KEK Archives, 11 August 2010

Why are social scientists interested in HEP?

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Since 1945 HEP is a model for

- Collaborative knowledge-making
- Translocal/global teams
- Pedagogies for collaboration
- Computing strategies for collaboration, knowledge-making, and communication
- Building knowledge at the intersection of universities, government, industry, & civil society
- Regional development via science cities

As I show the following slides ask yourself:

* How have these events and forces shaped HEP and your career?
- What kinds of documents exist for those changes?
* How could such documents be used for knowledge making, decision making, and education in HEP?

Terminology

Keep in mind that the HEP meanings for “history” and “sociology”

are not the meanings of those terms used in the social sciences.

Massive Changes in the Ecology of Basic Research

- **Wartime: 1910s, 40s, etc**
- **Computing: 1950s, 1970s, 1990s**
- **Emergence of post-industrial political economies in the 70s**
- **End of the cold war in the 90s**
- **Geography of knowledge making**

1. EMIGRATION

The "best and brightest" leave their home regions/nations for higher education, graduate school, research, employment

- **often true for US & Soviet Union until about 1940**
- **often true for Japan, Australia until about 1975**
- **Now often true for Brazil, China, India, Indonesia, and Mexico**

2. DEMOGRAPHIC CHANGES

Consider the changing geographic distribution of the world's scientists & engineers in

1900: Europe

1950: Europe & North America

2000: Europe, North America, & east Asia

2050:

3A. Basic Research FUNDING

in the US and the former USSR 1943-1993

- **For 50 years about 50% of the researchers using 50% of the funding are engaged in military-related work.**

- **These 50 years also represent the first time the US and USSR had scientific communities with 'world class' standing.**

- **The US and the former USSR had no experience maintaining that standing with less funding.**

3B. FUNDING since 1975

- **Decline in rate of increase in North America and Europe;**
- **Increase in rate of increase in many other countries, including Japan**
- **Watch rate of increase in Brazil, China, India, Indonesia, and Mexico.**

4A. DECISION-MAKING SITES

Where are the crucial discussions usually held for defining:

- **new research questions;**
- **new strategies for answering those questions;**
- **new techniques and devices for generating data and data analysis;**
- **new interpretations**

4B. QUERIES re DECISION MAKING SITES

- Who is present at these discussions?
- In what style are they conducted?
- How are the content of these discussions communicated to others?

5A. Infrastructure for Basic Research requires

- **Sustained funding for education & research at all levels, including:**
  - **facilities, materials, salaries**
- **'Critical mass' of researchers**
- **Information exchange must be frequent & sustained in several modes:**
  - **in/formal, oral/written, face-to-face**
- **Confidence/trust of other countries' researchers in the locally generated findings**

5B. Infrastructure for Basic Research

- **Funding this Infrastructure Requires Very High GNP**

  [GNP = Gross National Product]
- **Basic Research is also a symbol of high GNP**
- **Nation-states are the primary support for basic research 1675-1975**

5C. This infrastructure emerged outside Europe only during the last sixty-five years

- US & Canada during 1940s/50s,
- Japan during 1960s/70s
- Australia during 1970s/80s
- Korea during 1980s/90s
- China during 1990s
- Next: Brazil, India, Indonesia?

6A. Big Science goes Global

- **Emerges circa 1943**
- **Scale shifts1950-1975-2000:**
  - **$10 million to $100 million to billions;**
  - **25-1500 researchers per experiment**
- **New global laboratories:**
  - **ALMA, ITER, Global Linear Collider**

*** National government agencies have overseen the 'big science' laboratories.**

*** What agencies should oversee 'global science': UNESCO, G8, OECD?**

6B. Big Science defined by Dutch sociologist Arie Rip

- Extremely expensive equipment
- Limited access to extremely few research facilities
- Because design and construction time are long [10-20 years] fields using big science facilities must form & maintain long term consensus on key questions and methods for investigating those questions

7A. Computing in Basic Research 1

- First used to accelerate and clarify existing processes, techniques, and devices
- Now it offers new ways to conceive and define questions, experiments, equipment, and data analysis

7B. Computing in Basic Research 2

- **Computing can alter modes of thought, including styles and research aesthetics.**
- **Computing can also alter structure of collaboration, communication, pedagogy, and decision making**

History of all these Fundamental Changes

- Many historians of science think that these changes are comparable to those at the beginning of the “scientific revolution”.
- However, there are almost no historical records of these changes.
- The reasons:
  - New kinds of collaborations
  - Computing and telephones
  - Lack of archiving practices
  - New kinds of careers, sites, funding
  - Many sectors of society involved

Many crucial topics are discussed informally & never documented

- Reputations and contributions of individuals, teams, labs, & projects
- Gaining access to equipment and other scarce resources
- Modifications of experiments and data analysis
- Strategies for interpreting data and communicating results

Documentation

- Everyday scientific research records are primarily in two forms: handwritten and digital. There are also some audio visual records of group meetings.

- Have these been archived?
- What are metadata practices?

Some Existing Archives for High Energy Physics

KEK http://www-conf.kek.jp/archives_office/index-e.html

CERN
http://library.web.cern.ch/library/Archives/Welcome.html

SLAC http://www.slac.stanford.edu/history/

Fermilab http://history.fnal.gov

Brookhaven http://www.bnl.gov/ewms/cresources/

Center for the History of Physics [CHP]
at the American Institute of Physics [AIP]
http://www.aip.org/history/

Uses for Archives

- Scientists and engineers
- Institute leaders
- Policy makers
- Researchers in history, sociology, anthropology of science & technology
- Teachers and students
- Public worldwide

My current research: changing “best practices” for Large Scale Databases

- Structure and metadata practices?
- Maintenance and archiving practices?
- Access?
- Customs for sharing data?
- Professional identity of those who design, maintain, and curate large scale databases for HEP & astrophysics?

My current research projects are funded by the

NSF Office of Cyber-Infrastructure [OCI]

http://www.nsf.gov/dir/index.jsp?org=OCI

Program on Virtual Organizations as Socio-technical Systems (VOSS)

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503256&org=OCI&from_org=OCI