



Cornell University

The Past, Present, and Future (!) of Science Communication Research

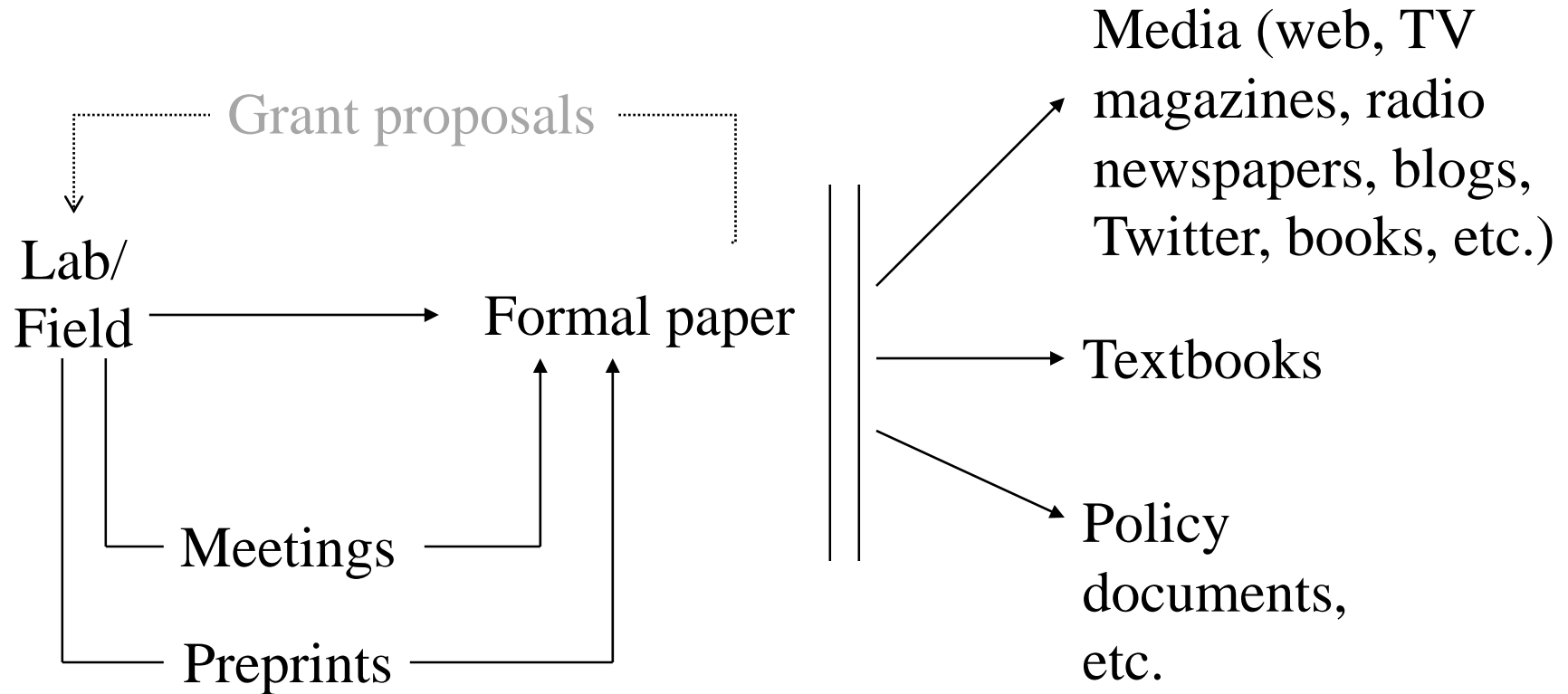
Bruce V. Lewenstein

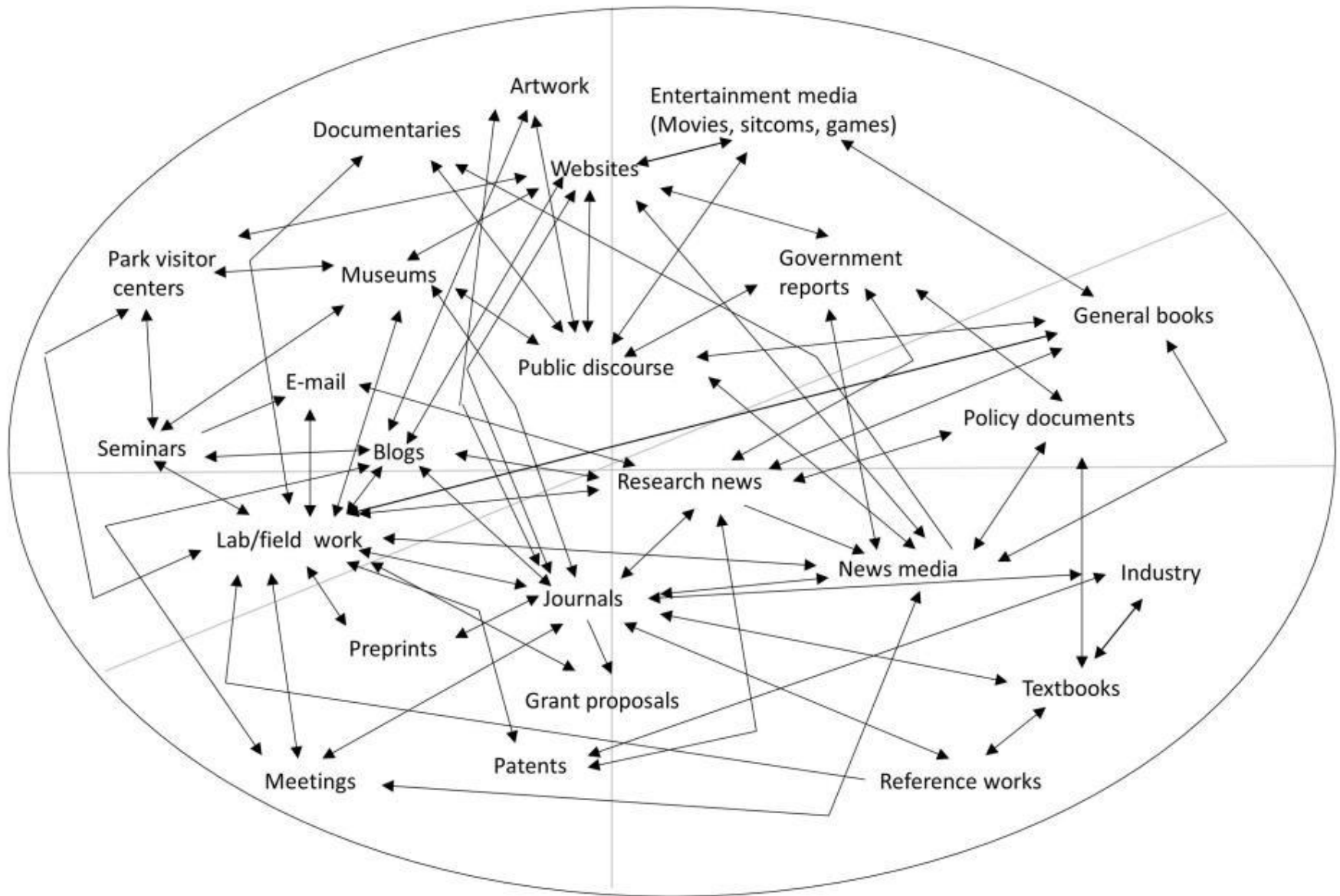
Professor of Science Communication

Cornell University

Ithaca, NY 14853 USA

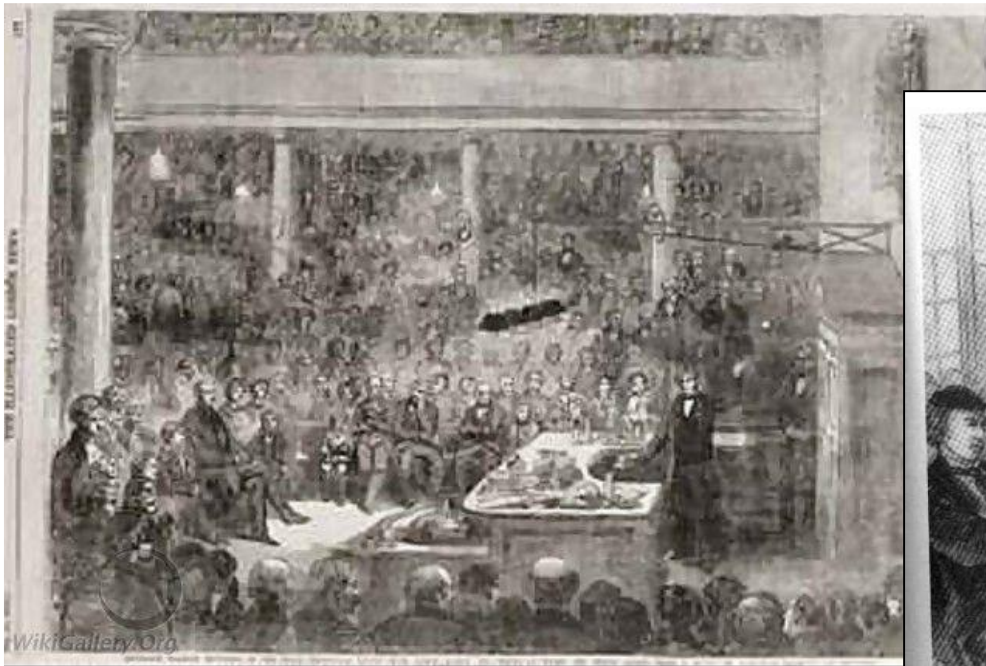
Is this science communication?





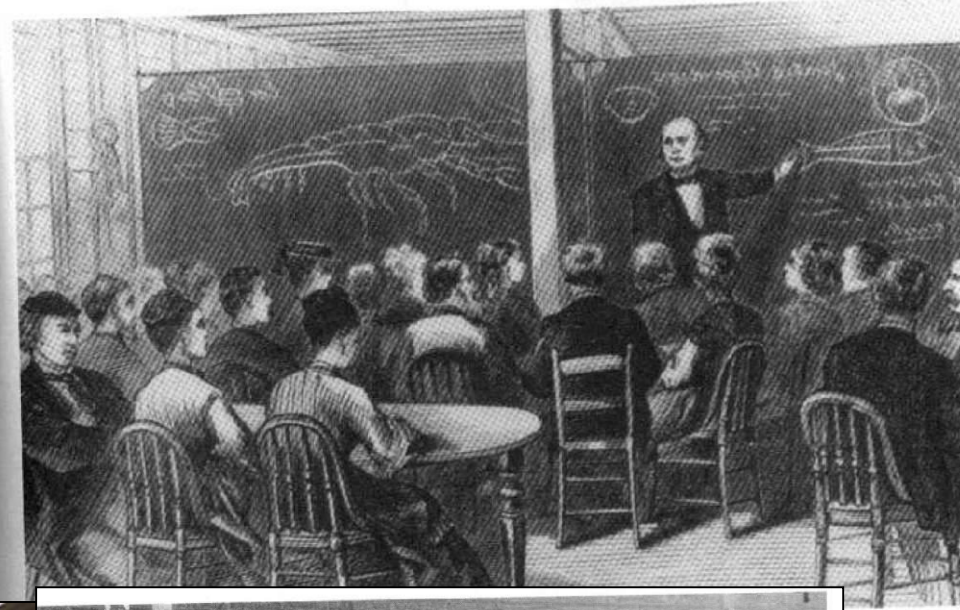
Sphere of Science Communication

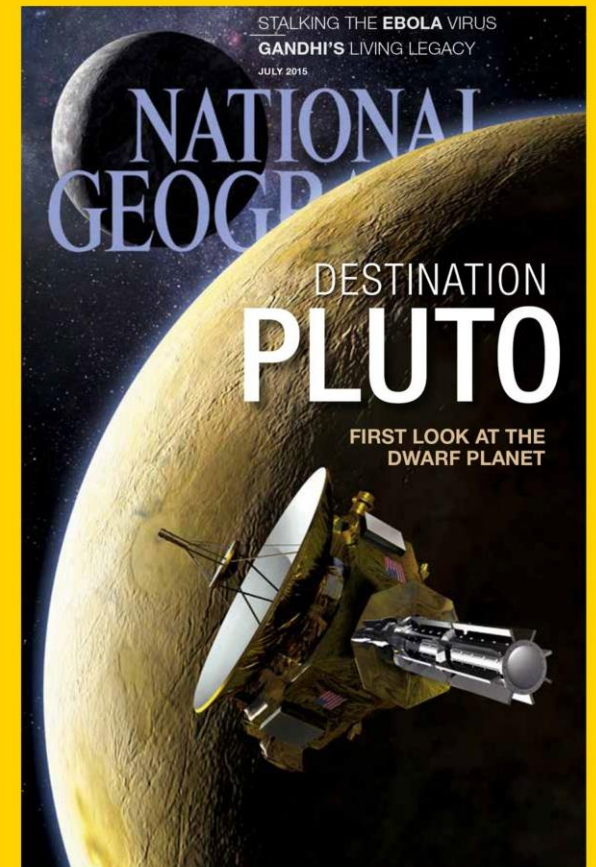
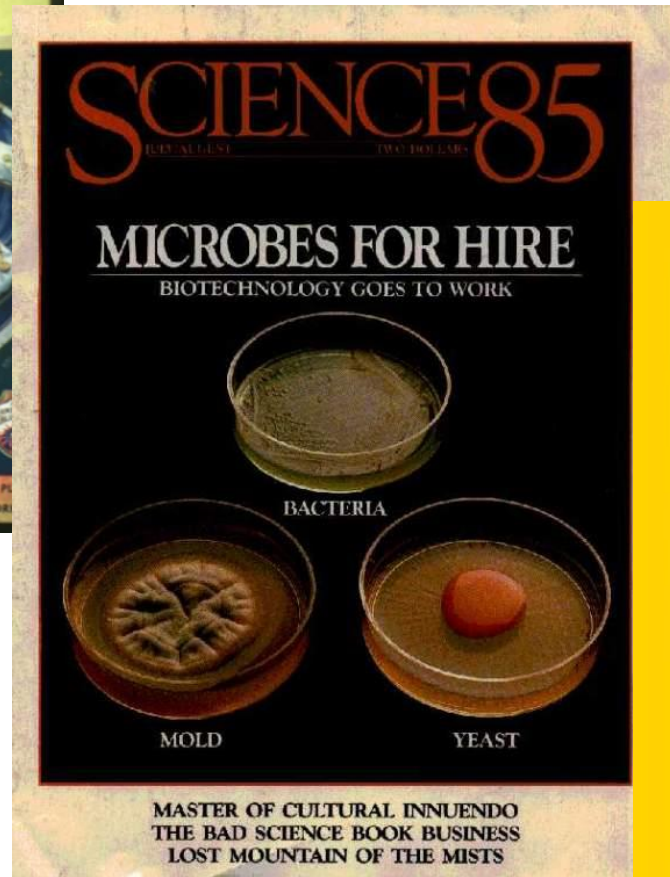
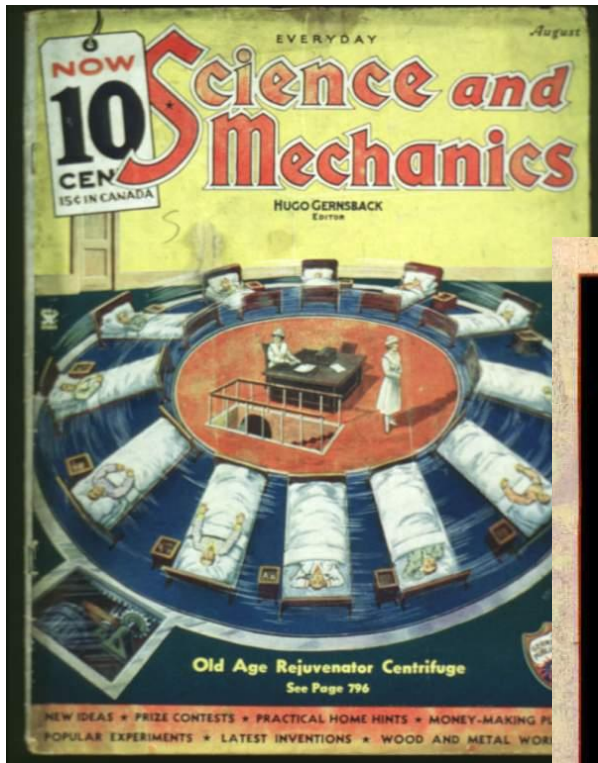
From: Lewenstein, Bruce V. (2011). Experimenting with Engagement. Commentary on "Taking Our Own Medicine: On an Experiment in Science Communication." *Science And Engineering Ethics*, 17(4), 817-821.



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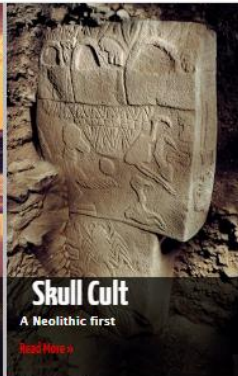


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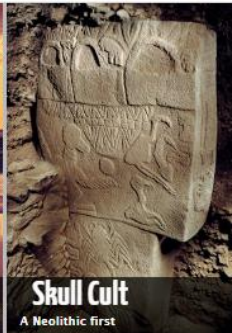
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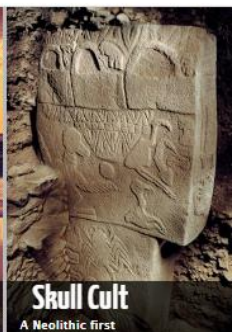
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Twitter interface showing the NASA profile page.

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nasa.gov
Joined December 2007
Born on October 1, 1958

Tweets 47.9K Following 265 Followers 24.9M Likes 2,645 Lists 9 Moments 9

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Drizzle or rain? We're studying how to improve short-term weather forecast accuracy & long-term model projections: go.nasa.gov/2hvvq8m

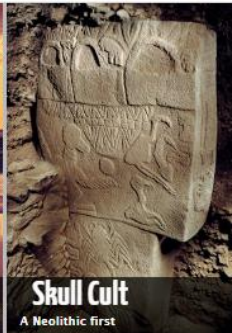
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695 posts 719k followers 138 following

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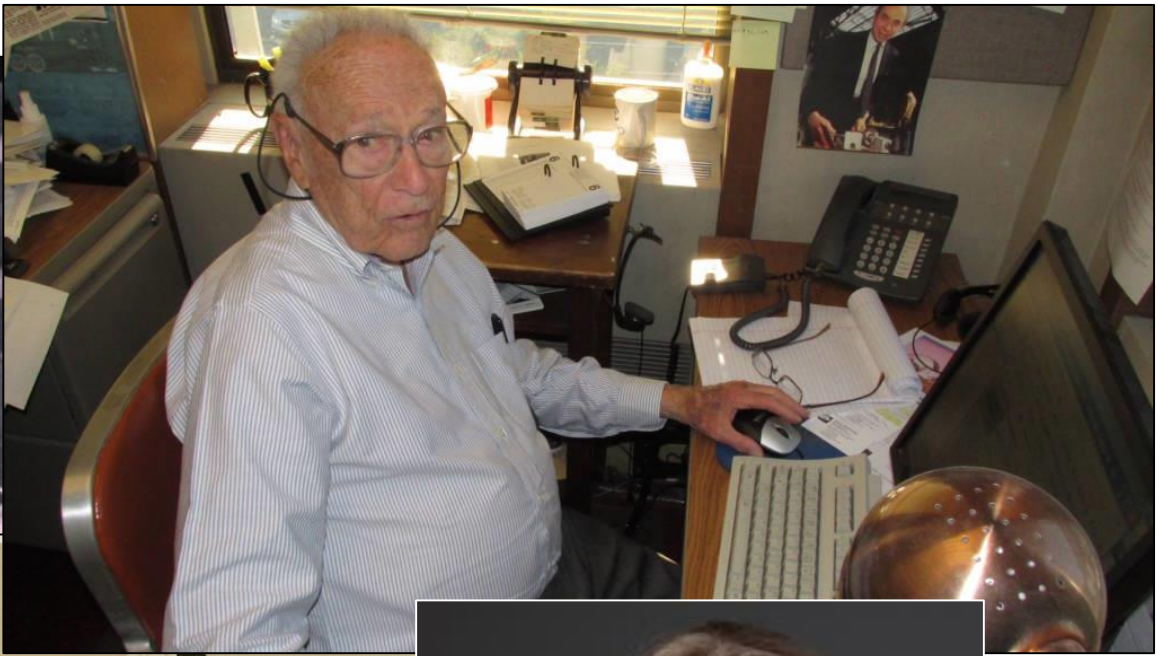
- National Geographic
- Barack Obama
- ESA

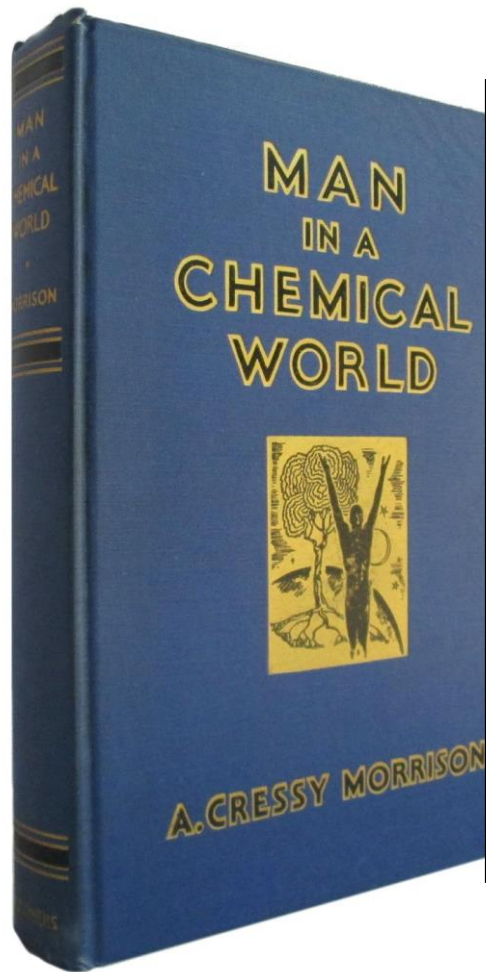




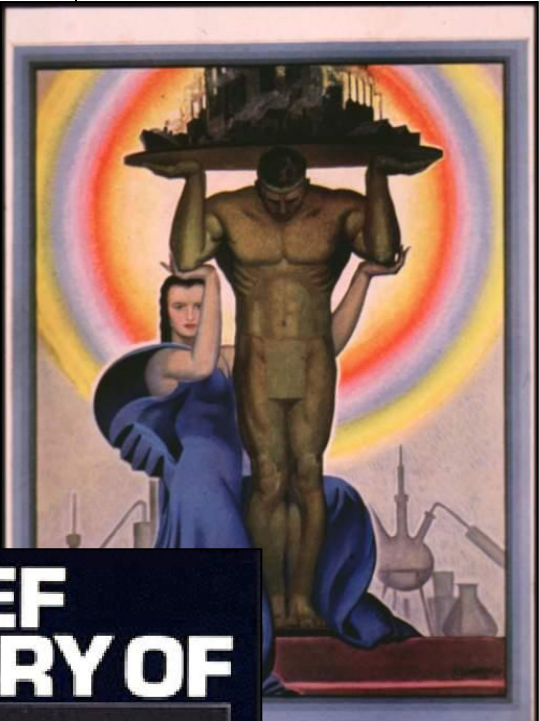
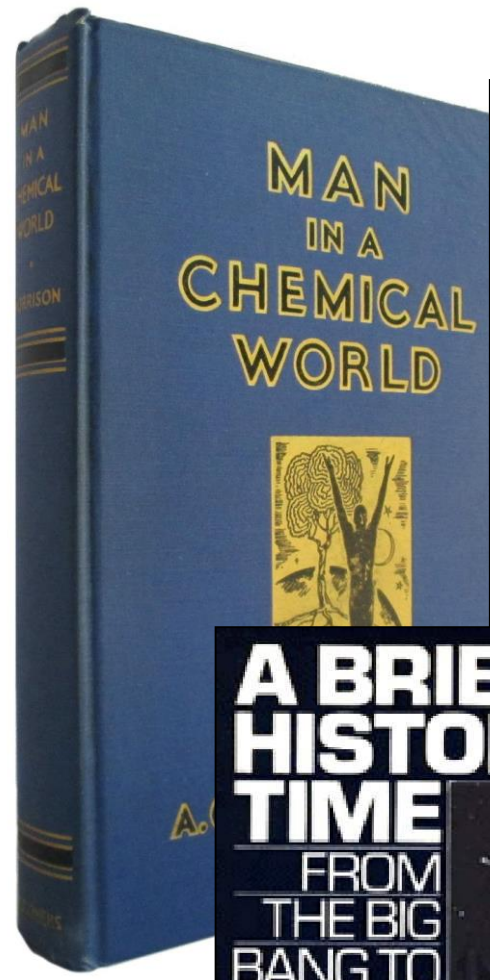








CHEMICAL INDUSTRY, UPHOLD BY PURE SCIENCE, SUSTAINS THE PRODUCTION OF MAN'S NECESSITIES



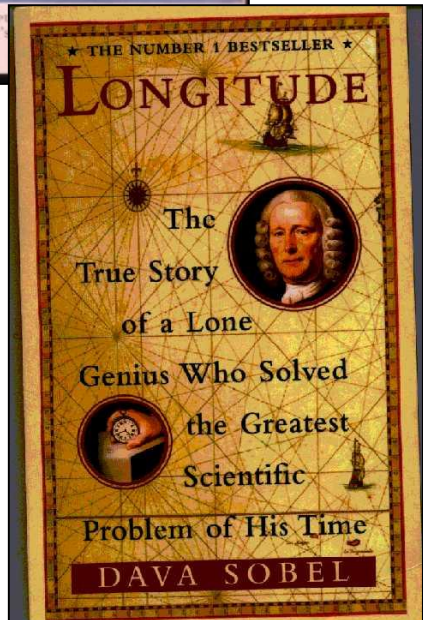
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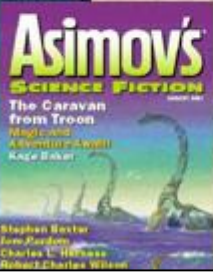
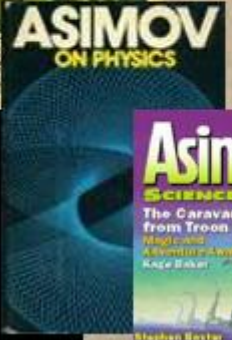
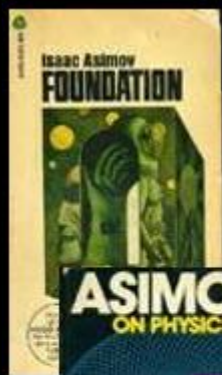
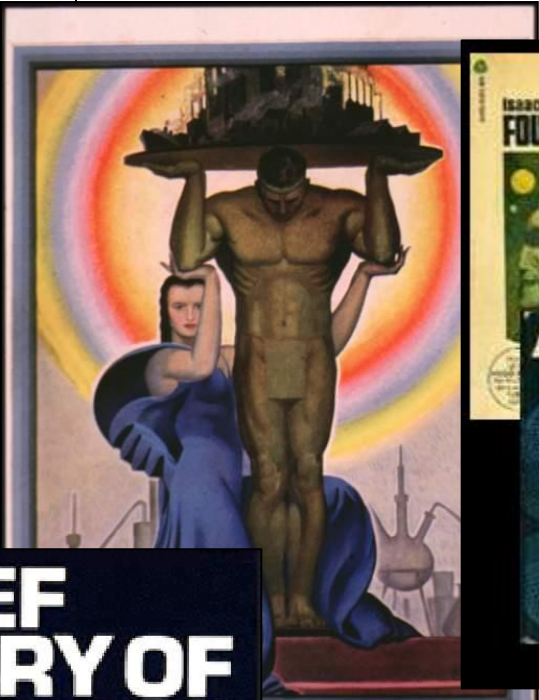
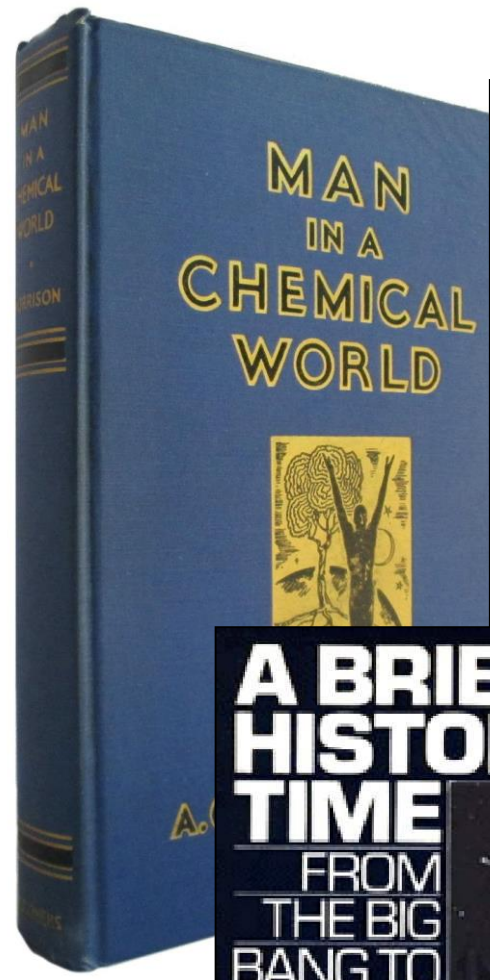
FROM THE BIG BANG TO BLACK HOLES



STEPHEN W. HAWKING

WITH AN INTRODUCTION BY CARL SAGAN

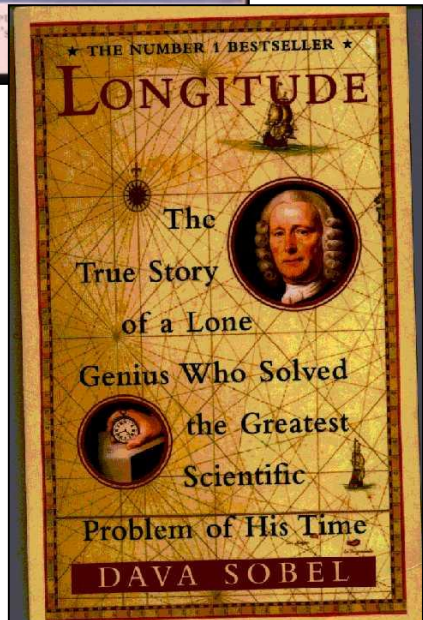


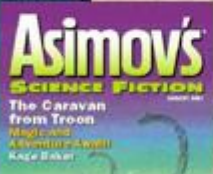
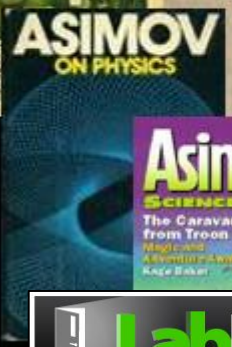
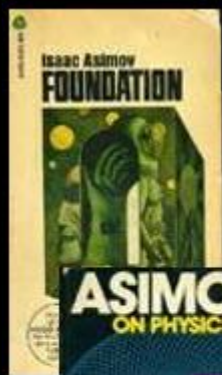
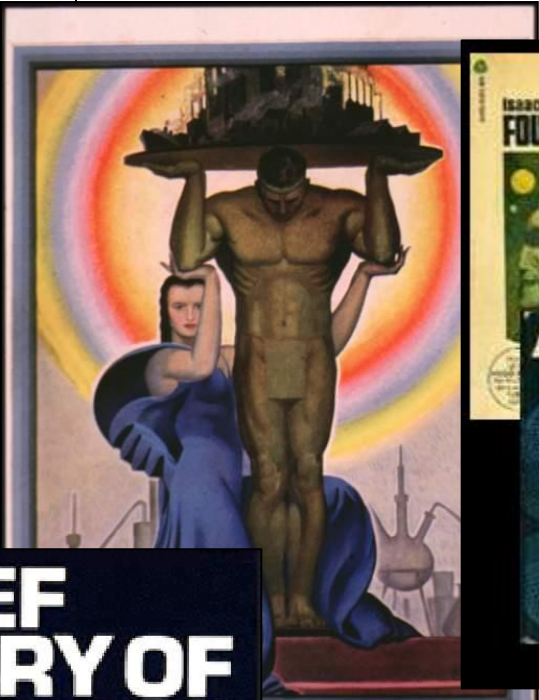
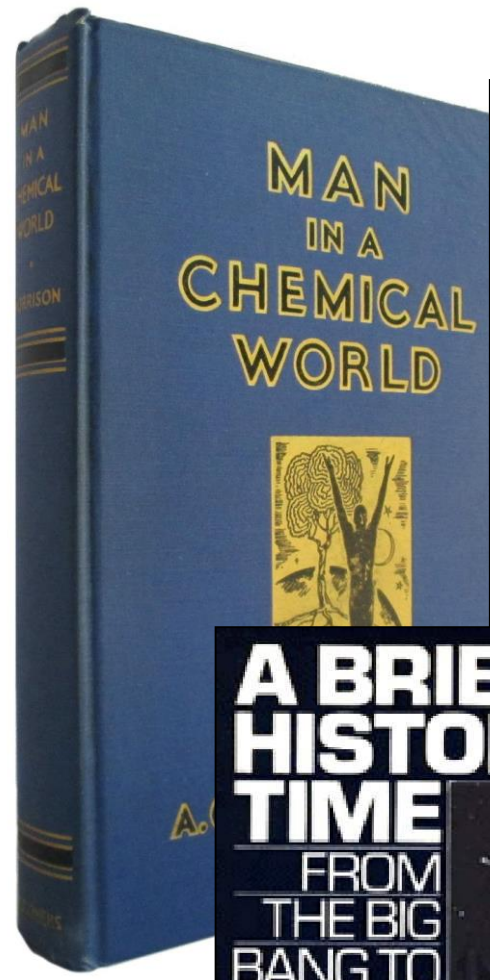


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FROM THE BIG BANG TO BLACK HOLES



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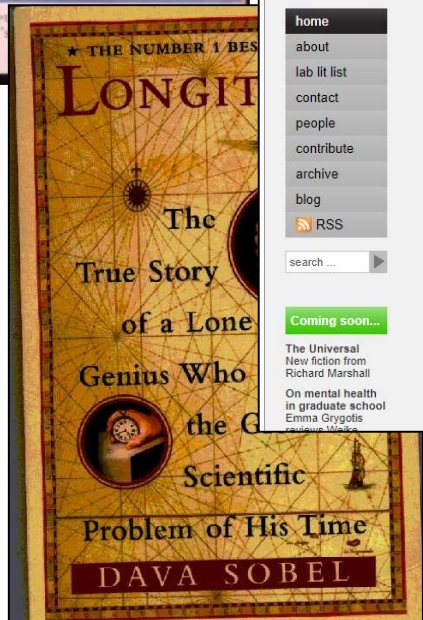




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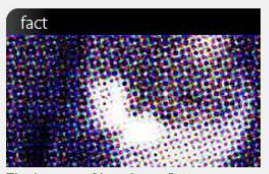
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- home
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He's just too French!
Fiction: by Helen-Frances Pilkington
"Many would hold that fools and buffoons are synonymous"



The League of Imaginary Cats
Editorial: A new series inspired by real science
"While it is very easy to criticize, it is much harder to create"

Coming soon...

The Universal
New fiction from
Richard Marshall
On mental health
in graduate school
Emma Grygolis

The discovery of insulin
Science at its finest
Fiction: Rebecca Nesbit

Zero
Musings about nothing
Poetry: Richard P. Grant

Fiction as environmental lobby
Coffin Road by Peter May
Review: Rebecca Nesbit

Evanescence
From the LabLit science verse series
Poetry: Peter Roberts



Deutsches Museum, Munich



Chicago Museum of Science & Industry

Franklin Institute, Philadelphia





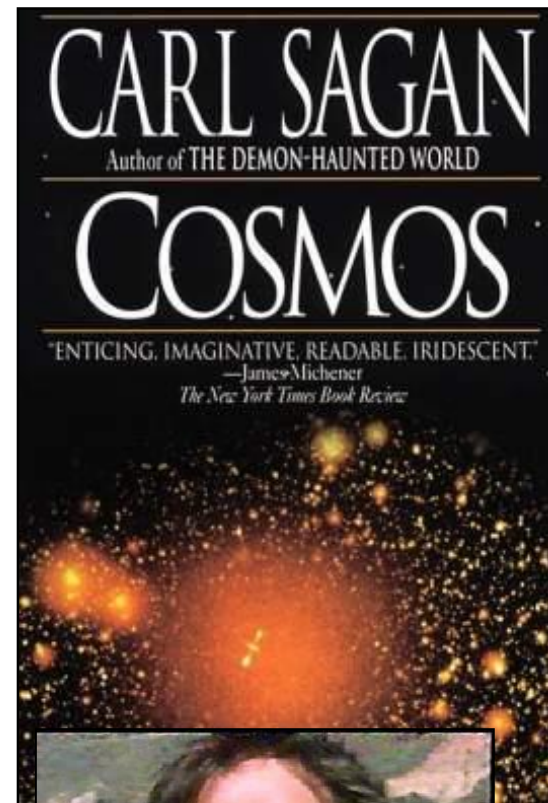
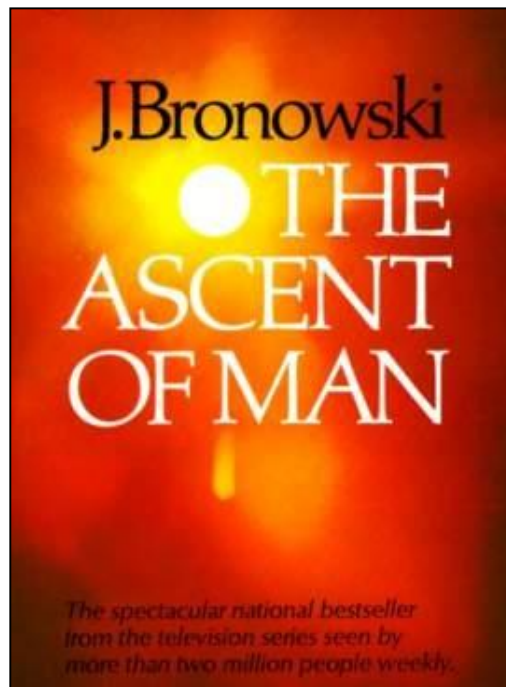
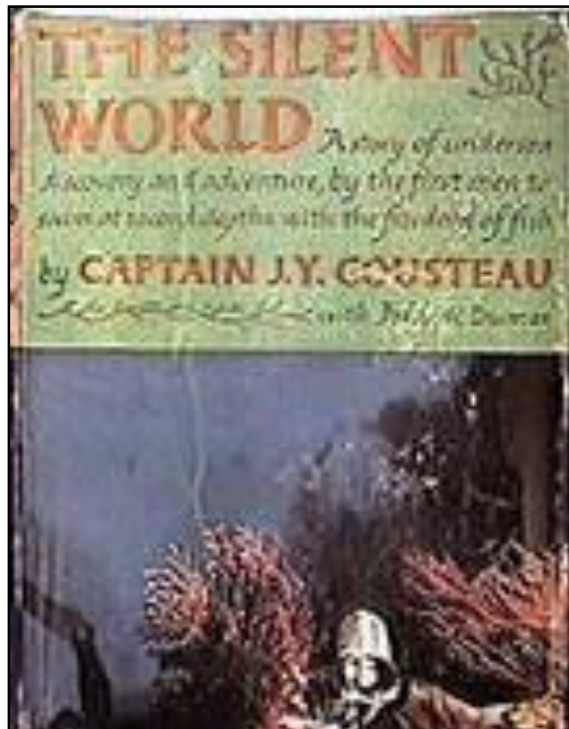
New Exploratorium at Pier 15 - View from the Embarcadero
Photo Courtesy of ZDM | zumlle.com

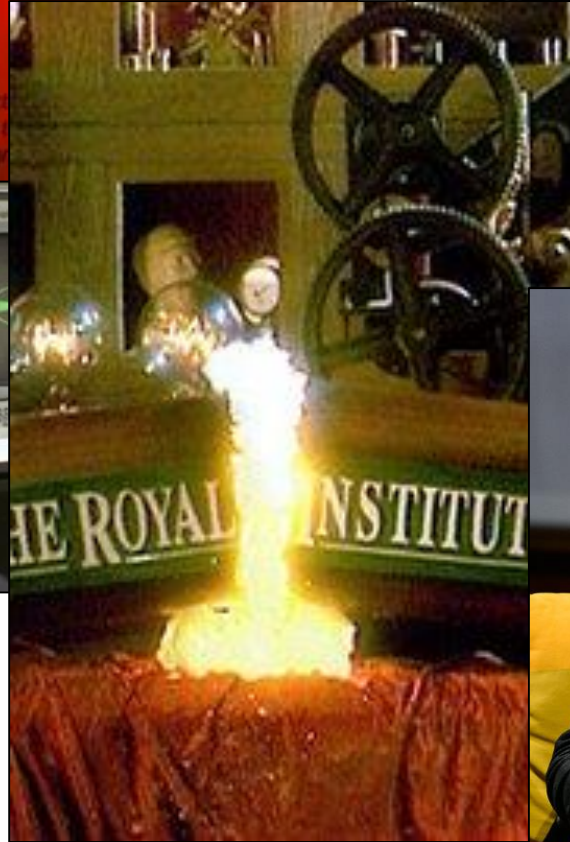
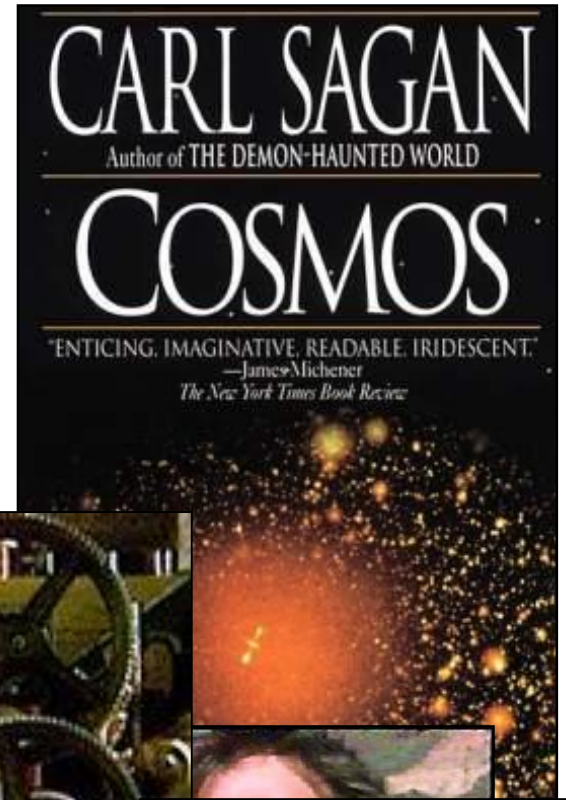
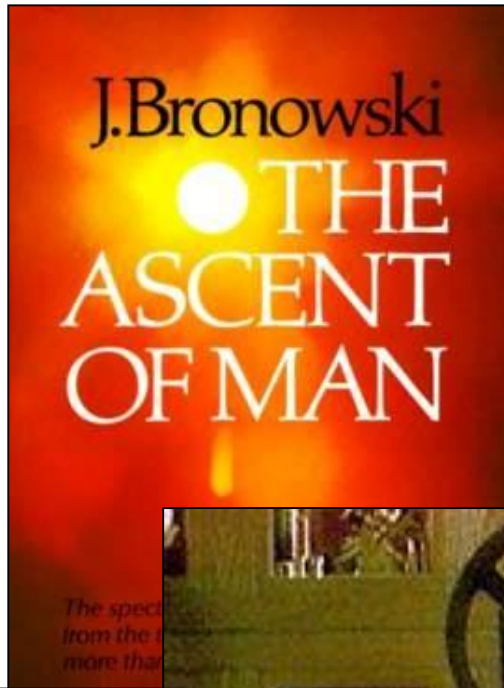
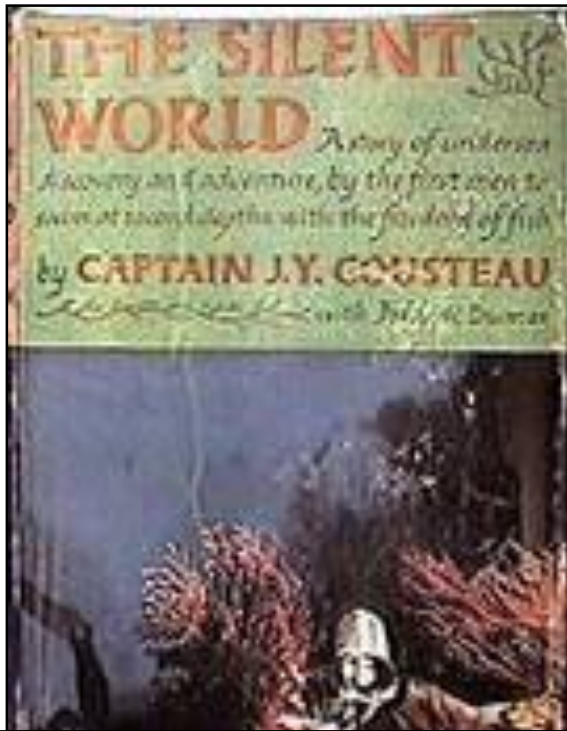


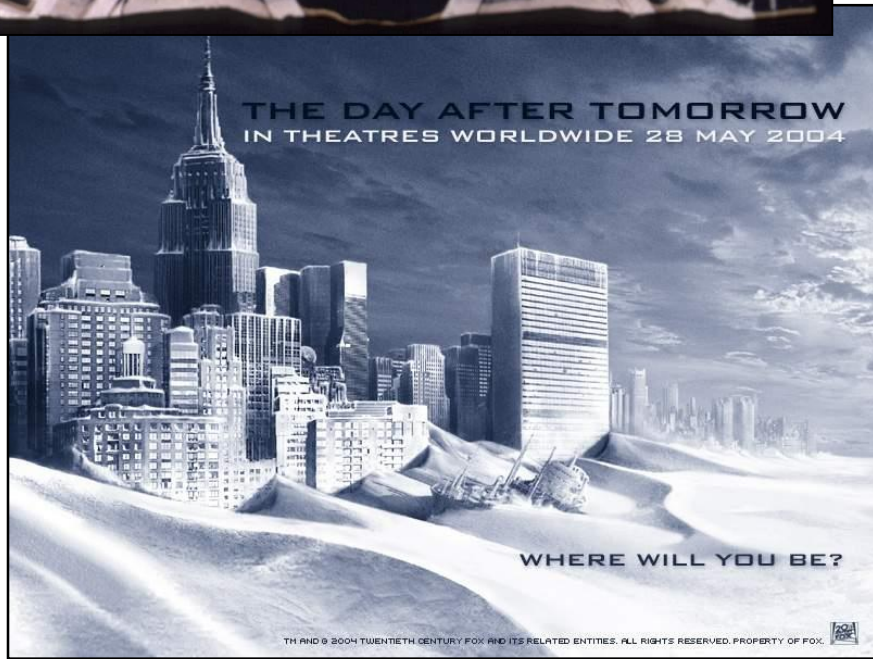


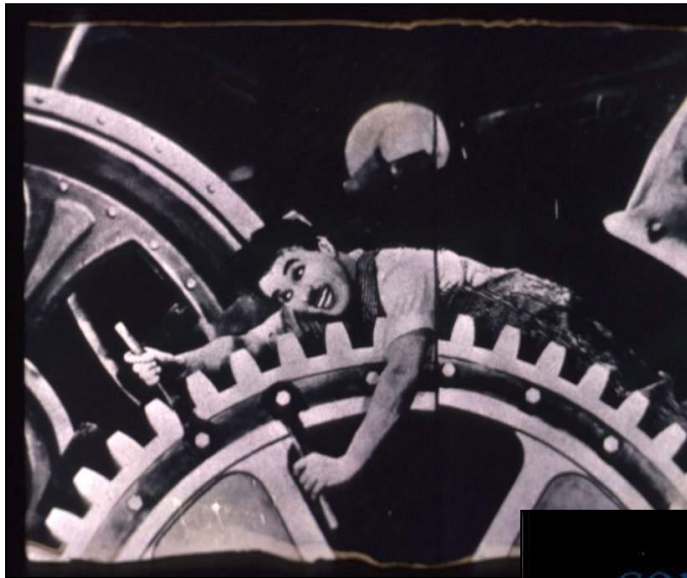
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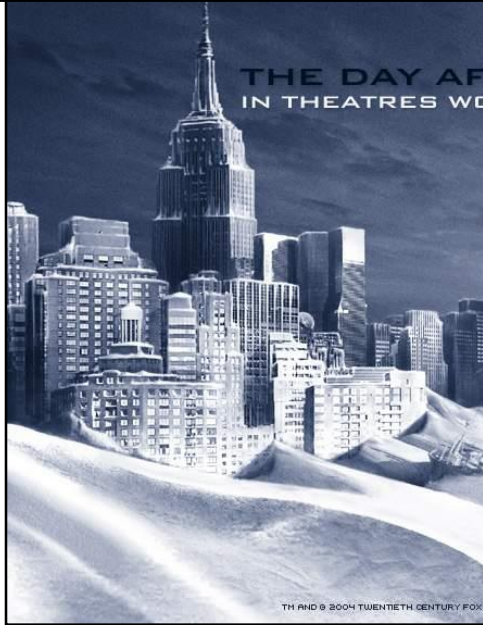




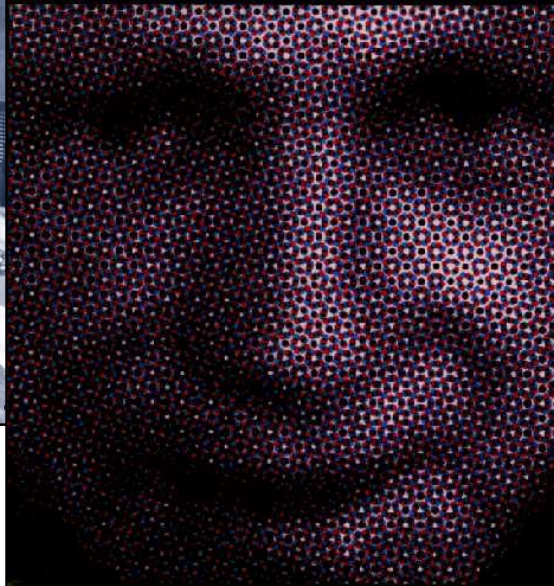


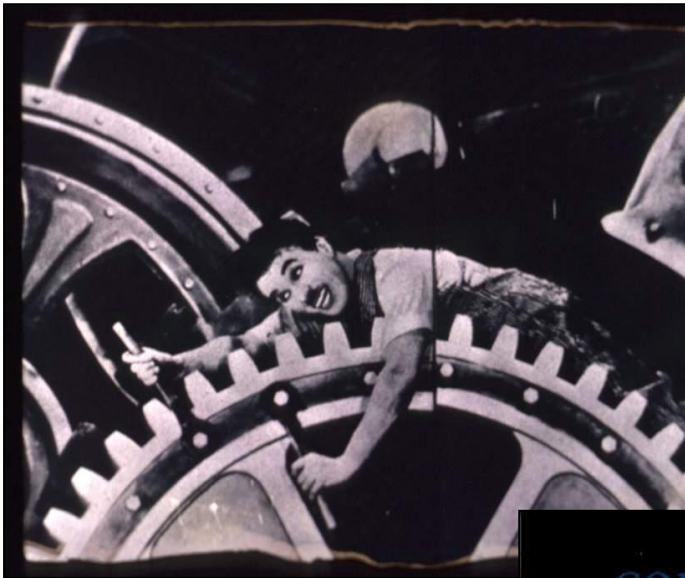


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THEORY

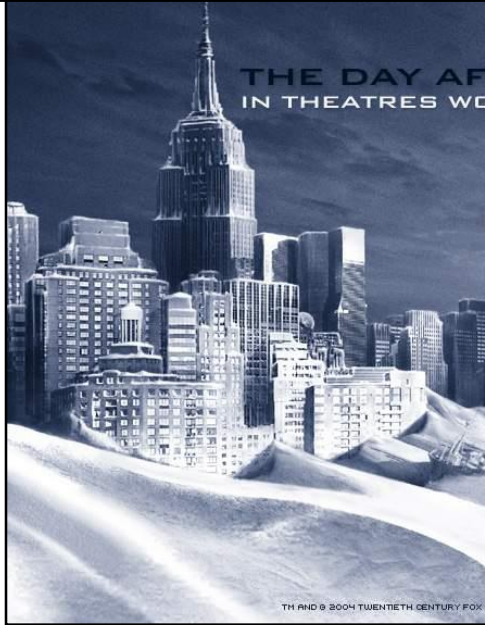


COPENHAGEN
Michael Frayn





the **BiG**
BANG
THEORY



COPENHAGEN
Michael Frayn



Issues in PCST, 1

- ◆ Defining “it,” whatever “it” is, before we can do research
 - Science literacy
 - Public understanding of S&T
 - Public awareness of S&T
 - Public engagement in S&T
 - Public communication of S&T
 - *Culture scientifique*
 - *Apropiación social de la ciencia*



Issues in PCST, 2

- ◆ What is the topic?
 - Basic information/education about S&T
 - Breaking news about S&T
 - Information about social/political issues involving S&T
 - Entertainment *using* S&T
 - » Or *using* entertainment for the first three items on the page?



Issues in PCST, 3

- ◆ Understanding audience needs and interests
 - Information, education, and entertainment
 - People focus or science focus?



Issues in PCST, 4

◆ Institutional needs

- Media (journalism): attract audience, sell ads
- Media (entertainment): attract audience, sell tickets
- Museums: attract audience, sell admissions
- Scientists: recruit young people, get money from government

[Notice the pattern?]



What's missing?



What's missing?



What's missing?



The past and (almost) present of research

| | Public Understanding of Sci Science Literacy PCST Public Engagement | History of Science | Social studies of science | Science education | Science journalism | (Science) museums | Visitor studies | Risk Comm | Other (including extension, environmental comm, public health comm, citizen science) |
|----------|---|---|---|---|--|---|--|---|--|
| Pre 1940 | | | | | Dietz (1937) | Goode (1889) | <i>[There is a pre-history; see Etggood and Loomis (2012); and</i> | | |
| 1940s | | | | | Krieghbaum (1940) | | | | |
| 1950s | Davis (1958) | | | Hurd (1958) | | | | | |
| 1960s | | | Holton (1965) Ziman (1968) | | Krieghbaum (1967) | | Shettel et al (1968) Screven (1969) | | Griffiths & Knutson (1960) |
| 1970s | Shen (1975) Goodell (1977) <i>1979: NSS studies begin</i> | Tobey (1971) Shapin (1974) Shapin & Barnes (1977) Kevles (1977) | Holton (1974) Garvey (1979) Meltner (1979) | | LaFollette (1979/1991) | | <i>[Rapid growth from mid-1970s]</i> | | Hungerford & Lemert (1973) Schoenfeld et al. (1979) |
| 1980s | Miller (1980, 1983) Bodmer (1985) <i>1989: 1st CSP conference (Paris)</i> | Turner (1980) Cooter (1984) Rydell (1984) Sheets-Pyenson (1985) Boyer (1985) Secord (1985) Burnham (1987) Bensaude-Vincent | Shinn & Whitley (1985); Clemens (1986) Collins (1987, 1988) Wynne (1989) | Roberts (1983) | Dunwoody (1980) LaFollette (1981) Friedman, Dunwoody, Rogers (1986) Nelkin (1987) Lewenstein (1987) | | <i>[1988: First Visitor Studies conference]</i> | Douglas & Wildavsky (1982) Slovic (1987) National Research Council (1989) | |
| 1990s | <i>1992: PubSci begins</i> Lewenstein (1992) Schiele et al. (1994) <i>1994: PCST Montreal</i> <i>1994: Knowledge--SciComm</i> | Secord (1994) Cooter & Pumfrey (1994) | Hilgartner (1990) Ziman (1991) Irwin (1995) Irwin & Wynne (1996) | DeBoer (1991) Jenkins (1994) Falk & Dierking (1998) | | H. Hein (1990) Macdonald (1992) Falk (1992) G. Hein (1990) | | Beck (1992) | |
| 2000s | Chen et al. (2006) Bucchi & Trench (2008) | Lightman (2007) | | Roth & Calabrese Barton (2004) Abell & Lederman (2007) Bell et al. (2009) | Bauer & Bucchi (2007) | | | Pidgeon et al. (2003) | Brossard et al. (2005) |
| 2010s | Fischhoff & Scheufele (2013) Bucchi & Trench (2014) Snow et al. (2016) | | Rodder et al. (2012) | | <i>[Do social media studies belong here?]</i> | Rader and Cain (2016) | | | Bonney et al. (2016) |



| | PCST | Hist Sci | SSS | Sci Ed | Sci jour | Sci mus | Vis stud | Risk Comm | Other |
|-------------|------|--------------|-------|--------|-------------|------------|-------------|--------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxx | | x | | xx | | x |
| 1970s | xxx | xxxx | xxx | | x | | xx | | xx |
| 1980s | xxxx | xxxxx xxx | xxxxx | x | xxxxx | | xx | xxxx | xx |
| 1990s | xxxx | xxx | xxxx | xxx | xxxx | xxxx | xx | xxxx | xx |
| 2000s | xxxx | xxx | xxx | xxx | xxxx | | xx | xxxx | xx |
| 2010s | xxxx | xxx | xxx | xxx | xxxx | x | xx | xxxx | xx |

Major categories of literature

- ◆ Public comm of S&T (PCST)
- ◆ History of science
- ◆ Social studies of science
- ◆ Science education
- ◆ Science journalism
- ◆ Science museums
- ◆ Visitor studies
- ◆ Risk communication
- ◆ Environmental, health, citizen science, etc.



History of science

| | PCST | Hist Sci | SSS | Sci Ed | Sci Jour | Sci mus | Vis stud | Risk Comm | Other |
|-------------|------|-------------|-------|--------|-------------|------------|-------------|--------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxx | | x | | xx | | x |
| 1970s | xxx | xxxx | xxx | | x | | xx | | xx |
| 1980s | xxxx | xxxxx | xxxxx | x | xxxxx | | xx | xxxx | xx |
| 1990s | xxxx | xxxx | xxxx | xxx | xxxx | xxxx | xx | xxxx | xx |
| 2000s | xxxx | xxx | xxx | xxx | xxxx | | xx | xxxx | xx |
| 2010s | xxxx | xxx | xxx | xxx | xxxx | x | xx | xxxx | xx |

- ◆ Public context for development of systematic research in 19th century
- ◆ Public responses to science issues in 20th century
- ◆ Many cases of scientists interacting with publics as scientists sought resources and authority



Social studies of science

| | PCST | Hist Sci | SSS | Sci Ed | Sci jour | Sci mus | Vis stud | Risk Comm | Other |
|-------------|-------|-------------|---------|--------|-------------|------------|-------------|--------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxxx | | x | | xx | | x |
| 1970s | xxxx | xxxxx | xxxx | | x | | xx | | xx |
| 1980s | xxxxx | xxxxxx | xxxxxxx | x | xxxxxx | | xx | xxxxx | xx |
| 1990s | xxxxx | xxxx | xxxxx | xxxx | xxxxx | xxxxx | xx | xxxxx | xx |
| 2000s | xxxxx | xxxx | xxxx | xxxx | xxxxx | | xx | xxxxx | xx |
| 2010s | xxxxx | xxx | xxxx | xxxx | xxxxx | x | xx | xxxxx | xx |

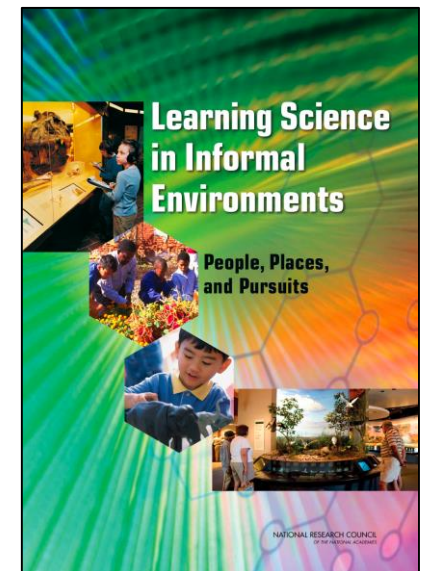
- ◆ Science as public knowledge
- ◆ Mechanisms of public display to create knowledge
- ◆ Political uses of knowledge display; public knowledges vs. expert knowledge
- ◆ Acquisition of authority by new groups (citizen science, responsible research and innovation); Shaping of research by demands of public science (medialization)



Science education

| | PCST | Hist Sci | SSS | Sci Ed | Sci jour | Sci mas | Via stud | Risk Comm | Other |
|-------------|------|-------------|------|--------|-------------|------------|-------------|--------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxxx | | x | | xxx | | x |
| 1970s | xxxx | xxxx | xxxx | x | x | | xx | | xx |
| 1980s | xxxx | xxxx | xxxx | x | xxxx | | xx | xxxx | xx |
| 1990s | xxxx | xxxx | xxxx | xxxx | xxxx | xxxx | xx | xxxx | xx |
| 2000s | xxxx | xxxx | xxxx | xxxx | xxxx | | xx | xxxx | xx |
| 2010s | xxxx | xxxx | xxxx | xxxx | xxxx | x | xx | xxxx | xx |

- ◆ 1958: 1st definition of science literacy
- ◆ Occasional attempts to define
- ◆ Since 2000s: Adding “informal science education” to educational research
- ◆ “Learning science in informal environments”



Science journalism

| | PCST | Hist Ser | SSS | Sci Ed | Sci Jour | Sci Mus | Vis stud | Risk Comm | Other |
|----------|------|----------|--------|--------|----------|---------|----------|-----------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxx | | x | | xx | | x |
| 1970s | xxx | xxxx | xxx | | x | | xx | | xx |
| 1980s | xxxx | xxxxxx | xxxxxx | x | xxxxxx | | xx | xxxx | xx |
| 1990s | xxxx | xxx | xxxx | xxx | xxxx | xxxx | xx | xxxx | xx |
| 2000s | xxxx | xxx | xxx | xxx | xxxx | | xx | xxxx | xx |
| 2010s | xxxx | xxx | xxx | xxx | xxxx | x | xx | xxxx | xx |

- ◆ Institutional contexts and forces
 - Differences between scientists and journalists
- ◆ Distribution of topics: change over time
- ◆ Accuracy
 - Sins of omission rather than commission
- ◆ Creation and training of (science) journalists
 - Identification with scientific community



It's okay, Pluto.



I'm not a Planet either.

Science museums

| | PCST | Hist Sci | SSS | Sci Ed | Sci jour | Sci mus | Vis stud | Risk Comm | Other |
|-------------|-------|-------------|--------|--------|-------------|------------|-------------|--------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxx | | x | | xxx | | x |
| 1970s | xxx | xxxx | xxx | | x | | xxx | | xxx |
| 1980s | xxxx | xxxxx | xxxxxx | x | xxxxxx | | xxx | xxxx | xxx |
| 1990s | xxxxx | xxxx | xxxxxx | xxx | xxxxxx | xxxxxx | xxx | xxxxx | xxx |
| 2000s | xxxxx | xxxx | xxxx | xxx | xxxxxx | | xxx | xxxxx | xxx |
| 2010s | xxxxx | xxxx | xxx | xxx | xxxx | x | xxx | xxxxx | xxx |

- ◆ Eternal tension between research and education
- ◆ Relation of knowledge display to knowledge production
- ◆ Changing audiences



Visitor studies

| | PCST | Hist Sci | SSS | Sci Ed | Sci jour | Sci mus | Vis stud | Risk Comm | Other |
|-------------|------|---------------|--------|--------|-------------|------------|-------------|--------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxx | | x | | xxx | | x |
| 1970s | xxx | xxxx | xxx | | x | | xxx | | xxx |
| 1980s | xxxx | xxxxxx xxx | xxxxxx | x | xxxxxx | | xxx | xxxx | xxx |
| 1990s | xxxx | xxx | xxxx | xxx | xxxx | xxxx | xxx | xxxx | xxx |
| 2000s | xxxx | xxx | xxx | xxx | xxxx | | xxx | xxxx | xxx |
| 2010s | xxxx | xxx | xxx | xxx | xxxx | x | xxx | xxxx | xxx |

- ◆ Free choice
- ◆ Importance of families/groups
- ◆ Interactivity
- ◆ Attention to social diversity



Risk communication

| | PCST | Hist Sci | SSS | Sci Ed | Sci jour | Sci mus | Vis stud | Risk Comm | Other |
|-------------|------|--------------|-------|--------|-------------|------------|-------------|--------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxx | | x | | xxx | | x |
| 1970s | xxx | xxxx | xxx | | x | | xxx | | xxx |
| 1980s | xxxx | xxxxx xxx | xxxxx | x | xxxxx | | xxx | xxxx | xxx |
| 1990s | xxxx | xxx | xxxx | xxx | xxxx | xxxx | xxx | xxxx | xxx |
| 2000s | xxxx | xxx | xxx | xxx | xxxx | | xxx | xxxx | xxx |
| 2010s | xxxx | xxx | xxx | xxx | xxxx | x | xxx | xxxx | xxx |

- ◆ Psychological components: trust, fear/dread, knowledge
- ◆ Social amplification and attenuation of risk
- ◆ In case you missed it: *Trust!*



Other: Environmental comm, health comm, citizen science

| | PCST | Hist Sci | SSS | Sci Ed | Sci jour | Sci mus | Vis stud | Risk Comm | Other |
|-------------|------|--------------|-------|--------|-------------|------------|-------------|--------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxx | | x | | xxx | | x |
| 1970s | xxx | xxxx | xxx | | x | | xxx | | xxx |
| 1980s | xxxx | xxxxx xxx | xxxxx | x | xxxxx | | xxx | xxxx | xxx |
| 1990s | xxxx | xxx | xxxx | xxx | xxxx | xxxx | xxx | xxxx | xxx |
| 2000s | xxxx | xxx | xxx | xxx | xxxx | | xxx | xxxx | xxx |
| 2010s | xxxx | xxx | xxx | xxx | xxxx | x | xxx | xxxx | xxx |

- ◆ Political context matters
- ◆ Behavior change instead of knowledge and attitude change
- ◆ Learning by doing – both learning science and learning politics



PCST: Recurring themes, 1

| | PCST | Hist Sci | SSS | Sci Ed | Sci jour | Sci mus | Vis stud | Risk Comm. | Other |
|-------------|------|-------------|--------|--------|-------------|------------|-------------|---------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxx | | x | | xxx | | x |
| 1970s | xxx | xxxx | xxx | | x | | xxx | | xx |
| 1980s | xxxx | xxxxxx | xxxxxx | x | xxxxxx | | xxx | xxxx | xx |
| 1990s | xxxx | xxx | xxxx | xxx | xxxx | xxxx | xxx | xxxx | xx |
| 2000s | xxxx | xxx | xxx | xxx | xxxx | | xxx | xxxx | xx |
| 2010s | xxxx | xxx | xxx | xxx | xxxx | x | xxx | xxxx | xx |

- ◆ Recording what exists
- ◆ Individual knowledge
 - Needed for action
 - Relationship to attitudes and emotions
 - Mechanisms and contexts for learning
- ◆ Institutions and people for PCST
 - Their needs and goals
 - Creating and training them
- ◆ Interactivity, dialogue



PCST: Recurring themes, 2

| | PCST | Hist Sci | SSS | Sci Ed | Sci jour | Sci mus | Vis stud | Risk Comm. | Other |
|-------------|------|-------------|--------|--------|-------------|------------|-------------|---------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxx | | x | | xxx | | x |
| 1970s | xxx | xxxx | xxx | | x | | xxx | | xxx |
| 1980s | xxxx | xxxxxx | xxxxxx | x | xxxxxx | | xxx | xxxx | xxx |
| 1990s | xxxx | xxx | xxxx | xxx | xxxx | xxxx | xxx | xxxx | xxx |
| 2000s | xxxx | xxx | xxx | xxx | xxxx | | xxx | xxxx | xxx |
| 2010s | xxxx | xxx | xxx | xxx | xxxx | x | xxx | xxxx | xxx |

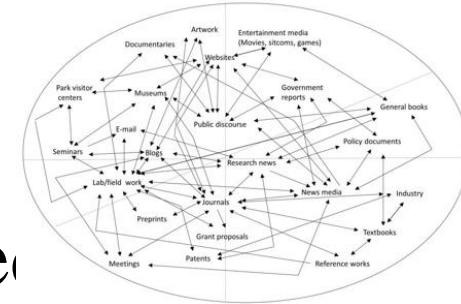
- ◆ Role of public communication in production of reliable knowledge
- ◆ Public authority of expert knowledge
 - And resistance to delegation of expertise
- ◆ *Trust*



PCST: Recurring themes, 2

| | PCST | Hist Sci | SSS | Sci Ed | Sci jour | Sci mus | Vis stud | Risk Comm. | Other |
|-------------|------|-------------|---------|--------|-------------|------------|-------------|---------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxx | | x | | xxx | | x |
| 1970s | xxx | xxxx | xxx | | x | | xxx | | xxx |
| 1980s | xxxx | xxxxxx | xxxxxxx | x | xxxxxx | | xxx | xxxx | xxx |
| 1990s | xxxx | xxx | xxxx | xxx | xxxx | xxxx | xxx | xxxx | xxx |
| 2000s | xxxx | xxx | xxx | xxx | xxxx | xxxx | xxx | xxxx | xxx |
| 2010s | xxxx | xxx | xxx | xxx | xxxx | x | xxx | xxxx | xxx |

- ◆ Role of public communication in production of reliable knowledge
- ◆ Public authority of expert knowledge
 - And resistance to delegation of expertise
- ◆ *Trust*



Missing (mostly) themes

| | PCST | Hist Sci | SSS | Sci Ed | Sci jour | Sci mus | Vis stud | Risk Comm. | Other |
|-------------|------|-------------|--------|--------|-------------|------------|-------------|---------------|-------|
| Pre 1940 | | | | | x | x | | | |
| 1940s | | | | | x | | | | |
| 1950s | x | | | x | x | | | | |
| 1960s | | | xxx | | x | | xxx | | x |
| 1970s | xxx | xxxx | xxx | | x | | xxx | | xxx |
| 1980s | xxxx | xxxxxx | xxxxxx | x | xxxxxx | | xxx | xxxx | xxx |
| 1990s | xxxx | xxx | xxxx | xxx | xxxx | xxxx | xxx | xxxx | xxx |
| 2000s | xxxx | xxx | xxx | xxx | xxxx | | xxx | xxxx | xxx |
| 2010s | xxxx | xxx | xxx | xxx | xxxx | x | xxx | xxxx | xxx |

- ◆ *Collective* knowledge
 - Families, communities
- ◆ Role of politics and activism in both individual and collective knowledge
- ◆ Literary/narrative analysis
- ◆ Gender, class, race

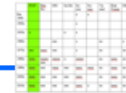
These exist in other literatures; we just haven't brought them in well



Present and future (!)

- ◆ Listen to the others at this symposium!
- ◆ Integrate the themes, find others
- ◆ Future: Fill in the missing areas!

Missing (mostly) themes



- *Collective knowledge*
 - Families, communities
- Role of politics and activism in both individual and collective knowledge
- Literary/narrative analysis
- Gender, class, race

These exist in other literatures; we just haven't brought them in well

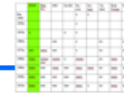


Present and future (!)

Obrigados!

- ◆ Listen to the others at
- ◆ Integrate the themes, find others
- ◆ Future: Fill in the missing areas!

Missing (mostly) themes



- *Collective knowledge*
 - Families, communities
- Role of politics and activism in both individual and collective knowledge
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These exist in other literatures; we just haven't brought them in well

