  • the specific object to measure is subjectively chosen
  • of instruments (tools) to measure
  • selection of the measurement methodology
  • explaining what certain phenomena mean and imply

• This means that
  • features/qualities of the object will be ignored in the measurement process
  • the limitations of the chosen instruments will cause data to be left out of consideration.

• Total objectivity is arguably not even possible in some, or maybe all, situations.

http://en.wikipedia.org/wiki/Objectivity_%28science%29
Subjectivity

Simply the opposite of Objective?

• Subjectivity requires
  • conscious awareness projected at the object of interest
  • unconscious awareness “indirectly” projected at the object

• Thoughts, perceptions, mental states, feelings are processed in a certain way that vary amongst human beings and result in that an object is perceived in a different way
Problems with subjectivity

- Incommensurability
  - When mental models differ so much between two sides that wish to communicate this might become impossible.

- The discussion on the creation of the earth between creationist and evolution theorists.
  - do not understand each other
  - can't prove each other right or wrong based on the concepts they use.

- “Ownership” of ideas/concepts
Model creation

• If we create a models we make subjective choices
  • Can the created result be objective?
  • Can something subjective be valid?

• Problems caused by incompatible formalisms
  • What is the system?
  • How to decompose it?
  • How do describe the components?
  • etc...
Interaction with Emergence

- What did Crutchfield say about it?
Patterns

• Systems levels are patterns
• Emergence makes novel patterns.

• The intuitive definition of emergence: “something new appears”

• Pattern formation: an observer identifies “organization” in a dynamical system

• Intrinsic emergence: the system itself capitalizes on patterns that appear
  • Patterns building on patterns
Interaction with Emergence

- Observer
  - chooses the level at which to observe
  - chooses the perspective from which to observe
  - recognizes the pattern
  - sees patterns when there are none

SM-on-toast
Post-Normal science

• It focuses on:
  • Uncertainty
  • value loading
  • plurality of legitimate perspectives/worldviews.

• PNS considers these elements as integral to science.

• In more interdisciplinary oriented sciences this attitude is more familiar and accepted.

Relation to traditional science
When solving complex problems

- Where natural science, engineering, social science and policy meet:
  - Traditional paradigms break
  - Clear assumptions are essential
  - Creativity/intuition is required
  - Uncertainties occur
  - Interfaces are required
  - Values *and* facts matter
  - Truth *and* quality are important