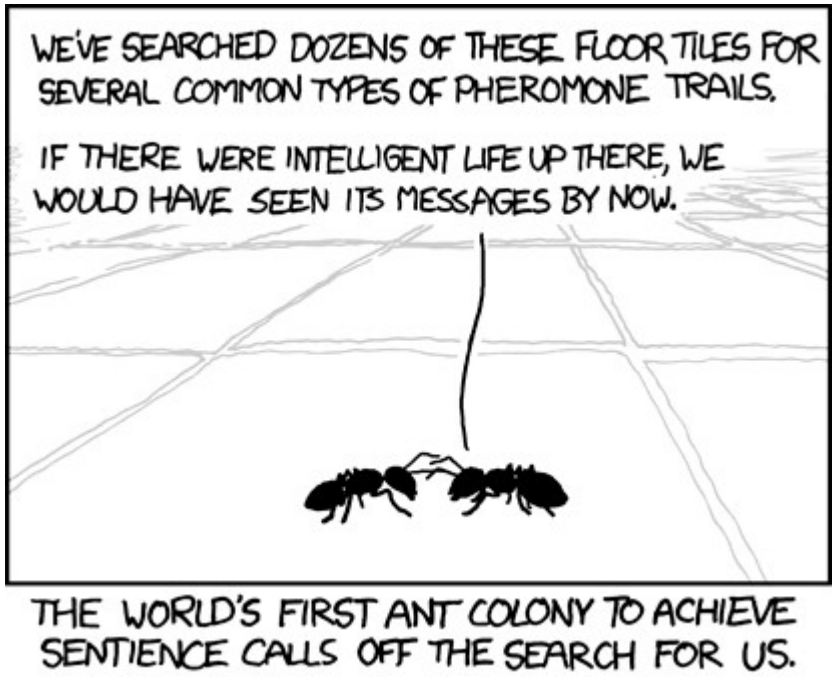
It is the theory that decides what we can observe. -- Albert Einstein



http://xkcd.com/638/

spm 9550:
Observer Dependence

Dr. ir. Igor Nikolic

12-03-10

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.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Observer dependency

- In a complex adaptive system, the observer can not 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.

D.C. Mikulecky. The emergence of complexity: science coming of age or science growing old *Computers and Chemistry*, 25(4):341–348, 2001.

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.

Facilitating the modelling of complex adaptive systems - P.J. Beers, I. Nikolic, P. Bots, G.P.J. Dijkema

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.

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 ?

Crutchfield, James P. and Crutchfield, J. P. (1994) Is Anything Ever New? Considering Emergence

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

Mary-on-toast

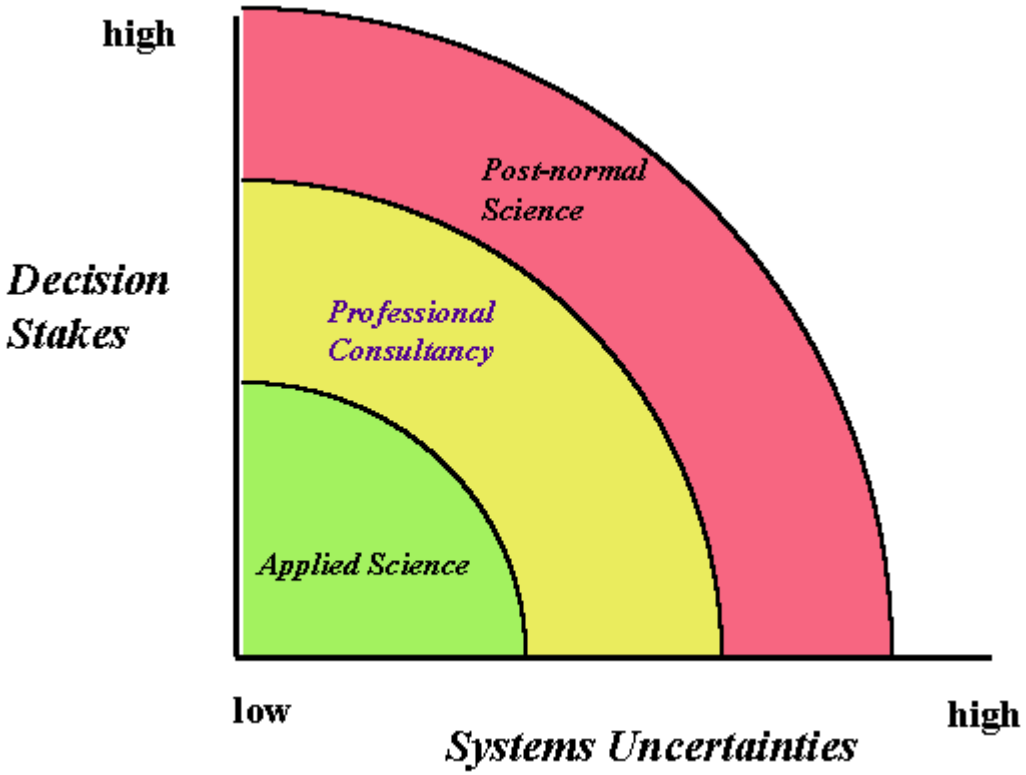
FSM-on-toast

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.

Fntowicz and Ravetz - http://www.www.eoearth.org/article/Post-Normal_Science

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