Scientific models as works

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<http://models.library.arizona.edu/>

Background

Traditional Libraries

- Three fundamentals of the catalog: author, subject, title
- Functions: Identification, Location, Collocation

Digital Libraries

- Resource discovery
- Creating Metadata for all types of objects
 - Anything can be a document – information package that can be described

Challenge

- Neither textual nor conceptual stability can be taken for granted (Wilson, 2002, p.11)
- Support the information retrieval process that accompanies teaching and learning functions/tasks
 - NASA (1988) identified prerequisites for integration of research and model use

Definition of models

Models

- Approx. 15 definitions of the word in OED Online
 - Denotative meaning
 - Connotative meaning
- Scientific Models
 - "A simplified or idealized description or conception of a particular system, situation, or process (often in mathematical terms: so *mathematical model*) that is put forward as a basis for calculations, predictions, or further investigation."
Source: OED Online. (2002)

Questions

- ☛ Are scientific models “works”?
- ☛ What is a scientific model and how can it be represented and retrieved in the library catalog?
- ☛ Information behaviors related to scientific models

Properties of models

- ☛ Reflect reality
- ☛ Small representations of reality
- ☛ Simple representations of process/phenomenon
- ☛ Closed
- ☛ Reality is mathematically modeled
- ☛ Most important features

Study of scientific models

- Science and engineering disciplines
- Works: Intellectual artifacts, Creative process
- Domain: Physical Geography
(Atmosphere, Soils, Water Quality)
- Examined: documents about models on the WWW and content analysis of models in published literature

Scientific models as works

- “A work is the intellectual content of a bibliographic entity; any work has two properties: a) the propositions expressed, which form ideational content and b) expressions of those propositions which form semantic content.”

- Source: Smiraglia, Richard P. (2001)

Physical components

- Texts (articles, bibliographies, reviews, reports, documentation)
- Datasets (data)
- Software (code)
- Services (databases)

Conceptual components

Subject + other

- Focus of research: object, process
- Type of model
- Mathematical functions
- Instrumentation
- Fundamental theory or law
- Replication, revision, modification

What is a scientific model?

Information resource (form & format)

- ☛ 1. Theory or Hypothesis (text file or graphic diagram/image)
- ☛ 2. Observations and Measurements (data sets in various formats)
- ☛ 3. Computer Hardware (descriptions only)
- ☛ 4. Computer Software (this includes actual software executable code, other software essential for running the model code itself)
- ☛ 5. Documentation (technical and user guide that accompanies the software)
- ☛ 6. Animations (images, video)
- ☛ 7. Visualizations (images, video)
- ☛ 8. Reports, Reviews, Annotations, Experiments, Articles (text)
- ☛ 9. Tools (applets, services)
- ☛ 10. Mathematic (algorithmic, numeric notation)
- ☛ 11. FAQs, Mailing Lists/Listservs, Discussion Groups, Events (various)

Scientific Model -Facets

- ☛ **Concept:** is an idea, the traditional subject (for example, calculus of variations)
- ☛ **Object:** the object studied in the model
- ☛ **Discipline:** the major discipline to which this model belongs (may be determined either through author affiliations or other means)
- ☛ **Phenomenon:** the phenomenon being modeled
- ☛ **Process:** the process being modeled
- ☛ **MathRepresentation:** the mathematical functions, equations used
- ☛ **Software:** the software needed to run the model
- ☛ **FundamentalLaw:** the fundamental laws that the model is based upon
- ☛ **Type:** the type of model based on its purpose
- ☛ **Variable:** number, types, conditions, and variables in this model
- ☛ **Problem:** the problem the model is analyzing stated often as a question
- ☛ **Theory:** is there an existing theory or research group to which this model belongs

Relationships

▮ Bibliographic relationships

- Tillett's Taxonomy of Bibliographic Relationships include derivative, equivalence, descriptive, whole-part, accompanying, sequential, and shared characteristic relationships

▮ Subject relationships

- Facet analysis of subjects

Sample models - Water Quality

- Plug flow reactor models (Streeter & Phelps, 1925)
- BOD/DO (Streeter & Phelps, 1925)
- Oxygen-balance model (Streeter & Phelps, 1925)
- QUAL models (current version, Brown & Barnwell, 1987)
- QUAL 11

Constitutive Models

Search terms & strategy	Sampling Frame	Number of hits & search date
CM – Subject	OCLC	9 (10/01)
CM – Google	WWW	35, 200
CR – Subject	OCLC	2
CR – Keyword	OCLC	33
Above	Sabio	0

More questions

- ☛ What are shared characteristics of scientific models?
 - How can they be used to sort and display results in library catalogs?
- ☛ Which bibliographic relationships do representations about model replications best fit?
- ☛ What's the difference between a work and a concept? (Identifying boundaries)

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