

NS 299: THE HISTORICAL DEVELOPMENT OF SCIENTIFIC THOUGHT

Humans, the Natural World and the Measurement of Time

Time is a strange concept. St. Augustine concluded that the perception of time was a psychological phenomenon. General relativity theory tells us that time is only one of many dimensions of the physical universe. In our own experience, we understand that time is a somewhat fluid notion: depending on what is happening, time may seem to pass very quickly or at a crawl.

Human efforts to keep time have a long history. The earliest human civilizations did not care much about the measure of time during a day; one day was much like the next. But predicting the change of seasons was a life-or-death matter. Agricultural peoples needed to know when to plant and when to harvest in order to ensure the survival of the group. It is not surprising, then, to understand that many of the oldest human monuments were constructed as timekeepers for the yearly passage of the seasons.

Later, ocean navigation and the Industrial Revolution made daily timekeeping of importance. Once educated people understood that the movement of the Earth could be interpreted as a clock, it was quickly determined that, if a standard location were used, one could determine the location of any place on Earth. "Setting the longitude" became of prime importance for ocean navigation and establishment of trade routes. In the United States as well, the foundation of railroad time was critical for the expansion of the West, and in the establishment of communications and interstate trade.

If the measurement of time played an important role in the history of human civilization, it also can tell us an older and more fascinating story. For the history of modern humanity and its worldwide migrations is written in our genes. During the last decade, we have begun to be able to read that story and to interpret its meaning. This still-unfolding story calls to question long-held ideas about the origin of modern humans, our similarities and differences, and our relationships with one another.

Course Learning Objectives:

1. To study and learn about ancient and historic ways of timekeeping by comparing the concept of time in different historical cultures, and by examining ancient monuments in the UK.
2. To learn about the concept of the Earth as a clock, and to explore the developments made possible by the precise measurement of time. We will also investigate and discuss the influence of precise timekeeping on the development of the British Empire.
3. To investigate other natural ways of timekeeping (geologic, genetic) that humans use.
4. To use your acquired knowledge about time as a scientific concept to understand the process of science and the interaction between science and society.

Grading Criteria:

1. Students will work on a group project, which will include an oral and visual presentation and a written summary. The grade on this project will constitute **30%** of the overall grade.
2. Students will sit for a final written examination. The grade on this examination will constitute **30%** of the overall grade.
3. There will be three (3) short assignments based on the fieldwork. Each assignment will count 10% of the grade for a total of **30%**.
4. There will be 2 Quizzes each worth 5% for a total of **10%**.
5. Students must attend and participate appropriately in all lectures and field trips. Failure to be an active, appropriate participant in the educational process can result in failure of the course.

Required Readings:

1. Dava Sobel, *The Illustrated Longitude*
2. Simon Winchester, *The Map that Changed the World*
3. James Watson, *The Double Helix*

Schedule for NS 299

| <u>Week</u> | <u>Date</u> | <u>Lecture/Activity</u> | <u>Reading</u> |
|-------------|-------------|---|----------------|
| 1 | A.M. | Course Introduction and Human Views of Time and Timekeeping | Sobel |
| | P.M. | Natural Measures of Time Observation, Discussion and assignment | |
| | A.M.: | Astronomical Observations – Star Chart | Sobel; |
| | P.M. | Museum of London – Geography, Humans and a View of Time | |
| | A.M./P.M. | Time and the Thames – Boat trip to the Royal Observatory in Greenwich | Sobel: |
| | A.M. | Quiz: Astronomy Lecture: Precise timekeeping and clocks | Sobel: |
| | P.M. | Student Views of Stonehenge - assignment | |

| <u>Week</u> | <u>Date</u> | <u>Lecture/Activity</u> | <u>Reading</u> |
|-------------|-------------|---|----------------|
| 2 | | A.M./P.M. All day trip to Oxford | Winchester |
| | | A.M. Geological Time and William Smith | Winchester |
| | | P.M. Visit to Geological Society of London | |
| | | Field Geology – The Cretaceous Coast Trip to Eastbourne and the South Downs | Winchester |
| | | A.M. Quiz: England and Geology Lecture: The History of DNA and understanding Molecular Time | Winchester |
| | | P.M. Student views of Geology and time - assignment Trip to Westminster Abbey – Human lineages and Historic scientists | |

| <u>Week</u> | <u>Date</u> | <u>Lecture/Activity</u> | <u>Reading</u> |
|-------------|-------------|---|----------------|
| 3 | | Cambridge and Scientific Discovery All day visit to Cambridge | Watson |
| | | Cambridge, DNA and molecular time At 10:00 a.m. we will leave for a tour of Parliament | Watson |
| | | P.M. Lecture: The Science of Time/Project Preparation | |
| | | Student Views of Time - Project Presentations Exam Review | |

Final Exam