

Atoms and Stars IST 2420 and IST 1990

Class 1

Winter 2006

Instructor: David Bowen

Course web site: www.is.wayne.edu/drbowen/aasw06

Handouts

- Class 1 Notes
- IST 2420 Syllabus
- Lab 1 Handout
- Midterm Questions
- For IST 1990 only:
 - Syllabus
 - Moodle

Tonight's Schedule

- Logistics
- IST 2420
 - Syllabus
 - Characteristics of science
- Lab 1
- IST 1990 (2420 free to leave)
- Moodle

Logistics

- Food & beverage machines
- Student Center is fairly close
- Bathrooms
- Water
- Take care of your own trash!
 - We are guests here, and individual conduct should not get us kicked out.
 - For labs, repack equipment where you found it.

IST 2420

- Meets WSU Gen Ed requirement for
 - o Physical Science (PS)
 - o Natural Sciences (PS and LS) laboratory requirement
- Initial the signin sheet
 - o Check 1990 column for correct number of credits
 - o If you are not on the list, add your name at the bottom – this is NOT registration!!!
- Review of names

IST 2420 (main course)

1. Physical science content
 - a. Nature of atmosphere
 - b. Speed of light
 - c. Solar system
 - d. Early chemistry, atomic theory
2. Nature of physical science
 - a. History and context
 - b. Scientific method
 - c. Experimentation
 - d. Nature of scientific knowledge

IST 2420

- Review of syllabus
- Contact information
 - Proof that I don't mind being contacted
- Textbooks and bookstore (Reader and Lab Manual are changed from all previous versions)
- Topics
- Grading scale (W, X, I)
- Weights
- Assignment schedule

Syllabus, continued

- Lab reports: two parts turned in as one
- Absence and Making up Work: labs, classes, exams
- Exam Questions and Essay Topics
- Essays
- Example of Mathematics Used In This Course
- Turning in assignments

Syllabus, continued

- Grade Appeals
- Educational Accessibility
- Assessment by the 4th Week
- Class Conduct
- Late/Missing Assignments
- Dropping Classes
- Grading for Course withdrawals
- Plagiarism

Assignments for next week

- Buy Reader / Lab Manual
- In Lab Manual, read General laboratory Instructions, Additional Laboratory Instructions and Experiments 1 and 2
- Report on Temperamental Can due
- In Reader, through Page 25

How Do We Know What Science Is?

- Who says what the scientific method is?
 - We listen to what scientists say they do, and watch them doing it
 - For example, Huxley (1863) and Copi (1986).
 - Exception: Frances Bacon present “at the birth” ~ 1600
 - Science is an open community, but to be taken seriously, you must take its methods and concerns seriously
 - Galileo, Newton, Einstein and others were “mainstream” at first, revolutionary later
- No exact definition of science that everyone agrees to, so looking at examples is a good method

Definitions for Reading

- In “We Are All Scientists,” Huxley uses “induction” and “deduction” without defining them
 - o Induction: reasoning from a series of identical cases to a general conclusion
 - In the reading: green apples example
 - o Deduction: reasoning from different pieces of evidence to a conclusion in a specific case
 - In the reading, missing teapot and spoons example

Overview

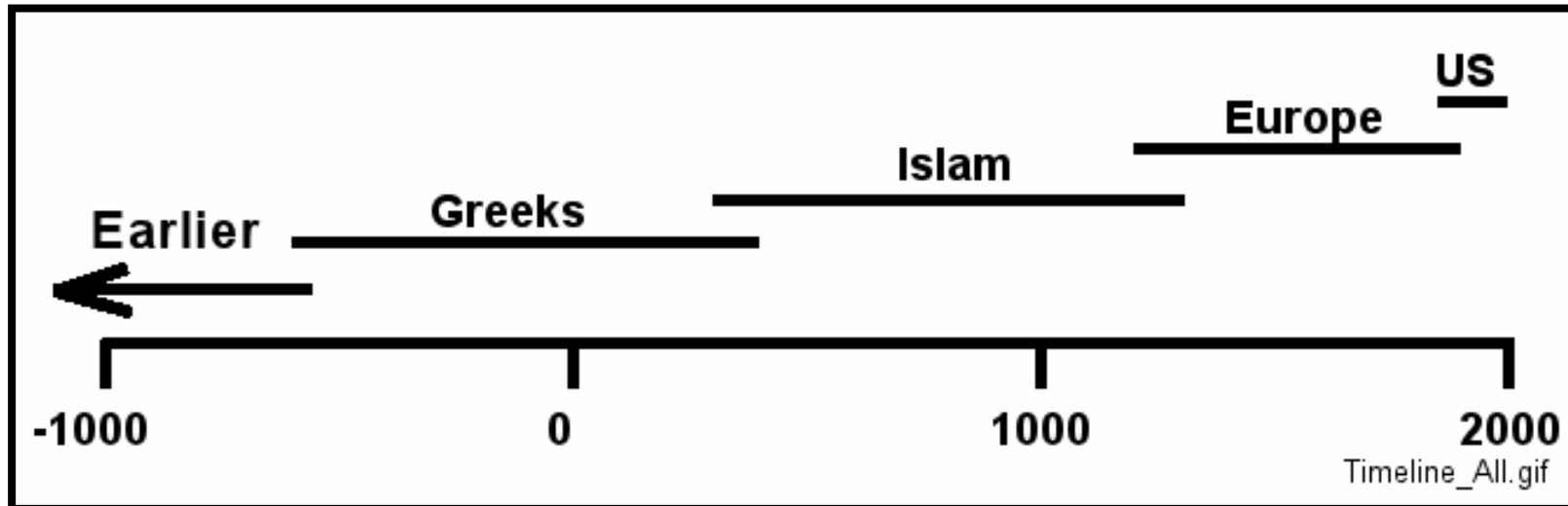
Scientific Method (as opposed to content):

- We will do more here than typical science course
- Here, Atoms and Stars is about origins of modern Physical Science (“science”) 1500 - 1700 AD in Europe
 - Development of Greek philosophy in the area of science, and how it was overthrown by science

Overview (cont'd)

- Scientific Method (cont'd):
- Modern Physical Science has roots going back to prehistory
 - It still represents something new
- Also part of the course – what happened:
 - Before the Greeks?
 - Between the Greeks and the development of science?
 - After the development?

Overview



- During development of science, much transmission by and (circa 1700) interaction with religion. Religion will come up.

Overview

- My views (so you can evaluate what I say):
 - o Scientist, advocate of science - secure and reliable information to support action
 - o At any time, science has limits, so it cannot be a complete basis for living: current shortcomings are human nature & interactions, place in world, purpose
 - Science skeptics be careful: science limits always expanding
 - o Member of church (Quakers, or Society of Friends), have taught Sunday School, been clerk, secretary, given counsel within the church.
 - A liberal church - I am liberal within that church.
 - o Also a Ph.D. physicist (technical qualification)

Overview

- o I make no claim to expertise in religion
- o You have right here to your beliefs, to state those beliefs, to question, to reject science
 - Grading on your understanding of the course material, including the basis for trusting science
 - Science makes truth claims - what is the basis for believing those claims?
- o I believe science and religion are compatible
 - Not all religious beliefs compatible with all science.
 - Once you reject some science, hard to stop
 - Science is interconnected

Overview

- Two pillars of science:
 - o Data / observations / experiments
 - These make science reliable
 - o Hypotheses / laws / theories
 - These make science valuable

Overview

- #1: Data / observations / experiments
 - Direct, not secondhand
 - Must be repeatable by anyone who cares to try
 - Often suggested by a hypotheses / law / theory, but must be repeatable even if you disagree
 - Anything important is repeated
 - Some things (speed of light) repeated for 100+ years
 - Improved technique triggers another round of measurements

Overview

- #1: Data / observations / experiments (cont'd)
 - If data from different scientists disagree, discrepancy must be checked and resolved – not taken seriously until then
 - Results cannot depend on beliefs or preferences – such effects must be checked and resolved
 - Often data suggested by a theory, but data stand even if theory fails

Overview

- #1: Data / observations / experiments (cont'd)
 - o Must be recorded, not restricted or secret, with procedure (what you did, including preparation) and results (what you saw / measured)
 - So that others can repeat and verify your results
 - o Journals and raw notes kept, will be reviewed if questions arise

Overview

- #2. Hypotheses / laws / theories
 - Hypothesis: first step - a guess, explain the data
 - Law is older term, theory is newer term (less assured)
 - Accepted theory must:
 - Be capable of being disproven (falsifiability)
 - Explain all (vast majority) data
 - Discrepancies must be addressed and eventually resolved

Overview

- #2. Hypotheses / laws / theories (cont'd)
 - Accepted theory must (continued):
 - Have direct evidence - not accepted just because rival theory fails
 - If two theories agree with data, must look for and do critical experiments that decide between them
 - If two theories are inconsistent, this must be eventually be fixed
 - Be productive - predict new, unsuspected measurements, new phenomena, new results, which must be tested and which must agree
 - Simpler theory preferred to more complicated

Overview

- Typical sequence of advance (focus comes first and is assumed here):
 1. Observation / Measurement
 2. Description
 3. Understanding (theory)
 - o Often this is first association (statistical) then causal
 4. Control or technology (especially last 50 years)
- Science is progressive
 - o Start in small area, expand

Overview

- Science is progressive (cont'd)
 - Later theory / experiment can change earlier theory
 - Example: Einstein's 1915 General Theory of Relativity changed ideas about his 1905 Theory of Special Relativity
 - However, old results still correct but range extended
 - Scientific knowledge provisional – subject to change

Overview

- Science is progressive (cont'd)
 - Scientific knowledge can change rapidly at the frontier
 - Later experiments can show errors in the first ones
 - Extending theory beyond data can introduce errors
- Science is not:
 - Fair – theories do not have a right to be considered – someone must want to do this

Overview

- Science is not:
 - Democratic – no votes, nor formal consensus, theories can come “back to life” (string theory)
 - Not based on authority – Newton and Einstein can be (were) wrong
- Most scientists follow these rules but (with many scientists) there are many exceptions
 - Science works socially – check each other

Overview

- Most scientists follow these rules but (with many scientists) there are many exceptions (continued)
 - o Scientific arguments can be fierce
 - Issue about women and aggressive argument
 - Our heroes – the people who overthrew the established order
 - Instant success: prove someone else wrong
 - o Scientists often become advocates of a theory
 - Social interaction corrects this

Overview

- Scientists are skeptical about truth claims
 - Many strongly-held beliefs have been shown to be wrong, e.g. common ideas about space
 - Many purely rational arguments have been shown to be wrong – e.g. Aristotle

Lab

- Form five Lab groups. Will generally be the same each lab session
 - If changes, max group size is six
- Temperamental Can – handout
- Each person keeps his/her data sheet
- Report will be individual, with an answer for each Assignment 1 – 12.
- Start heating water for Assignment 2 as soon as possible. This will take time to boil.

Lab

- Discuss Assignment 1 before doing Assignment 2, and write individual answers.
- Then do rest of Assignments, come back to Assignment 2, 3 and 4 at the end.

IST 1990 continues after

Lab

- Reports should include (but it is one report):
 - o Raw Data Sheet:
 - Setting: your name, experiment number, title and date, full names of lab partners
 - Procedure: what you did
 - Observations: what you saw happen and measurements during the lab period.
 - Hypotheses where requested, identified as hypotheses and separated from the rest
 - o Typed analysis: Calculations and answers to questions in the lab manual
 - Do not retype Data Sheet – it would be less reliable

Questions or comments?

Lab session now
Afterwards, IST 1990 only

IST 1990

Course Topic

- Science and religion - the interaction
- Free to hold your own religious beliefs, but course is about the range of ideas. Optional: where do yours fit in?
- Range of beliefs is very wide
 - o Religion is superior
 - o No conflict, some conflict
 - o Science is superior

IST 1990

- Review of syllabus
 - o Course description
 - o Working on your own
 - o Textbooks (at Barnes & Noble Campus Bookstore. 313-577-2436)
 - Gould: science and religion are, and should be, separate – they deal with separate areas
 - Barbour: what is the range of attitudes? Matrix
 - (four credits only) Ruse: How to reconcile Catholic doctrines with science
 - www.bkstore.com/wayne
 - My notes will be on the course web site

IST 1990

- Review of syllabus
 - o Assigned readings on course web site
 - o Assignments and schedule
 - Participation in online discussion
 - Set up account this week
 - Essays (two or three depending on credits)
 - o Standards for essays and participation

Moodle

- Handout
 - o techttools.culma.wayne.edu/moodle
 - o Creating an account
 - Enrolment key: 1990w06 (it is zero, not oh)
 - o Using Moodle
 - o This course listed as "W06 IST 1990 Science and Religion" or "W06_1990"

[DCC_Learning](#) » [W06_1990](#)

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| <div data-bbox="163 323 521 432"> <p>People [-]</p> <p> Participants</p> </div> <div data-bbox="163 456 521 600"> <p>Activities [-]</p> <p> Assignments</p> <p> Forums</p> </div> <div data-bbox="163 624 521 759"> <p>Search Forums [-]</p> <p><input type="text"/> <input type="button" value=">"/></p> <p>Advanced search </p> </div> <div data-bbox="163 783 521 1038"> <p>Administration [-]</p> <p> Grades</p> <p> Activity report</p> <p> Edit profile</p> <p> Change password</p> <p> Unenrol me from W06_1990</p> </div> <div data-bbox="163 1062 521 1262"> <p>My courses [-]</p> <p> W06 IST 1990 Science and Religion</p> <p> Fall 2005 IST 2420 / 1990</p> <p>All courses...</p> </div> | <div data-bbox="544 323 1680 616"> <p>Weekly outline</p> <ul style="list-style-type: none"> News forum Introduce yourself Starting off Messages not about the course content Science and Religion discussion (counts towards requirements) </div> <div data-bbox="544 624 1680 1292"> <table border="1"> <tr> <td style="text-align: center;">1</td> <td>11 January - 17 January</td> <td style="text-align: right;"></td> </tr> <tr> <td style="text-align: center;">2</td> <td>18 January - 24 January</td> <td style="text-align: right;"></td> </tr> <tr> <td style="text-align: center;">3</td> <td>25 January - 31 January</td> <td style="text-align: right;"></td> </tr> <tr> <td style="text-align: center;">4</td> <td>1 February - 7 February</td> <td style="text-align: right;"></td> </tr> <tr> <td style="text-align: center;">5</td> <td>8 February - 14 February</td> <td style="text-align: right;"></td> </tr> <tr> <td style="text-align: center;">6</td> <td>15 February - 21 February</td> <td style="text-align: right;"></td> </tr> <tr> <td style="text-align: center;">7</td> <td>22 February - 28 February</td> <td style="text-align: right;"></td> </tr> <tr> <td></td> <td> Essay 1</td> <td></td> </tr> <tr> <td style="text-align: center;">8</td> <td>1 March - 7 March</td> <td style="text-align: right;"></td> </tr> <tr> <td style="text-align: center;">9</td> <td>8 March - 14 March</td> <td style="text-align: right;"></td> </tr> </table> </div> | 1 | 11 January - 17 January | | 2 | 18 January - 24 January | | 3 | 25 January - 31 January | | 4 | 1 February - 7 February | | 5 | 8 February - 14 February | | 6 | 15 February - 21 February | | 7 | 22 February - 28 February | | | Essay 1 | | 8 | 1 March - 7 March | | 9 | 8 March - 14 March | | <div data-bbox="1702 323 2072 456"> <p>Online Users [-]</p> <p>(last 5 minutes)</p> <p> David Bowen </p> </div> <div data-bbox="1702 480 2072 576"> <p>Latest News [-]</p> <p>(No news has been posted yet)</p> </div> <div data-bbox="1702 600 2072 775"> <p>Upcoming Events [-]</p> <p>There are no upcoming events</p> <p style="text-align: center;">Go to calendar... New Event...</p> </div> <div data-bbox="1702 799 2072 1292"> <p>Recent Activity [-]</p> <p>Activity since Sunday, 8 January 2006, 04:01 PM</p> <p style="text-align: center;">Full report of recent activity...</p> <p>Course updates:</p> <p>Added Forum: Introduce yourself</p> <p>Added Forum: Starting off</p> <p>Added Forum: Messages not about the course content</p> <p>Added Forum: Science and Religion discussion</p> </div> |
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Moodle

- What is there:
 - Participants (list of class)
 - Online users (class members online now)
 - Chat
 - Edit Profile
 - Forums
 - Assignments – turn in files – file names
 - Recent activity (everyone, since the last time)
 - Under Administration, Activity report (yours)
 - Link back to course web site
 - More coming (grades)

Moodle: keeping track

- Moodle will keep excellent track of what you have done
 - o Assignments (essays)
 - o Postings (online discussion)

Moodle

- Assigned postings (count towards course requirement for number of postings):
 - Introduce yourself
 - Starting out
- Pictures
- Warning about online courses
 - One week – two weeks is stretching it
- Moodle warning – watch for message
- Watch course web site and email (weekly)

Moodle

- Do not expect instantaneous responses from me
- You do not need to respond to everything – gets out of hand if you do
 - I usually do not respond to messages that I agree with
 - I always respond to messages that I disagree with
 - Responses as well as original messages count
- In a public setting, be sure to log out

Questions or comments?