HSS 102
History of Science
Lecture 3

What History?

Historiography of the History of Science?

- Historiography of the history of science is the examination and analysis of how history of science has been written.
- It can also mean a theoretical discussion on the nature of history writing.
- Major Pattern I: ‘great men theory’ vs ‘social roots of science theory’.
- Major Pattern II: ‘history of ideas’ (often called ‘Newtonian science’) vs ‘crafts/artisanal traces of science’ (termed as ‘Baconian science’) leading to experimental culture.
- Trajectory followed in the Course: Privileging latter over the former and also re-examining the idea/practice binary associated in our own understandings of the ‘hand-brain coordination’.
- Four Theses to be Followed: ‘Hessen Thesis’ (already discussed) developed in 1930s, ‘Zilsel Thesis’ developed in 1930s and in 1940s,‘Neo-Zisel Thesis’ developed in late 1990s and early 2000s and ‘Kuhn Thesis’ developed in early 1960s.

The Hessen Thesis

- A causal command-execution relation between social developments and scientific developments.
- ‘The technical problems the newly developing economy raised for solution’: navigation and the problem of longitude…> The Newtonian synthesis of terrestrial gravity and celestial motion. The third section of the Principia:

‘is devoted to the problems of the movement of planets, the movement of the moon and the anomalies of that movement, the acceleration of the force of gravity and its variations, in connection with the problem of the inequality of the movement of chronometers in sea-voyages and the problem of tides’ (p. 26).

The Zilsel Thesis

- ‘The Sociological roots of science’ (1939): Modern science was born in the intense conversation between university knowledge of natural philosophy and the craft knowledge of the ‘superior craftsmen in guilds’.
- The superior craftsmen wrote treatises in vernacular. ‘Real science is born when, with the progress of technology, the experimental method of the craftsmen overcomes the prejudice against manual work and is adopted by rationally trained university-scholars’ (Zilsel 1939).
- From 13th c onward, humanist scholars began to carry out reforms in pedagogy, one of which was to visit artisanal workshops
- They believed, familiarity with matter and natural materials, central to the craft of the artisan, could be put in conversation with the existing frameworks of natural philosophy.
- Legitimation of bodily labour in a specially designed space>laboratory as a means to produce scientific knowledge (Renaissance).
- New emphasis on a direct understanding of nature as a way to acquire knowledge>experience became the crucial link in obtaining knowledge.

Zilsel's Legacy in Pamela Smith's Work

The Production of the Hand-Mind distinction in the Western Thought:

- Scholars with mind/Artisans with hands [lower epistemological status]: A social and intellectual fissure in ancient and medieval Western culture influenced by the hegemonic Aristotelian thought
- Slavery
- Aristotle considered artisans to be non-citizens of the Greek Polis
- No room for moral excellence in craftsmanship.

Scholars/Artisans in Aristotelian Thought
Developed partially from P. Smith, Laboratories, in Cambridge History of Science, Vol 3, 2008

Scholar (domain of words)	Artisan (domain of works)
Unproductive of material things	Produced goods for commerce and subsistence
Reason [domain of the freeman], a pure search for truth	Dissociated from a pure search for truth Sensation [domain of the animal and the slave]
Abstract speculation on the causes of things and phenomena	Base knowledge of how to make things or produce effects
Study of books and treatises	Neither taught in schools, nor written down
Attainment of perfection through reading, commenting, writing and lecturing	Supposed to have been perfected through apprenticeship, imitation and manual work>non-textual and non-verbal literacy and hence, mechanical
Goal: producing a ‘lettered man’	Goal: making knowledge productive

Christianity and the Artisanal Knowledge

- Manual labour as the necessary component of redemption of mortals.
- Maintenance of the monastic community through the penitential manual labour.
- The leisured man of Antiquity becomes an impediment to salvation.
- Augustine Hippo (354-430): art as the way to create the ‘second nature’.
- Protestantism elevated artisanal knowledge. Luther famously commented on Aristotle’s corpus, ‘any potter has more knowledge of nature than these books’ (Conner 2005).
- Seeking wisdom in the workshops became even less objectionable with reforms in Christianity.

Galileo's mathematical propositions were a direct outcome of his interaction with the manual workers of that era.

- ‘Dialogues Concerning Two New Sciences’ (Galileo):

‘The constant activity at Venice’s weapons factory suggests to the studious mind a large field for investigation, especially that part of the work which involves mechanics; for in this department all types of instruments and machines are constantly being constructed by many artisans, among whom there must be some who, partly by inherited experience and partly by their own observations, have become highly expert and clever in explanation’(Conner 2005, 285)

- A correspondent writes back to Galileo:

‘You are quite right…Conference with them has often helped me in the investigation of certain effects including not only those which are striking, but also those which are recondite and almost incredible’ (Conner 2005, 285).

- Artisan’s workshop appeared to be novel and generative of new knowledge about nature and objects to this new generation of natural philosophers such as Galileo.
- Central to the artisanal epistemology was the ability to recognize that nature constituted the primary source of knowledge and that knowledge of nature could be obtained by ‘bodily encounters’ with matter—that is, in the act of making. Knowledge is not to be gained from books but by manual labor (Pamela Smith 2004). This understanding was the harbinger of the modern experimental culture in science.

The Result of the Unification of Hand and Mind (Pamela Smith)

- Mathematical hypotheses about nature>derivation of their precise quantitative consequences>testing of them through experimental method.
- Invention of tools of measurement such as barometers, thermometers, compasses, telescopes, clocks>modern laboratory in which these instruments in controlled environment would produce a detailed understanding of nature.
- The growth of a mechanistic understanding of nature that sought to elucidate the operation of the natural world in terms of matters in motion.
- The experimental method that characterizes modern science was developed primarily by unknown artisans. Zilsel: ‘These quantitative rules of the artisans of early capitalism are, though they are never called so, the forerunners of modern physical laws’.

What are the Key Features of the New Scientific Knowledge?

- Units and Quantitative Analyses
- A mathematically driven understanding of the patterns in natural occurrences.
- In this context, what are the historical questions that a historian of science asks about the early-modern period?
- “How did the fundamental scientific concepts — such as number, force, heredity, and probability—and practices—such as experiment, proof, and classification — develop in specific historical contexts? How and why did everyday cultural experiences, such as counting, weighing, collecting, and describing, become specialized scientific techniques? And in what ways did originally local knowledge, devised to solve specific problems, become universalized?” (Smith, 2009).