HSS 102 HoS

Lecture 1

Jan 5, 2016

Introduction

What this course is about:

Think of this course as an experience in **Time travel:** we will travel through nearly 2500 years of history of how different civilizations have understood the natural world. Our focus will be how modern science – the science you do today – emerged out of these earlier sciences.

Our special focus will be on the following time-periods, civilizations and themes:

**Time** **period –** The Scientific Revolution , 1500-1800, from Copernicus to Newton.

**Civilizations:** Even though modern science emerged in Europe, it is not purely Western or European. The rest of the world -- including the Indian, the Islamic, Persian and the Chinese civilizations -- contributed ideas that went into the birth of modern science. Nearly one third of the course will look at the HoS in India, and we will also look at the role of the Islamic world. Because of time constraints, we will not be able go into any depth where Chinese science is concerned.

Themes: **HOW science became modern**.

 Here our focus will be on two main themes:

* Evolution of empirical testing through experimentation
* Using mathematics to understand natural phenomena.

What is history of science……

Think for a moment: When you study Indian history in school, what do you study?

You learn about how people lived in the past, what was the structure of the family, the position of women, caste relations, the kings and queens and other famous people. You learn how things changed and how modern India emerged after Independence.

Why is history important? Why do you study India’s past, for e.g.? You study the past to understand the present: going back in time helps you to understand what kinds of political, economic, cultural forces have shaped the world we live in.

Just imagine, if we knew nothing about the past – if every generations started from the scratch … how strange that would be: we will have no idea how we got where we are… we will no sense of traditions, no idea of cultural continuity..

**Just like India has a history, science also has a history. JUST LIKE civilizations, nations and kings and queens have histories, IDEAS also have a history.**

History of science tries to understand science historically: it tries to understand **what** people in the past knew about nature, what **methods** did they use, and how that knowledge and methods have changed with time.

People in the past believed many **facts** about the natural world which were very different from what we know today. For example, for most of history, people thought that

* The earth is in the center of the universe and the sun goes around it.
* The earth is a flat disc. The Hindu Puranas talk of a flat earth rotating around Mount Meru, a tall mountain in the center around which the entire universe moved.
* The earth is standing still and the rest of the universe moves around it. The very idea that the earth could be moving was laughed off as silly.
* The natural world is made of only four elements: Air, Fire, Earth and Water. India: panch bhuta
* The universe is only 5000 years old, or literally hundreds of billion years old
* Each species of plants and animals is unique and created separately by God, or by karma…

Not only what we knew was different, **HOW** we arrived at these conclusions was also different:

All civilizations, at all times, have developed some understanding of nature: they simply HAD to in order to survive. In that sense, all societies --even the most primitive hunter-gatherers – have their “science.” Even if we today reject many of the pre-modern scientific theories, the fact is that those who came before the emergence of modern science were ALSO engaged in scientific activities – that is, they were also observing nature and using logical thinking to make sense of their observations. So one must not think that just because today we don’t accept their findings, they were “unscientific” – they were quite scientific within their own context and conceptual framework.

Through most of history:

* Material nature was seen as a part of God’s plan or lila (as we call it in India).The natural world was either as something that God had created out of nothing and obeyed God’s laws (as in Christianity and Islam), or the natural world was something that was ultimately spirit, or Brahman (as in Hinduism).
* So what the holy books/philosophers said about God/ set the limits on what could be said about nature. Bible and the Vedas as the ultimate authority. In India, sciences of astronomy (jyotis), and medicine (Ayurveda) were called Vedangas, limbs of the Vedas and could not contradict the Vedas which were considered divine and eternally true.
* Since you don’t challenge sacred teachings and the dictates of the holy books/holy men, observations were fitted into the framework provided by the faith traditions.

It is with the emergence of modern science that nature came to be studied as just physical matter, which obeys its OWN laws, which followed from its OWN material make-up. With modern science, God and nature started to separate, and scientific methods started to separate from theology.

NO STRAIGHT LINES: Revolutionary overthrow.

So now it should be clear **what** history of science is all about:

History of Science (HoS) tries to explain how beliefs about nature and the methods of understanding natural phenomena changed over time and what social and cultural forces brought about these changes in our knowledge.

In this course our focus will be on the MOST central theme of HoS, namely, how modern science – the experimental sciences that we do toady -- emerged out of earlier sciences. This period when modern science emerged is called the Scientific Revolution which started with Copernicus in the 15th century and culminated with Newton in the 17th century.

Why should you study HoS?

* Meet your ancestors
* Many scientific ideas defy the commonsense. Many times, science students simply memorize the laws. Understanding how these laws were first discovered, what were the original arguments, what were the alternative theories at that time helps to understand the logic behind the laws.
* History of science also helps to understand how social and cultural forces shape our beliefs about nature and how social changes influence scientific theories and practices.