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 Science, Technology, and Society

Science is for Sheldon Cooper and technology is for Elon Musk, right? The two fields of study are separated from the rest of education and society, reserved for those with the supposed intelligence and sufficient awkwardness that the pursuit of engineering or computer science requires. For decades, science and technology have been viewed as separate entities from the arts, and true interdisciplinary studies have been perceived as either superficial or daunting. Universities have gone so far as to separate the degrees that students receive into Bachelor of Science degrees and Bachelor of Arts Degrees.

 And yes, technical science needs to be approached differently than the arts, but why does that mean that it needs to be seperate? The methodic study of “Science, Technology, and Society” was introduced by American sociologist Robert Merton in 1938, and was featured in his doctoral dissertation “Science, Technology and Society in Seventeenth Century England” (“Robert K. Merton”). In his influential papers, Merton argued that science and technology are products of society, not independent of them, and that they are also the tools that will allow society to progress (“What is STS?” *Stanford*).

 Despite Doctor Merton’s revolutionary social research in the 1930s and 1940s, it was not until the 1970s that universities began forming programs specific to Science, Technology, and Society. STS has risen in popularity due to the growing notion that degrees in both science and social science are not preparing students for the problems of the real world. An undergraduate degree in STS teaches someone how to look at the world not only from the perspective of a scientist, but also as a civil servant and member of a democracy. A Masters degree in STS addresses the necessity of research that is not confined to--and can not be addressed by--a single discipline (“What is STS?” *Harvard University*).

 Due to unprecedented climate crisis and ethical issues arising through the use of technologies such as artificial intelligence, there is a growing need for people who can address these issues from an economic, legal, and scientific approach. A degree in STS could potentially prepare one student for all three, but the programs are different in both their approach to STS and the opportunities that STS students have across the country, and certain programs emphasize different aspects of STS better than others in their specific concentrations (“Careers for STS Majors”). Before deciding on a university to study STS at, one must consider if the program at the school will be able to give the student the technical science or liberal arts education that they want.

 The pivotal difference in STS programs is if program offers a Bachelor of Science, a Bachelor of Arts, or both. While Stanford University, Tufts University, and University of California, Davis, all have STS programs, the degrees and opportunities they present for students are extremely different. At Tufts University, STS is offered as a co-major, with the intention of having students also study a technical science, because the STS program itself is not a Bachelor of Science program(“Co-Major and Minor In STS”). This is similar to UC Davis, where majoring in Science and Technology Studies results in a Bachelor of Arts, but there is strong encouragement to pair with a technical science degree (“The STS Major”). In contrast to these two programs, Stanford University offers both a Bachelor of Arts or Science in STS, so that the technical science can be built into the degree, and the difference between the degrees lies in the balance of technical science to socio-cultural upper division courses . Students can either take eight technical science courses and four socio-cultural courses for a B.S., or the inverse for a B.A. (“Requirements and Policies”). The difference in degrees and courses at these three schools stems from the difference in concentrations and research opportunities in each location.

 While pursuing either a B.A. or B.S. at Stanford University, students choose from one of the five possible concentrations: Communication and Media, Life Sciences and Health, Nature and Environment, Innovation and Organization, and Politics and Policy (“Concentration Areas”). The core requirements outside of the concentrations include STS 1, Global STS, two engineering or technical sciences, four humanities courses, and a writing course that is specific to the major. Along with the core classes, students must take twelve courses specific to their concentration, and this is when the ratio of technical science to humanities courses determines what type of degree a student receives (“Requirements and Policies”). If none of the concentrations fit the specific interests that a student has, they can create their own concentration with the help of a peer advisor (“Concentration Areas”). The self designed concentration has the same number of courses required as the other concentrations, but it includes writing a ten to fifteen page proposal on the purpose of the created concentration and how it relates to the foundations of STS studies that must be submitted to staff for approval (“Self-Designed Concentration in STS”).

 In addition to offering specific concentrations, Stanford University invites seniors majoring in STS to complete a research project as part of an honors program or senior capstone (“Requirements and Policies”). The research project for both requires a submitted proposal and staff advisor, and can be carried out in conjunction with any department at Stanford. The project culminates in a fifty to one hundred page thesis that is submitted before the end of senior year, and the overall structure of the project is highly comparable to an STS Master’s thesis. To help undergraduate students through this process, the STS department provides workshops and the time of peer advisors (“Honors Program”). Camila Lee, a graduate of Stanford STS, cites the peer advisors as being one of her top resources throughout completing the honors program as well as during her earlier semesters.

 One research project gained national attention this year when STS students mapped political activism on campus and in local areas. Working with the Stanford Geospatial Center, students were able to connect historical displays of activism to recent demonstrations, and they wrote an article about how in order to understand the issues society faces today, it is important to see how those same issues were addressed historically. The article sparked conversation on national news sources at a time with high levels of public dissent and protests around the country (Wilcox).

 Common projects and centers for STS students at Stanford to work with include The Program on Liberation Technology, the Virtual Human Interaction Laboratory, The Public Knowledge Project, and the Stanford Center for Automotive Research (“Labs and Internships.”)

While the opportunities may seem limitless at a prestigious university like Stanford that is filled with cutting edge research, it is important to note that the STS department provides no funding for student research. All funding for student projects must be obtained through university funding or grants (“Prospective Students FAQ”).

 Because STS is considered a STEM major at Stanford, students in the program have many of the same opportunities that students studying technical science have including traveling abroad to France to study biochemistry and research policy (“BING Overseas Studies”). Because of the interdisciplinary and versatile nature of the major, the STS department also works closely with liberal arts departments at Stanford--especially the History and Philosophy of Science department. Each year, the two departments host a national conference together called *Critical Conversations* that attracts speakers to the campus while giving graduate and undergraduate students a chance to showcase their research and engage with professionals that work in prospective fields (“Stanford University”).

 As one of the older STS programs in the country, the department attracts a lot of attention from Stanford students, and the program graduated seventy-six students in the spring of 2017(“What is STS?” *Stanford*; “The Program in Science, Technology, and Society”). Forty-four percent of these students received a B.S and fifty-six percent received a B.A.-- an testament to the versatility of the program at Stanford(“The Program in Science, Technology and Society”).

 One hundred miles to the north, the University of California, Davis has a similar program called Science and Technology Studies that is connected to the Stanford program through calSTSnet: a network of STS programs in California that collaborate. Students in California STS programs can go to conferences through calSTSnet and receive funding from the program for undergraduate research (“calSTSnet”).

 While the UC Davis STS program is different from Stanford in that it only offers a B.A., it is similar in that it also has concentrations that allow students specialize while studying in such a broad field. The concentrations or “modules” at UCD are Cultural Studies of Science and Technology; Ethics, Values, and Science Policy; History and Philosophy of Science; and Medicine, Society, and Culture (“The STS Major”). Students in the major must complete eight upper division science courses, two STS courses, and six classes for each of two modules to receive a degree. Because UCD has a large undergraduate student population and is a research based university, STS majors can choose from over thirty-seven upper division science courses and forty module courses. STS majors can easily take advantage of the fact that the school already offers so many courses in these categories and study anything from soil science to aeronautical engineering (“STS Major Requirements”).

 Despite the fact that there are over 29,000 undergraduate “Aggies” at UCD, STS only graduates about twenty students a year, but its students are intermixed with departments such as Data Studies to create a larger atmosphere amongst peers (“Campus Metrics”;“Data Studies”). Students are also encouraged to pair the STS major with another scientific or policy major or minor to expand career opportunities and expertise, partially because the department is limited by size (“The STS Major”).

 Taylor Davis, a former student and an now undergraduate advisor for the UCD College of Letters and Sciences that houses STS, claims that the small size of the major is because of a very similar minor that is offered. She says that many students want to obtain a B.S. but still be able to explore policy and ethics in relation to research, and so they minor in History and Philosophy of Science. The classes offered for the History and Philosophy of Science minor are almost identical to those offered to STS students, which attracts many students studying biological sciences at UCD (“History and Philosophy of Science”).

 Because of the large size of UCD and the vast amount of resources that they have for the student population, there are numerous ways for STS majors to obtain funding for research. The competition for lab positions and individual research grants is extremely high, but the Undergraduate Resource Center is a resource for all students at Davis, regardless of it they study a technical science or not. Through the center, STS majors can apply to lab positions or mentorship programs such as MURALS so that they can have the oversight and advice of a professional while conducting research projects. There are also various scholarships and grants at UCD, including the Provost’s Undergraduate Fellowship, that provide funding for student driven research in any field (“Research.”)

 Across the country, Tufts University offers a program that has similarities to both Stanford and UC Davis, but has no exclusively STS majors. The degree offered at Tufts in STS is for a ten course co-major in which students can choose one of three concentrations: Science and the State, Mathematics and Modeling, or Bodies of Health and Medicine. At Tufts, the co-major is primarily of interest to those in the College of Engineering and those studying natural sciences due the fact that the co-major is not a B.S. but many students there wish to pursue this interdisciplinary study. The values of STS education are similar to the general interdisciplinary atmosphere at Tufts and tie in well to the school’s strong emphasis on political and social sciences One of the most popular classes in the co-major is Techno Science and the State-- a study of the intersection of technology and policy, and other classes range from musical modeling to ancient mathematics to environmental ethics (“Co-Major and Minor in STS”).

 While STS programs have been developed at universities across the country, having a mathematical modeling program is unique to Tufts, and the Tufts program is growing rapidly as a whole (Ong). Even though there are already forty professors involved in STS at Tufts, the program was founded only two years ago in 2016 when Tufts professors were inspired by the MIT STS program and how interdisciplinary questions were being answered across their campus (Nelson).

 The Tufts program is dedicated to being active on campus and it hosts guest and student speakers in various libraries and community centers on a weekly basis (“Events”). Along with these events, themed reading seminars are hosted each semesters that allow students to gather once a week to discuss scientific current events (Ong). The students that participate in this program are also extremely active off-campus and have interned with over 100 companies, firms, and hospitals in the greater Boston area. Tufts University is active in helping its students acquire these positions and is a rare resource for undergraduate students (“Internship Profiles”).

 In addition to internship opportunities, students at Tufts are able to participate in research on campus through lab positions and individual research projects. The university itself provides $450 for each student that applies for a research grant per academic year, but many students are able to obtain outside funding through the school’s connections to industry in Boston (“Undergraduate Research Fund”). Students in STS typically find positions in the departments of their technical science counterpart to STS, but there are some STS specific projects such as a project supported by Moon Duchin, the program director for STS. Since 2016. Duchin has been applying mathematical modeling tools to mapping programs in order to identify and combat gerrymandering in the process of redrawing district lines in the United States (Najmabadi).

 Undergraduate research at Tufts can result in students completing a senior honors thesis, similar to the honors program offered at Stanford University. During their senior year, students can complete and independent study research project that must first be approved through a proposal process, and culminates in a paper similar to a master’s thesis, that potentially prepares students for graduate studies or careers (“Senior Honors Thesis”).

 Sheldon Cooper and Elon Musk seem so far away from society, and not simply because Sheldon is fictional. The average citizen does not have a PhD in research science or a JD in environmental policy and is often uninformed about how science and technology impact their lives in both economic and practical ways. The job of STS majors is to begin to bridge this gap, and ultimately pull science and technology closer to the general public, informing people how to make educated decisions in their voting or how to live more sustainably. The discussions happening in STS classes are fueling future leaders who will pioneer policy in regards to artificial intelligence and establish international guidelines for genetic engineering (“Program in Science, Technology, and Society”) . The issues created by science and technology, and the ways that technology can be used to study society, are increasingly diverse. In response to the expanding need for people to answer these global questions, STS graduates in 2015 became the highest paid humanities majors post-graduation (“Top-Paid Humanities Grads: Science, Technology, and Society”).

 There are many different professions that have to deal with the ethics and policy regarding science and technology, and many people who use science and technology to analyze policy. Jobs that look critically at these issues include environmental economists, lawyers, doctors and more. Luckily STS programs attempt to match this variety of issues by offering the many concentrations and specializations that they do. Students with an undergraduate degree in STS can enter fields such as law and policy, educational outreach, medicine and public health, or government and public service (“Career Options”). UC Davis has noted that many of their STS students go into the high tech industry in Silicon Valley or environmental policy because the two fields have so many current issues and challenges.

 An undergraduate degree in STS can also lead into multiple graduate programs such as business school, law school, and PhD programs. Stanford has sent STS students to Harvard Law School, which is one of the most prestigious graduate programs in the world. Graduate programs help STS majors become even more specialized, but they also prepare students for a career that the undergraduate major does not necessarily do(“Careers for STS Majors”). While an undergraduate degree teaches students how to critically look at science, technology, and society in ways that allow them to see connections that others do not, it is difficult to make a career out of simply an academic philosophy or interdisciplinary approach to life. There are job opportunities for those with only an undergraduate degree, but they are highly dependent on local issues and industry, and they are limited. Graduate school prepares STS majors for practical careers in standard fields such as law or business, and focuses their STS concentrations into workplace skills (“What is STS?”*Harvard*).

 STS programs are evidently varied, but they all essentially have the same purpose: to equip the next generation with the tools they need to solve real world problems. Home to the largest graduate STS program, Massachusetts Institute of Technology claims that the core of STS is learning to “examine how the people who practice science, engineering and medicine influence the knowledge and innovations produced,” and also to “remind us that knowledge and innovation have differential implications” (“About Us”). The further society advances, the more difficult situations it faces in terms of policy and decision making, such as the impending issues regarding limited resources. In a little over 100 years there will be no fossil fuels left. This is the kind of issue that scientists, policy makers, and businessmen alike need to think about, and an STS degree teaches students to approach these issues as all three (Singh).

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