Spring 2022

Science, Technology, and Society 345

**Science and War in the Modern World**

Tu-Th 12:30-1:50 pm (29 class sessions) in Thompson 153

Andy Rex Office Hours:

Professor of Physics M 10-11 am; F 9-10 am

Thompson 165B and by appointment

x3816 / rex@pugetsound.edu

Seth Weinberger Office Hours:

Professor of Politics & Government MWF: 12:30–3:00; TTh: 9:30 – 11:30

Wyatt 214 and by appointment

x2994 / sweinberger@pugetsound.edu

**Course Materials Available in the Puget Sound Bookstore:**

* Richard Rhodes: *The Making of the Atomic Bomb* (1986)
* Max Boot, *War Made New* (2006)
* Michael Brown, et al, *Offense, Defense, and War* (2004)

**Note:** Additional materials are provided as needed on Canvas. See the list of daily assignments and bibliography below.

**Bulletin Description:**

This course examines the connections between 20th century science (with particular emphasis on physics) and the effects of science on public policy, international relations, and the strategy and tactics of modern warfare. During the first half of the 20th century, physicists’ concepts of the universe changed as new fields of thought emerged: relativity, quantum theory, and eventually nuclear physics. At the same time, the interactions between scientists and governments evolved significantly, as the scope of war expanded and, in response, new technologies were integrated into warfighting. The course focuses on the role that scientists played in the two world wars, culminating in the Manhattan Project, which produced the first atomic bombs. It also examines the consequences of scientific and technological advancements for the conduct of 20th century warfare, including the impact of trains and machine guns on the battlefields of the First World War and of tanks and airpower in World War II. After considering the development of the atomic bomb and the results of its use against Japan, the course will move to explore the role of nuclear weapons during the Cold War and in the 21st century, as well as the emergence of new science-based military technologies, such as cyberwar.

**Multiple University Requirements Satisfied by STS 345:**

Connections courses must create connections between disciplines with respect to methodology and content. This course satisfies the Connections requirement by being designed to contribute to students’ understanding of the interrelationship of knowledge between natural science and social science, specifically politics and international relations. STS courses make useful connections between scientific work and studies of the history or philosophy of science. By making strong historical connections, this course is applicable to the STS major or minor. Finally, this course can be applied to the university’s requirement for 300-level courses outside the major. Although there are no formal prerequisites, expectations for reading, analysis, and writing are commensurate with a 300-level experience.

**Course Outline:**

One focus of the course is the blossoming of knowledge that occurred in the physical sciences (particularly physics) in the period 1895-1945, studied within the context of the larger world in that period. A second focus, studied in parallel with the first, is the evolution of the concept of modern warfare during that period and the applications of that concept during the first two world wars. In keeping with the Connections core rubric, these two areas of study are considered in relation to one another. This is done principally by considering the role that scientists played in these wars, both in the development of new technology and in the decisions on how best to use that technology. At the end of the course, attention is given to the post-war period and the Cold War, with continued development of the theme of how science is used in modern warfare.

**Attendance policy:**

We expect you to be present every day and participate actively. (See notes below on participation grade.) Attendance will be recorded. We excuse absences for legitimate reasons, provided you notify us by e-mail no later than the day of your absence. Some examples of legitimate reasons include illness, family emergencies, graduate school interviews, and university-sponsored activities such as research, performing arts, and athletics. With only 29 class sessions on the Tuesday-Thursday schedule, you should make every effort to attend class. More than one unexcused absence may result in your automatic withdrawal from the course.

**Assignments:**

Written assignments for the course will include frequent short reaction papers based on the reading assignments, one class-based essay and one research paper, a midterm exam and a final examination.

* Active participation in the course is expected of all students. With each student participating actively, students’ diverse skills and interests enrich the experience for all. In order to participate, students must be present and alert; a pattern of absences will indicate a decided failure to meet the requirements of the course. Perhaps students engage the course in the most obvious way when they contribute constructively to discussion, whether through an insightful comment, a telling observation, or a pertinent question. Yet students may demonstrate a positive involvement with the course in many other ways as well—through consultation with the professor when that is needed or helpful, or through supportive intellectual relationships with other students. The largest single measure of participation will be in short written responses (reaction papers) to questions about the readings, given with the day’s reading assignment and due at the beginning of the next class period. The quality (not simply quantity) of a student’s participation in the course will account for **30% of the final course grade**.
* A midterm exam will be given in class on **Thursday, March 10**. The format for the exam will be discussed ahead of time, but it will cover mostly scientific material presented in the first half of the course. The midterm exam will account for **15% of the final course grade**.
* A take-home exam, consisting of an answer in essay form of 7-10 pages will be due the second week after the midterm break (**March 31**). Students will be given one or more writing prompts and will be expected to base the essay on class readings done to that point in the course. The essay will account for **15% of the final course grade**.
* A 10-12 page research paper will be due in the last class session (**May 3**). Students will be asked to augment class materials by identifying and making use of sources external to the course. Each student will submit a one-page précis and bibliography for the paper in the week prior to the due date. The paper will be approximately 10-12 pages in length and will account for **20% of the final course grade**. (A more detailed assignment will be given just after the take-home exam is complete.)
* The final examination will be held **Thursday,** **May 12th** from 12:00 noon – 2:00 PM and will not be offered at any other time. The final examination will provide **20% of the final course grade**.
* Late work will not be accepted. All work is due at the beginning of class on the due date (papers handed in within 30 minutes following the beginning of class will be penalized one full grade). Requests for extensions will only be granted in exceptional circumstances, such as serious illnesses or family emergencies; if such a circumstance occurs, contact the professor immediately!

**Daily schedule with reading assignments:**

**1. Introduction January 18**

1. Class brainstorm and discussion of forms of energy.
2. Framing questions in international relations theory.

**2. Szilard and Energy/Understanding the International System** **January 20**

1. “Moonshine,” *The Making of the Atomic Bomb* (*MAB).*
2. Energy primer.
3. “The Anarchic Structure of World Politics,” Waltz.

**3. The Nuclear Atom and Atomic Spectra January 25**

1. “Atoms and Void,” *MAB*.
2. *“Tvi*,” *MAB.*

**4. The Impact of Science and Technology on War January 27**

1. “Cooperation Under the Security Dilemma,” Jervis, *Offense, Defense, and War (ODW)*.
2. “Offense and Defense in the International System,” Quester, *ODW*.
3. “Introduction,” Boot, *War Made New (WMN)*.

**5. Science in Warfare: The U.S. Civil War to the Russo-Japanese War February 1**

1. “Part II: The First Industrial Revolution,” *WMN*.

**6. Science in Warfare: World War I, pt. 1 February 3**

1. “The Cult of the Offensive and the Origins of the First World War,” Van Evera, *ODW*.
2. “Civil-Military Relations and the Cult of the Offensive, 1914 and 1918,” *ODW*.

**7. Scientists and X-Rays in World War I February 8**

1. “The Long Grave Already Dug,” *MAB*.
2. Video: “The Great War: Episode 4.”

**8. Science in Warfare: World War I, pt. 2 February 10**

1. “1914 Revisited,” Sagan, *ODW*.
2. “Correspondence,” Snyder and Sagan, *ODW*.

**9. Early Quantum Mechanics and Oppenheimer** **February 15**

1. “Men From Mars,” *MAB*.
2. Video: “The Great War: Episode 8.”

**10. Quantum Mechanics, Uncertainty, and Anti-Semitism February 17**

1. “Machines,” *MAB.*
2. “Exodus,” *MAB*.

**11. Radioactive Decay and Experiments into Fission February 22**

1. “Stirring and Digging,” *MAB*.

**12. Science in Warfare: World War II, part 1 February 24**

1. “Part III: The Second Industrial Revolution,” *WMN* pp. 205-267.

**13. The Discovery of Fission March 1**

1. “An Extensive Burst,” *MAB*.
2. Nuclear physics supplements (in Canvas).

**14. Fission Research and Political Leadership March 3**

1. “Neutrons,” *MAB*.
2. “Cross Sections,” *MAB*.

**15. Science in Warfare: World War II, part 2 March 8**

1. “Part III: The Second Industrial Revolution,” *WMN* pp. 268-304.
2. Continued discussion of Rhodes Chapters 9-11.

**16. Midterm Exam March 10**

**\* SPRING BREAK – NO CLASS MARCH 15 OR 17 \***

**17. Cherwell and the MAUD Committee March 22**

1. “A Communication from Britain,” *MAB*.
2. Video: “Road to War: Japan.”

**18. Pearl Harbor and the First Nuclear Reactor March 24**

1. “The New World,” *MAB*.

**19. Los Alamos March 29**

1. “Physics and Desert Country,” *MAB*.
2. “Supreme Emergency,” Walzer, *Just and Unjust Wars*.

\* **TAKE-HOME EXAM DUE MARCH 31 \***

**20. Oak Ridge and Hanford March 31**

1. “Different Animals,” *MAB*.

**21. Research Continues April 5**

1. “Revelations,” *MAB*.

**22. Strategic Bombing and Atomic Bomb Designs April 7**

1. “The Evils of This Time,” *MAB*.
2. The decision to drop the bomb. More information will be provided before the class date.

**23. Discussing Using the Atomic Bomb and the Potsdam Conference April 12**

1. “Trinity,” *MAB*.

**24. Dropping the Bomb April 14**

1. “Tongues of Fire,” *MAB*.
2. Video: “World at War Episode 24: The Bomb.”

**25. Nuclear Weapons—Historical Perspectives April 19**

1. “Atomic Energy and American Foreign Policy,” Haskins.
2. “The Atom Bomb as Policy Maker,” Brodie.

**26. Nuclear Weapons—Historical Perspectives (continued) April 21**

1. “Strategy for Two Atomic Worlds,” Baldwin.
2. “Epilogue,” MAB

**27. Nuclear Weapons—Modern Perspectives April 26**

1. “Why Iran Should Get the Bomb,” Waltz.
2. “Correspondence,” Kahl and Waltz.
3. “Let Them Make Nukes,” Bandow.
4. “Epilogue,” MAB

**28. The Information Revolution and War April 28**

1. “What is the Offense-Defense Balance and Can We Measure It?,” Glaser and Kaufmann, *ODW*.
2. “Part IV: The Information Revolution,” *WMN*.
3. “The Fog of Cyberwar,” Valeriano and Maness.
4. “The Offense-Defense Balance in Cyberspace,” Locatelli.

**\* RESEARCH PAPER DUE MAY 3\***

**29. Future Science and Future War May 3**

1. “Part V: Revolutions Part, Present, Future,” *WMN*.
2. “Epilogue,” *WMN*.
3. “What the Next Arms Race Will Look Like,” Lamrani.
4. “The United States Can’t Sleepwalk into the Coming Military Revolutions,” Tyson Brown.

**\* THE FINAL EXAM WILL BE GIVEN THURDAY MAY 12 @ 12 NOON \***

**Spring 2022 syllabus inserts**:

***Classroom Emergency Response Guidance***

Please review university emergency preparedness, response procedures and a training video posted at [www.pugetsound.edu/emergency/](http://www.pugetsound.edu/emergency/). There is a link on the university home page. Familiarize yourself with hall exit doors and the designated gathering area for your class and laboratory buildings.

If building evacuation becomes necessary (e.g. earthquake), meet your instructor at the designated gathering area so she/he can account for your presence. Then wait for further instructions. Do not return to the building or classroom until advised by a university emergency response representative.

If confronted by an act of violence, be prepared to make quick decisions to protect your safety. Flee the area by running away from the source of danger if you can safely do so. If this is not possible, shelter in place by securing classroom or lab doors and windows, closing blinds, and turning off room lights. Lie on the floor out of sight and away from windows and doors. Place cell phones or pagers on vibrate so that you can receive messages quietly. Wait for further instructions.

***Student Accessibility and Accommodation***

If you have a physical, psychological, medical or learning disability that may impact your coursework, please contact Peggy Perno, Director of Student Accessibility and Accommodation, 105 Howarth, 253.879.3399. She will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

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***Student Religious Accommodations***

The university provides reasonable religious accommodations for academic courses and programs, and the university policy is found at [Policy on Student Religious Accommodations in Academic Courses or Programs](https://www.pugetsound.edu/office-university-counsel/policies/campuswide-policies/student-religious-accommodations-academic-courses-or-programs).