THE CITY AND TECHNOLOGY

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Center for Social Sciences

Your Concerns and Suggestions

最好能提前预习，包括阅读材料和视频

视频太难，最好能提前看一下

英语有时听不懂

Reading有时候太难，"高级词汇"太多；有的视频也比较难，语速比较快

两个小时不够多，没法消化完所有内容。可以提前发送课程材料、单词表、视频、阅读材料等，最好能提前一天

视频有点难，可以播放两遍或者时不时停顿下

可以多一些实践的内容，譬如带我们看看空调到底怎么工作

英语太难，ICE不是很明白

稍微复杂的英文可能听不太懂

Topic statement 能不能给个大概的例子

有些概念难以理解，需要时间

听不懂，有些概念比较难，一节课下来口干舌燥，大脑被掏空

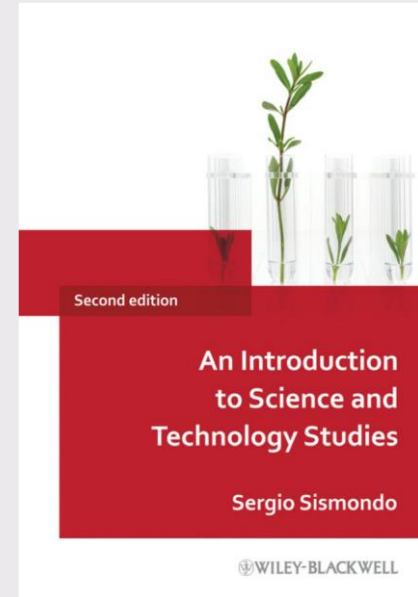生僻概念（例如alienation）理解有难度，可以举例解释

理论的深度和浅度能不能平衡一下

教室侧墙的屏幕怎么调出来？

想了解大城市的历史

课程内容（阅读材料、视频、概念）太难
Content is too difficult, incl. reading materials, videos, concepts, etc.

英语太难 Language issues

其他问题 Other issues

CONTENT OF TODAY'S CLASS

1. Review of last class
2. Definition: STS studies
3. Prehistory of STS studies
4. Variants of STS Studies
5. Boon or bane: Debates

Second edition

An Introduction
to Science and
Technology Studies

Sergio Sismondo

WILEY-BLACKWELL

1.

REVIEW OF LAST CLASS

» **Cinema and broadcast media**

» **On mass media: Theories and critiques**

» **The Internet and mass mobile communication**

Cinema
- Definition
- History
- Impacts

Broadcast media: from radio to TV
- Social-cultural impacts: News, entertainment, commercials, lifestyle, cultural reproduction
- Economic impacts
- Television and migration

Watch video: Cinema, Radio, and Television
- Why did the US movie industry choose to move to the west coast in the late 19th century?
- Why was radio invented later than cinema?
- How has radio impacted people's lives?
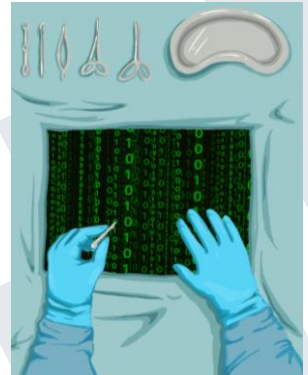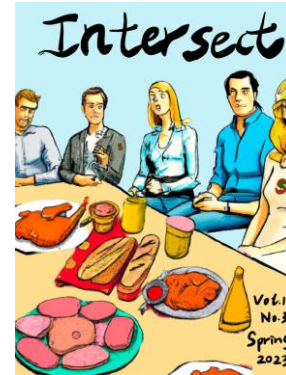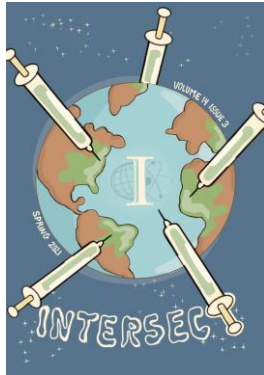
2.

DEFINITION: STS STUDIES

What is Science and Technology?

Objectivity/Truth
Consistency
Experiments

What is STS?

READING EXERCISES (10 min)

Read through the handout titled "What is STS" (by Harvard Kennedy School). Think about the following questions:

1) What are the "two broad streams of scholarship" in STS? What are their main research goals?
2) Why and how does STS promote cross-disciplinary integration?

READING EXERCISES (10 min)

Read through the other handout titled "On STS" (by the Stanford Program in STS). Think about the following questions:

1) What have STS studies done in the past? What are their major arguments and contributions?
2) What is the "fish joke" about?
3) Consider the earlier reading as well, how shall we understand the relationship between STS and regular science and technology studies? What are the main goals and contributions of STS?

Definition of STS Studies

STS Studies:

» Many Definitions…

» "Even the name of the field is not uniform" (Hess, 1997: 2)

» Focusing on the relationship between science and technology on the one hand and society on the other

» Focusing on the direction science and technology should take in society

» Both descriptive and prescriptive

S&T
Science and Technology Studies

STS
Science, Technology, and Society

STS
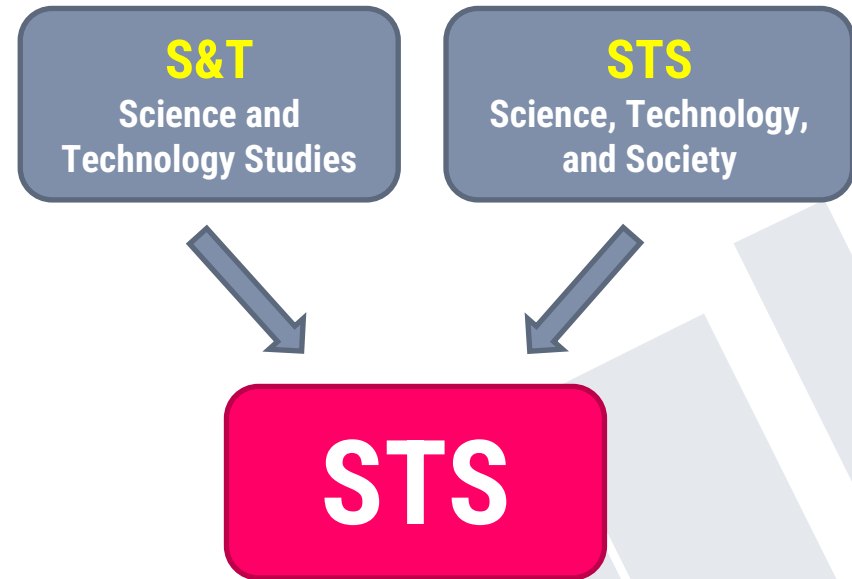
Two broad streams of scholarship

» The **first** stream:

» On the nature and practices of science and technology (S&T)

» Research questions
  ◊ Is there a scientific method?
  ◊ What makes scientific facts credible?
  ◊ How do new disciplines emerge?
  ◊ How does science relate to religion?

» The **second** stream:

» On the impacts and control of science and technology

» Research questions:
  ◊ How should states set priorities for research funding?
  ◊ Who should participate, and how, in technological decision-making?
  ◊ How should societies measure risks and set safety standards?
  ◊ How should experts communicate the reasons for their judgments to the public?

EXPLORATION EXERCISE (10 MIN): TOPICS OF STS

Stanford University

Intersect: The Stanford Journal of Science, Technology, and Society

Intersect: The Stanford Journal of Science, Technology, and Society
https://ojs.stanford.edu/ojs/index.php/intersect/issue/archive

Penn UNIVERSITY *of* PENNSYLVANIA

Science, Technology & Society (STSC) COURSES A-Z
https://catalog.upenn.edu/courses/stsc/

Cornell University Registrar

Science, Technology & Society course list
https://courses.cornell.edu/preview_program.php?catoid=41&poid=20015

3.

PREHISTORY OF STS STUDIES

- LOGICAL POSITIVISM (VERIFICATIONISM)
- FALSIFICATIONISM
- PARADIGM SHIFT

The Vienna Circle: Logical Positivism

» **The interwar period (1920s-1930s):** a group of European historians, sociologists, philosophers of science, and scientists themselves became interested in **the relationship between scientific knowledge, technological systems, and society.**

Selected members of the Vienna Circle (from left to right: Moritz Schlick, Rudolf Carnap, Otto Neurath, Hans Hahn and Philipp Frank. http://www.psiquadrat.de/html_files/wienerkreis.html

The Vienna Circle: Logical Positivism

» **Historical context and the initial goal:**
  ◦ Rapid development of natural sciences and mathematics
  ◦ to modernize philosophy by grounding it in science and logic.

» **Empiricism (经验主义)**: Knowledge should come from empirical observation

» **The verifiability principle:** A statement is meaningful only if it can be empirically verified or is analytically true (true by definition, like mathematics or logic).
  ◦ Formal logic, e.g., "an unmarried man is a bachelor" → An issue of language

» **A vigorous denial of idealism, theology, abstract metaphysics (e.g., being), etc.**

» **Scientific progress made by** increasing the correctness, number, and range of potential observations that the theories indicate.

The Vienna Circle: Logical Positivism

» **Role of philosophy:**

⬧ Philosophical problems are problems of language.

⬧ Philosophy should work as an assistant to science, by analyzing scientific methods, clarifying concepts, and ensuring logical coherence in scientific theories.

⬧ Philosophy can be viewed as a "scientific" enterprise in having rational standards and being pursued by a "scientific community" (rather than building on a single person's work)

» **The doctrine of unified science:**

⬧ The form (or logical structure) of any particular scientific theory could be specified quite apart from its content.

⬧ Therefore, there aren't fundamental differences between various "sciences," e.g., physical sciences, social sciences, etc.

The Vienna Circle: Logical Positivism

» **Problems with logical positivism:**

  ◇ "Synonyms" forms of theories with different meanings

  ◇ Theories are often too abstract to be observed

  ◇ There is no principle of induction that is true (Popper's critique)

» **Dissolved** under political pressure (and tragic incidents) in **1936**. Many of the members immigrated into the US.

Karl Popper: Falsification

» **In the 1960s**

» **Goal:** science should be able to demarcate science from non-science

» **Where do the scientific theories come from:**
  ◇ They are free-floating and imaginative creations.
  ◇ They cannot be created but can be tested.
  ◇ A theory that makes good predictions is provisionally accepted – until new evidences come along.

» **A denial of logical positivism:** We should replace induction and the verifiability principle with deduction and the falsification principle
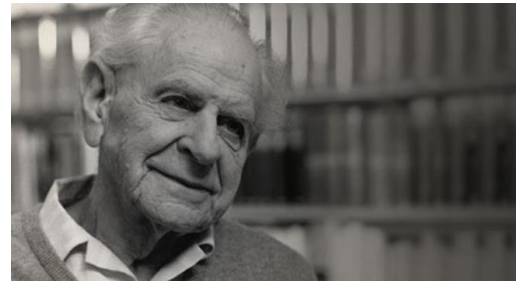
Karl Popper (1902 –1994)
Austrian–born British philosopher, academic and social commentator.

Karl Popper
(1902-1994)

No amount of experimentation can ever prove me right; a single experiment can prove me wrong. – Albert Einstein

Karl Popper: Falsification

» **The Falsification Principle:**
  ◇ For a theory to be considered scientific it must be able to be <u>tested and proven false</u>.
  ◇ Science should attempt to <u>disprove</u> a theory, rather than attempt to continually support theoretical hypotheses.
  ◇ Science <u>may or may not reach the truth</u>, but the process of conjectures and refutations allows it to encompass increasing numbers of facts.

» **Problems with falsificationism:**
  ◇ Theories can be too abstract to be falsified.
  ◇ Scholars tend to explain away incorrect predictions rather than reject the theories.
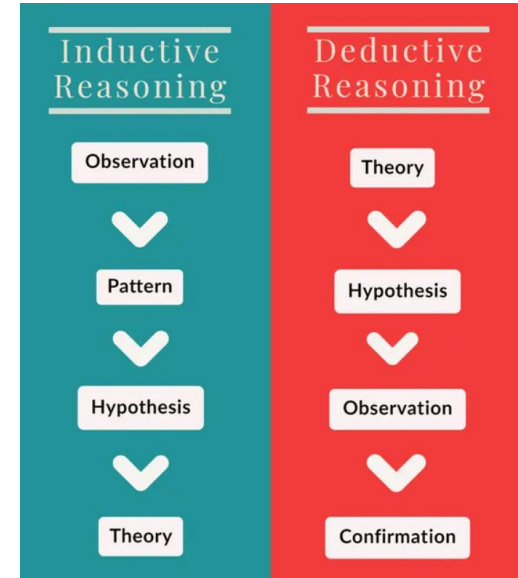
|	Logical Positivism (Induction)	Falsificationism (Deduction)
Source of scientificity	A condensed summary of observations	Truth is provisional. Falsifiable and evaluated by a strict method.
Scientific progress achieved through	Increasing the correctness, number, and range of potential observations that its theories indicate	Successive refinement and enlargement of theories to encompass increasing numbers of facts
Is truth achievable?	Yes.	Truth is provisional.
Example: Sun rises every 24 hours	It is true and scientific, since everyday confirms the observation.	It is falsifiable – think about the polar region.

Paradigm shift

Thomas Kuhn's classic 1962 study, ***The Structure of Scientific Revolutions***.

» Paradigm shift (范式转型): a profound change in a fundamental model or perception of events.

» Scientific facts were seen as products of scientists' socially conditioned investigations rather than as objective representations of nature.

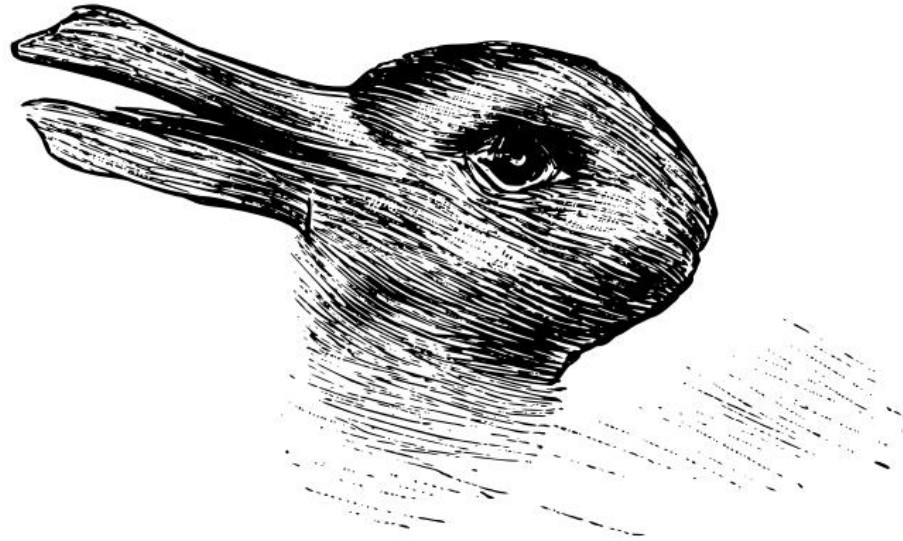**Thomas Kuhn** (1922-1996) American philosopher of science; author of *The Structure of Scientific Revolutions* (1962)
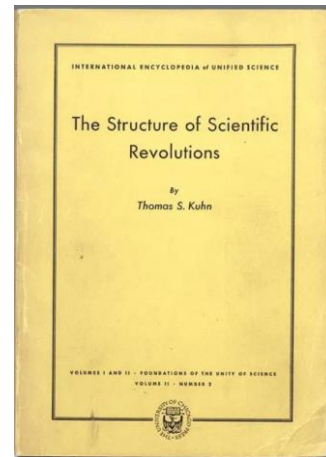
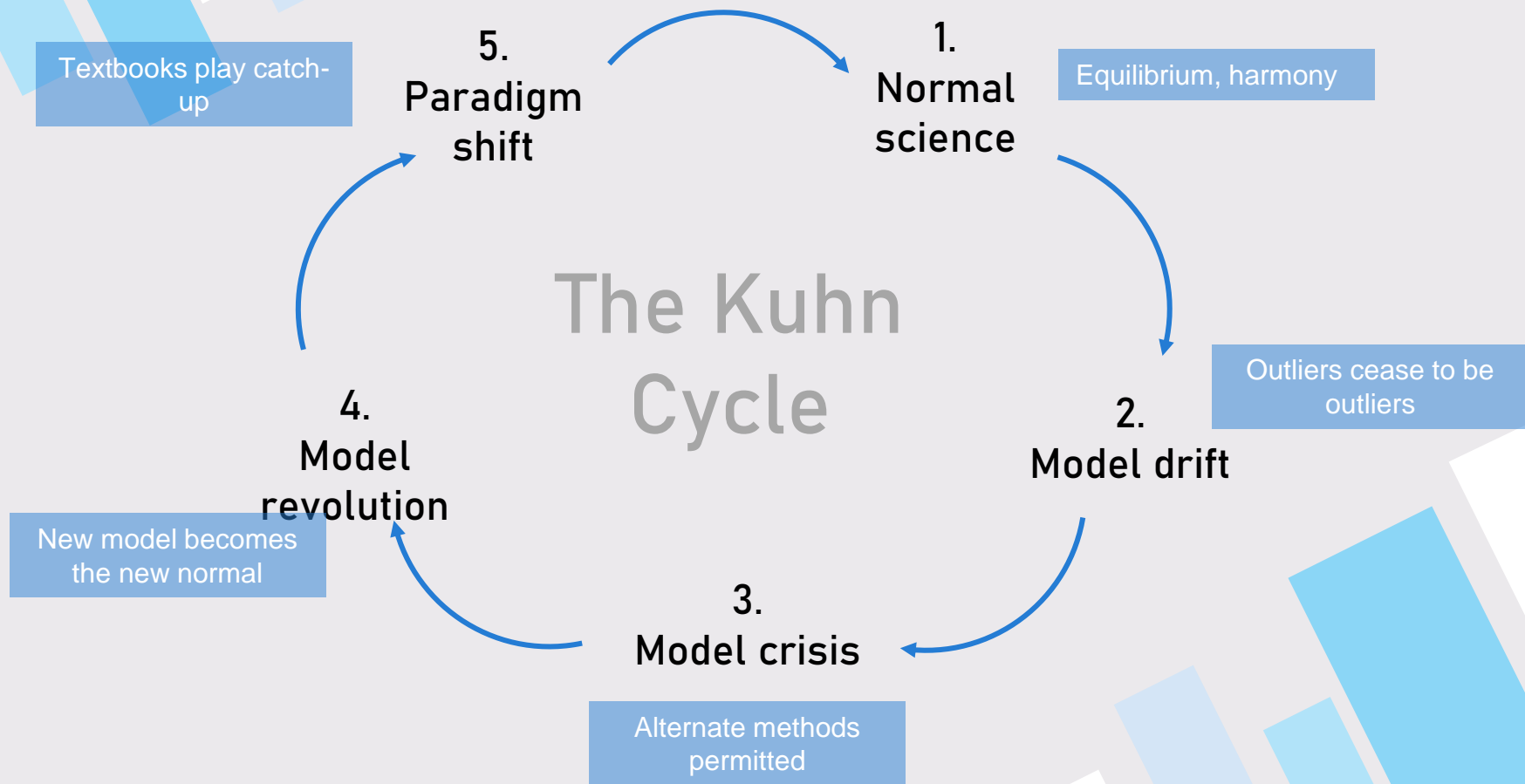Book cover of the first edition of ***The Structure of Scientific Revolutions***

A paradigm shift could cause one to see the same information in an entirely different way. (Thomas Kuhn)
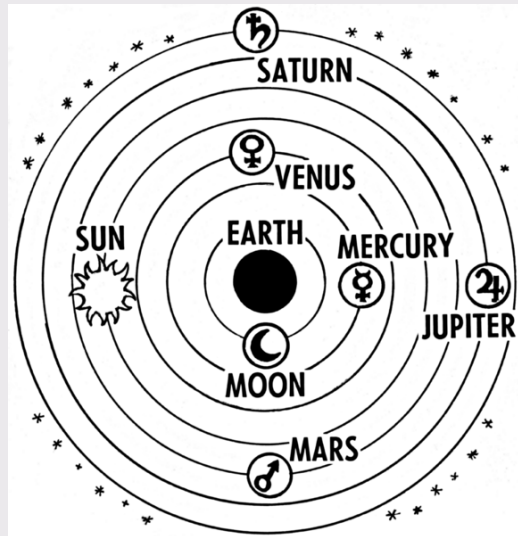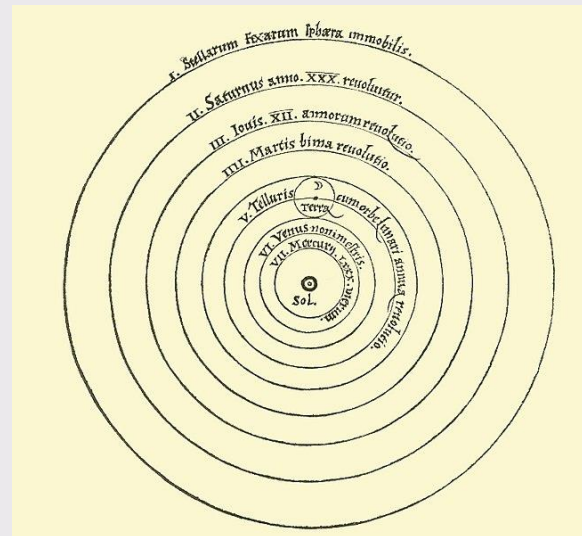
The rabbit–duck illusion

Welche Thiere gleichen einander am meisten?

Kaninchen und Ente.

https://en.wikipedia.org/wiki/Rabbit%E2%80%93duck_illusion

The Kuhn Cycle

5. Paradigm shift

Textbooks play catch-up

1. Normal science

Equilibrium, harmony

2. Model drift

Outliers cease to be outliers

3. Model crisis

Alternate methods permitted

4. Model revolution

New model becomes the new normal
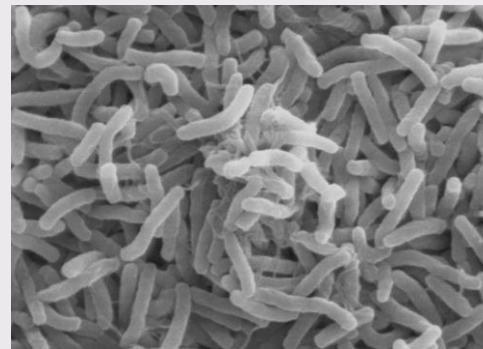
Cosmology

Ptolemaic geocentrism

Copernican heliocentrism

Medical theory

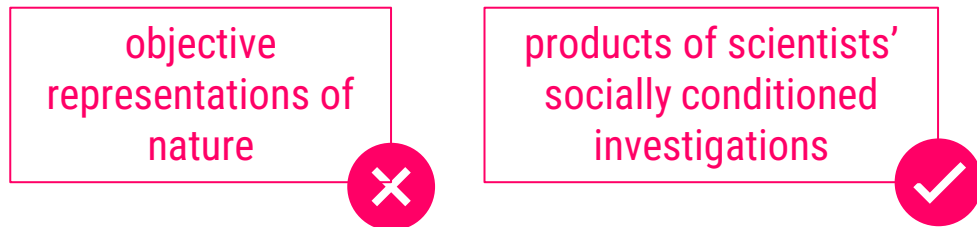**The miasma theory of disease**

The germ theory of disease

Paradigm shift

Profound impacts

» A new approach to historical and social studies of science

» Stimulated further research on science and technologies

Scientific Facts

| objective representations of nature ✖ | products of scientists' socially conditioned investigations ✔ |

Scientific discovery and its technological applications

| law | politics | public policy | ethics | culture |

4.

VARIANTS OF STS STUDIES

What are the research agendas in the field of STS studies?

CONTENTS

1. New school of Sociology of Scientific Knowledge (SSK)
2. Social construction of technology (SCOT)
3. Socio-technical systems
4. Actor Network theory

1. New School of SSK

» Kuhn's *The structure of scientific revolutions* → **"death"** of philosophy of science → Then, what's next?

» **Sociology**: The study of human social structures and social activities

» **Sociology of Scientific Knowledge (SSK)**: Knowledge production as social processes

» **Main research questions of SSK**:
  ◊ What is something that we know in science?
  ◊ How do we know what we know?

1. New School of SSK

logical positivism

- A prevailing view of the philosophy of science since the 1920s, advocated by the Vienna Circle and the Berlin Circle.
- The **verification** principle of science; induction as the scientific method
- Attacked by Karl Popper's **falsification** thesis
- Kuhn's **paradigm shift** → logical positivism was "dead, or as dead as a philosophical movement ever becomes"

The Strong Program based in Edinburgh in the 1970s: A stronger critique of logical positivism

David Bloor's "four tenets" for the sociology of scientific knowledge (1991[1976])			
Causality - Look at the social conditions that lead to a claim of knowledge (scientific or otherwise)	**Impartiality** - Look at both successful and failed knowledge claims	**Symmetry** - The style of explanation should be symmetrical. The same types of cause would explain true and false beliefs.	**Reflexivity** - The rule must be applicable to sociology itself.

1. New School of SSK

» **Problems with "Truth"**

- ◊ There is nothing truly "TRUE"
- ◊ Instead, beliefs, or, the claimed truths, are explained by local norms and interests
- ◊ **What are the norms and interests, then?**

How do different communities reward or punish people for believing in the "right" thing?

2. Social Construction of Technology (SCOT)

» An application of **social constructivism** (社会建构主义)

» A response to **technological determinism**

» Technology does not determine human action. Rather, human action shapes technology.

» **Research questions**
  ◇ How do actors interpret the technology?
  ◇ How do these interpretations shape technology design and development?
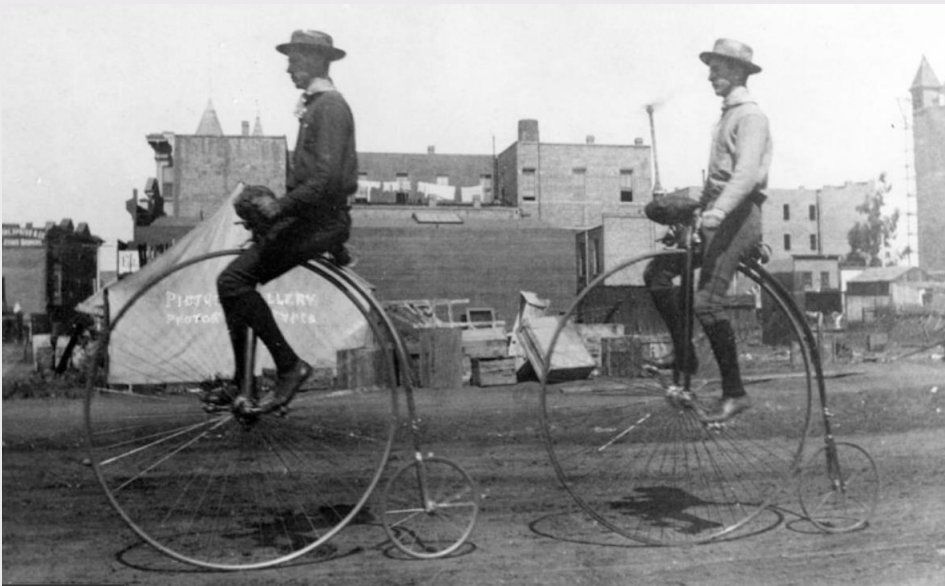 ◇ Do these interpretations change over time due to social interactions?

SSK:
- Scientific knowledge is socially constructed
- It has no *a priori* special status

SCOT:
- Technology is socially constructed
- It does not have any <u>intrinsic obduracy</u> (内在固性)

How shall we explain the evolution of technology?
The idea of impartiality and symmetry in SCOT

High wheeler/Penny Farthing (1870s)

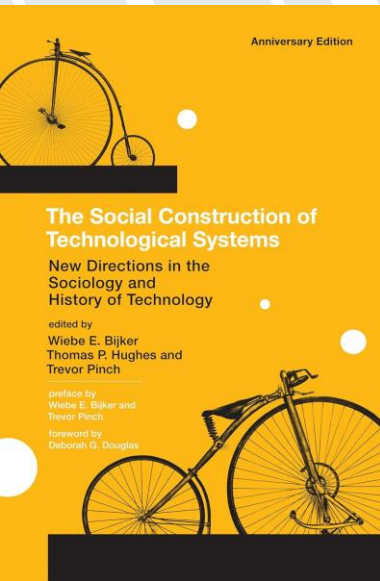Chain-driven safety bicycle (1880s)

3. Sociotechnical Systems

Sociotechnical Systems:

» A field of study that investigates the interaction between society's complex infrastructures and human behavior.

» Society itself, and most of its substructures, are complex sociotechnical systems.

» Technology does not only mean material technologies.

For example, the study of the Internet and the Information Age

Anniversary Edition

The Social Construction of Technological Systems

New Directions in the Sociology and History of Technology

edited by
Wiebe E. Bijker
Thomas P. Hughes and
Trevor Pinch

preface by
Wiebe E. Bijker and
Trevor Pinch

foreword by
Deborah G. Douglas

3. Sociotechnical Systems

» **Information Age:** A period starting in the last quarter of the 20th century information became effortlessly accessible through publications and through the management of information by computers and computer networks.

» **Characteristics**
  ◇ Interconnection of computers, people, and places via telecommunications
  ◇ Operating on both a real-time and as-needed basis.
  ◇ Primary factors driving this new age forward are convenience and user-friendliness
  ◇ All these will also lead to user dependence

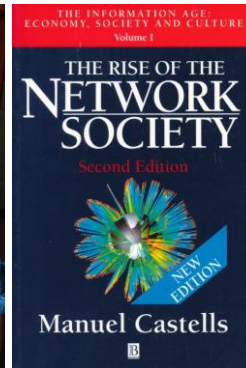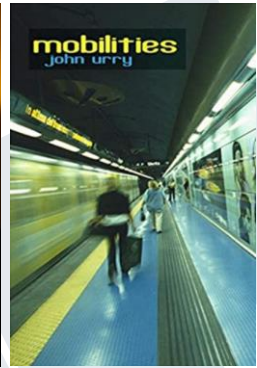# 4. Sociotechnical Systems

» **Consequences**

  ◇ **Changing socio-economic organization**

  ◇ Information Anxiety

  ◇ Digital Divide

  ◇ Globalization

  ◇ Mobility

Manuel Castells (1942–)
Spanish sociologist

John Urry (1946)
British sociologist

Area	Industrial Age Business	Information Age Business
Economic	Assembly line production	Customization of products
	Stable markets and suppliers	Fluid markets and suppliers
	Domestic competition	International competition
Organizational	Inside out (Bottom-up)	Outside in (Top-down)
	Complex business processes	Reusable, simple processes
	Intra-organizational communication	Inter-organizational communication
	Domestic reach\ ambition	Global reach and ambitions
Technical	Mechanical technology	Electronic technology
	Proprietary standards	Open, inter-operable standards
	Predictable innovation	Rapid unpredictable innovation
Socio-cultural	Authoritarian, hierarchical	Horizontal, team consensus
	Business task focus	Business process focus
	Individual responsibility	Team responsibility

Table 1.1: Emerging Business Trends in the information Age
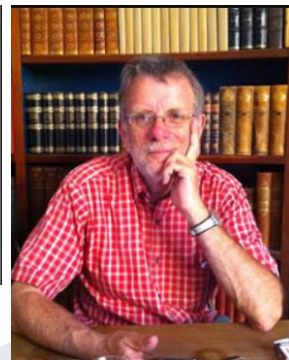
4. Actor-Network Theory (ANT)

» Developed in the 1980s in France

» Originally to understand processes of innovation and knowledge-creation in science and technology

» Conceptual origins
  ◇ French post-structuralism: non-foundational and multiple material-semiotic relations (French semiotics 符号学)
  ◇ Materialism: how to talk about things within a constructivist paradigm - Does matter matter?
  ◇ Ethnomethodology (民族志方法论)

Bruno Latour (1947-) French philosopher, anthropologist and sociologist.

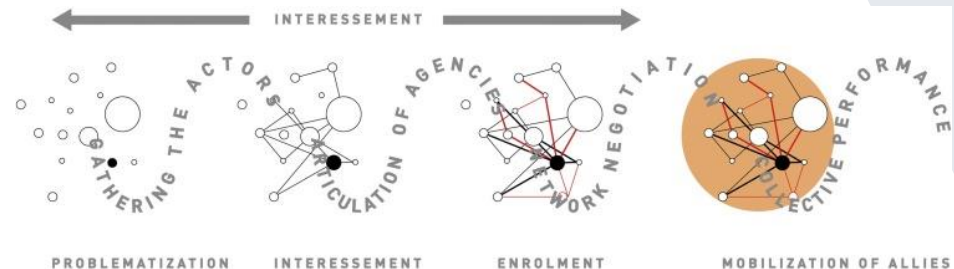Michel Callon (1945) French Sociologist and STS scholar

John Law (1946-) British sociologist and STS scholar

4. Actor-Network Theory (ANT)

» An analytical approach that takes the world to be composed of associations of heterogeneous elements and its task is to trace those associations.

» A sociology of associations

» **Methodology and framework**
  ◇ Actants (*things made to act*)
  ◇ Sociology of Translation (of needs/goals)
  ◇ Distributed power

◇ Four moments of ANT (Callon, 1986)
  ◇ Problematization
  ◇ Interessement
  ◇ Enrollment
  ◇ Mobilization
  ◇ Dissidents
  ◇ Obligatory Passage Point (OPP)

Anne Tietjen, Gertrud Jørgensen (2016) Translating a wicked problem: A strategic planning approach to rural shrinkage in Denmark. Landscape and Urban Planning, 154, 29-43. DOI: 10.1016/j.landurbplan.2016.01.009.

"

Nature brought to a human scale, teased into components, made stable in the laboratory, and turned into marks on paper or in a computer, is manipulable, and manipulable at leisure in centers of calculation (Latour 1987) where inscriptions can be combined and analyzed to produce abstract and general representations. When they become accepted, those representations are often taken to be Nature, rather than products of or interpretations of nature.

Sismondo (2009: 85)

On the notion of "black-box"

» **Black-boxing**: a process through which a network of heterogeneous human and non-human actors (messy constellations) aligns and stabilizes its associations to act as a single whole (as a completed object) → a single factor or a single node in a wider network

» **Implications**:
  ◇ Working as foundations/common senses in science and technology; everything builds off of it
  ◇ Invisible, or opaque to outsiders
  ◇ Disallowing or discouraging suspicions and alternatives

» **Key research questions**: how does the process of black-boxing occur? how are the black-boxes kept opaque and sealed?
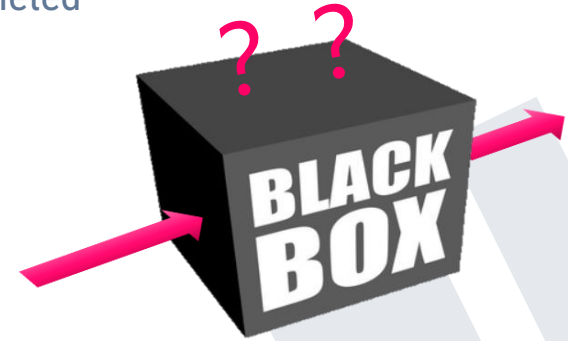
4. Actor-Network Theory (ANT)

» **How is it used?**
  ◇ Most commonly to analyze large scale technological developments in an even-handed manner to include political, organizational, legal, technical and scientific factors.
  ◇ Focused on the connections that are being made and remade between human and non-human entities that are part of the issue at stake.

» **Critique**:
  ◇ Can things really have agency/intentionality?
  ◇ How useful is identifying a network of some aspects of some associations?
  ◇ Doesn't really tackle weighting in terms of power
  ◇ It is amoral - no regard to social consequences of technological choice
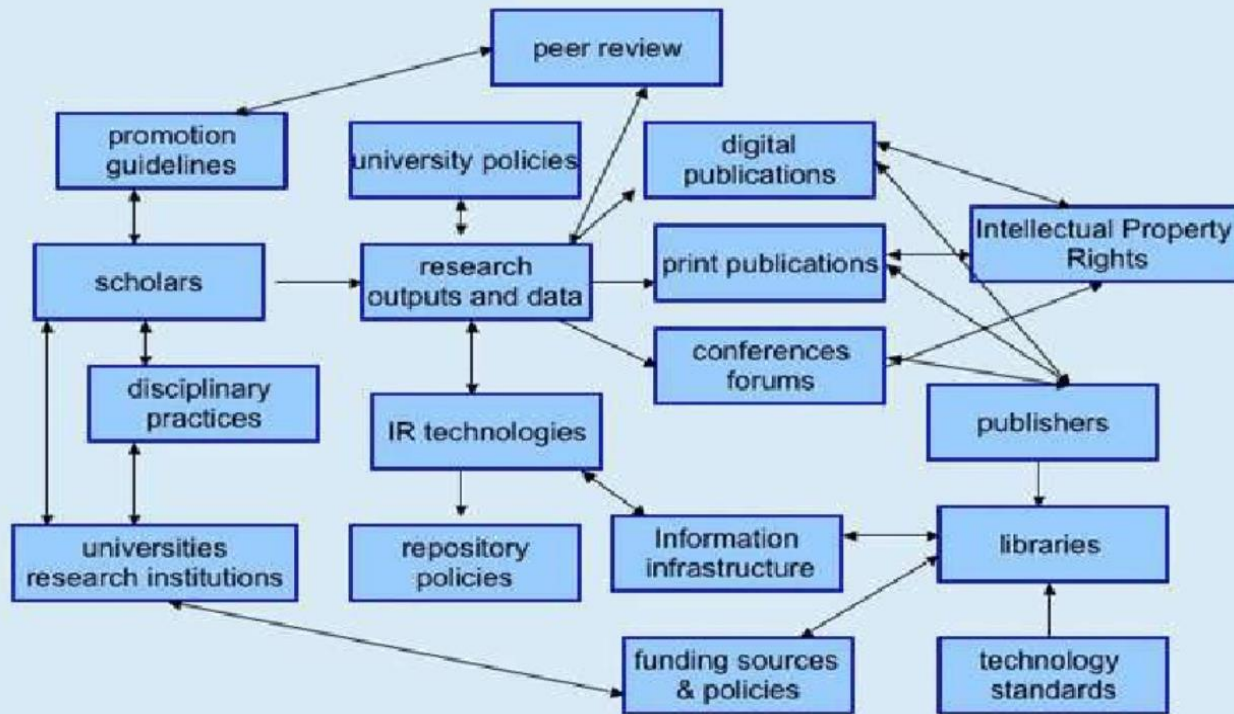
An actor-network of academia

5. BOON OR BANE: DEBATES

Collisions between advocates and critics STS

Backlashes: Science Wars

The Sokal Affair

» Alan Sokal submitted the piece "Transgressing the Boundaries: Towards a Transformative Hermeneutics of Quantum Gravity to the journal *Social Texts* in November of 1994 and it was published in a special spring-summer issue in 1996.

» But the whole paper was a joke…

» The paper basically claimed that gravity was socially constructed and that quantum gravity has specific political implications.

» An attack on the post-structuralist approach to science

» Sparked intense debates in academia

Alan David Sokal (1955-) Professor of mathematics at University College London and professor of physics at New York University

Why STS studies?

» **Bridge courses** that do not usually come together in a student's curriculum, e.g. sociology and science, law and science, anthropology and technology, environmental science and political theory, or technology and philosophy, and **integrate knowledge** in areas that are impossible to grasp through any single discipline.

» Through **cross-disciplinary integration**, it promotes and cultivates
  ◊ **civic engagement, and critical thinking.**
  ◊ **professional responsibility and ethics**
  ◊ **More robust understandings of epistemology (方法论) and ontology (本体论)**, including issues such as the nature of controversy, the causes of scientific and technological change, the relationship of culture and reason, and the limits of rational analytic methods in characterizing complex problems, etc.

QUESTIONS?

If you have any questions about the course, write them down. Feel free to ask me in the QQ group or via email. You can also bring your questions to our next class.

END OF CLASS

SEE YOU NEXT WEEK.