San José State University
Department of Urban and Regional Planning
ENVS121 and GEOG121: Population and Global Change

Fall 2023

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Course and Contact Information

Instructor: Gary Pereira

Office Location: Online only.

Telephone: (510) 825-3506 (**text** please, at least initially)

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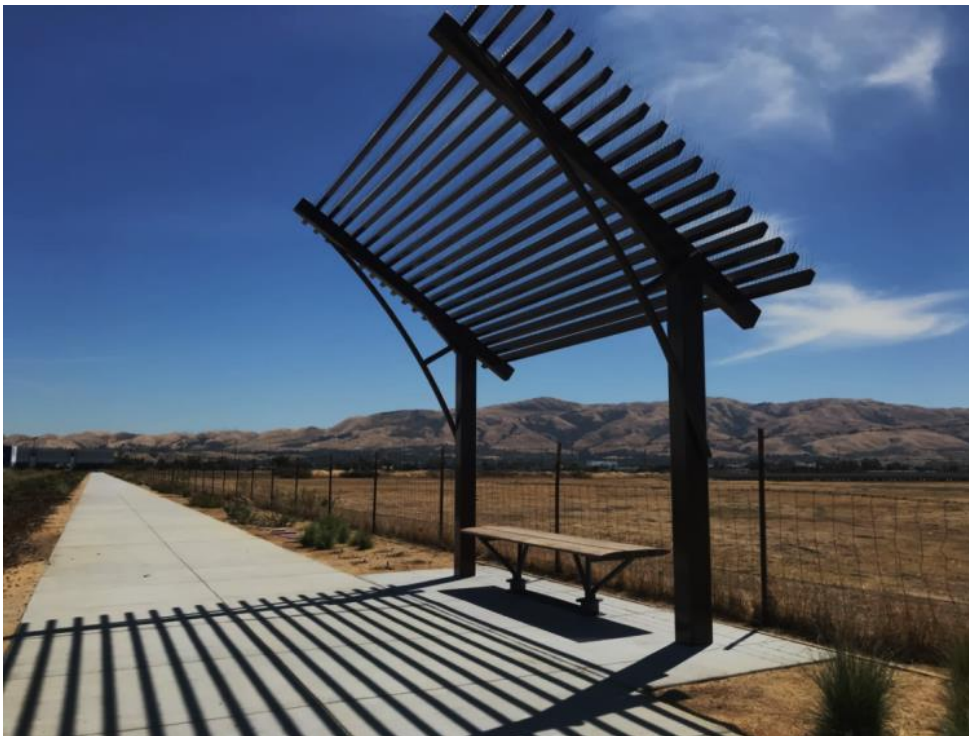   gary.manuel.pereira@gmail.com

Office Hours: Please message me if you need to set up an appointment.

Class Days/Time: Weekly homework and announcements as scheduled.

Course Format

This is an online-only course. Internet connectivity and computer are required. Many of the resources that we will use are from safe, reliable sources on the Internet. The course itself can be accessed through the Canvas Leaning Management System course login website, primarily through the **Announcements** and **Assignments** for this class. Additional course materials (including this syllabus) can be found and uploaded from **Files**, as prompted by the schedule. Students are required submit one homework assignment each week, as well as a final evaluation paper. Study material and assignments are listed and described under **Assignments**, but additional requirements or suggestions may be described within the **Announcements**. Please check the Announcements at least once a week, particularly before submitting homework. Your grades may reflect repeated failure to address additional questions or concerns that I may post there. All homework must be submitted, even if late. Any work that has not been submitted by the end of the semester will receive a zero grade. Repeated lateness should be explained in an independent Canvas message or with a message pinned to the assignment itself. Messages may be pinned to each assignment by both the instructor and student. I will try to get to each submission within a week after its due date, although I may sometimes run late. Check in a week for any remarks or instructions that may have been pinned to that assignment, regardless of whether you have received a grade. Please address any requests for revision and resubmission I may have made. If you want to respond to a pinned message after a grade was issued, please do so by sending me an independent message within Canvas. I am unlikely to return to any particular submission once it has been graded, unless I've been prompted to do so by you.

The photo below represents (hopefully with a little humor) my impression of some of the systems and applications that have become commonplace in education. You might notice something a little strange. The structure looming over the bench looks it might provide some shade or shelter from the rain, but in fact it does neither, at any time. You can take this photo as my commentary on contemporary decision-making. Several of these structures were built, and it wasn't easy. Spikes had to be installed to keep birds from perching and messing up the bench, which would have been left undisturbed, had these remarkable structures not been there.

The bench is intended here to represent the parts of Canvas that we will be using: **Announcements**, **Assignments**, **Files**, and messaging. The stylish, attractive, but completely useless structure looming above it might be taken to represent what I consider some of the less helpful facets of Canvas, as well as most of the published resources that students are often required to buy. For this course, I have found that freely available readings are sufficient to supplement some carefully chosen Internet sources, as well as some of my own material. This strategy I believe results in a more substantive, robust, personal, and direct understanding of the topics described here than even the most expensive textbooks and their associated resources offer.

What makes a course engaging should be its subject matter, not the structure of the course or the personalities of the instructor or participants. Let's try a simple metaphor. If you're looking for the moon in the night sky, it would certainly be foolish to confuse the finger that someone might be using to point out the moon for you, with the moon itself. The characteristics of the finger are completely unimportant. It just points the way. For the most part, that is what I will be doing for you: pointing the way. As best I can, of course, given what I find to be true and meaningful thus far in my understanding of things. I've kept the structure of this course simple so that we will have more flexibility to follow relevant current events, discoveries, or connections in real time. Therefore, despite the structural simplicity of this course, it is important that you follow the **Announcements** by checking them at least once a week, and **respond in subsequent homework assignments to specific questions that may be posted there.**

Remaining within our metaphor, the tendency to confuse some pointing 'finger' with some external object of study can have another unfortunate association. Because we can manipulate our fingers any way we want, we might start to believe that by doing so we can magically affect the object being pointed at. Consider that the opposite might be true. Possibly, at least for educational purposes, I would like you to try to set aside the implications of your own personal or collective identities and just do your best to learn about what exists well beyond (or invisibly within) yourselves. I have found that, by taking this approach, we can learn to more realistically evaluate and adapt to whatever the unknown forces of nature (and of the human heart) might throw our way.

Within **Announcements**, I might try to be helpful by making some observations or offer general advice regarding earlier and future homework responses, but I will never identify students by name without prior permission. I further promise to keep any information we exchange via either messages or homework completely private. You of course may share any such exchanges or documents with anyone, at any time.

We can communicate as much or as little as you'd like, within Canvas messaging. I've had some long conversations with some students, and none (outside of homework comments) with others. I leave that up to you; it has no effect on your grade. With messaging, conversations cannot be ignored, misplaced, manipulated, forged, modified, or inappropriately shared with others. There are no such assurances with email (including the one assigned by the university, and is run by Google) or with other social media platforms, which are as a result often used as tools of manipulation, power, confusion, and disrespect, particularly by people in positions of authority. I prefer not to use email in my role as educator. The gmail address listed on page one here is a good way to get in touch with me down the line, but during the semester, **Canvas messaging is sufficient.** Text my private number, which is also listed on page one, if you have a time critical emergency, and I'll call you back. Being late with homework is not an emergency. If any of your work is late, submit it anyway and pin an explanatory message to the homework itself, or message me separately regarding more serious issues.

Given the current state of America's universities, I will not require you to share your work, your opinions, or even your image with others in the class, or with anyone else that happens to be looking in. Unfortunately, every moment of screen time can be inappropriately saved, shared, and broadcast publically, and it can live forever. I do not want anyone to suffer retaliation for anything expressed in any of my classes. This is not an idle concern. I know what it's like. It has happened to me repeatedly, and it is likely to happen again, and again. For the foreseeable future, I will not be asking students to use zoom or skype or whatever the latest thing happens to be to gather around a screen at some particular time. Nor will I

organize or participate in any sort of online discussions, so long as innocent people like you and me remain under threat for expressing or exploring ideas that someone somewhere now or at some future time happens to find problematic. Instead, I encourage you to refine and edit the work that you do for my courses and for others, and to post it online: **in your own time, at your own discretion, in a way that is fully under your own control** (e.g., via Portfolium).

Please carefully read and view the material that I have provided at the beginning of each **Assignment**, as well as any new **Announcements** at least once a week. These locations are where the material or pointers to the material that would otherwise be covered in lectures will be located. If you do not read over this material and view the videos, I will know through your homework responses. Homework questions are posed within each **Assignment**. Additional questions issued in an **Announcement** should be addressed within a week or two. If you do not address these additional questions, I will assume that you are not reading the **Announcements**, and this will be reflected in your grade.

I am not obsessive about the quality of your writing, since you have a limited amount of time each week to proofread, but I do appreciate good organization, reasoning, and grammar. **I am looking mostly to see that you have actually accessed and examined the material in question, and that you have put in the time.** If you are uncertain, make adjustments based on the grades and pinned comments you receive from me. You might want to ask someone to independently read and edit your homework before submission. However, your words and thoughts should be your own. You may quote extensively from material in the assigned or suggested texts or videos, but please provide attribution, by means of notes or references. A URL alone is not enough; provide proper references. The style is unimportant; just be consistent.

Copying and pasting text without attribution, or using an AI service to generate homework responses, is very likely to:

1. get me (your instructor and grader) extremely annoyed;

2. prompt me to investigate how much of your response has been synthesized or plagiarized (this isn't difficult);

3. generate a zero grade for each synthesized or plagiarized response, and possibly for the entire assignment;

4. prompt me to investigate all previous and subsequent submissions from you very carefully, and repeat steps 1, 2, and 3.

So plagiarism on assignment 1, even if it is only discovered at the end of semester, can still lead to a reevaluation of its original grade. Most of my questions are intended to elicit your impressions, rather than just regurgitate facts, so plagiarism would be pointless anyway. It should be easier for you to ask yourself for such impressions, than for you to ask the Internet. Try writing the way that you talk. If you have no clear impression or opinion on a topic, try the following strategy: on the one hand…, on the other hand….

The university expects that each student put at least **nine hours of work per week into each three-credit course** (University Policy S12-3 at http://www.sjsu.edu/senate/docs/S12-3.pdf).Your homework assignments and final paper will be evaluated and graded primarily on the degree to which this expectation has been met, based on my impression of your work. The more detailed, organized, and thoughtful your responses are, relative to your classmates, the better your grades will be. You are not graded on the basis of any opinions or conclusions you may express on any issue, even when I might ask you to express one. I am more interested in whether you understand and appreciate the issues themselves. Further details are discussed below under **Course Requirements** and Assignments, in the **Course Schedule**, and in my introductory video.

Course Description

This course is about the global human population and how it has changed, or is likely to change, in response to a number of physical and social factors. At least one different theme is explored each week. These include health, agriculture, climate, hydrology, energy, innovation, and the sciences and technologies of observation and modeling.

Textbook

This course is not based on a textbook, and no textbook reading is required. I will ask you to use as reference portions of **Introduction to Human Geography**, edited by David Dorrell and Joseph P. Henderson. We can use this book freely because it is intentionally licensed for such purposes under a Creative Commons Attribution 4.0 International License by the University System of Georgia. You can download it as a pdf file from Canvas **Files**.

Readings

Readings are required for certain assignments. All of the readings listed in the schedule are preceded by one of the following:

> **Read**: take the time to read all or most of the text, keeping in mind any associated homework questions.

> **Reference:** contains information that may help to fill out your understanding of key terms and relationships. You may use this information to inform your homework responses.

> **Recommended reading**: read this if the topic interests you, and if you intend to study or write about the topic in greater detail (for example, for the final paper).

Videos

Videos are a big part of this course, and much of the homework will be judged on the basis of how closely you consider them in your discussions. If you are accessing each assignment directly through Canvas **Assignments**, you can watch the videos coming from YouTube embedded directly within Canvas, but you also have the choice of running each video in a separate browser. Watching videos within separate browsers often provides you with additional textual information, as well as access to the author's channel. You might want to watch videos on a tablet or TV as you write on a laptop. Use whatever method feels comfortable, but make sure you have a large enough screen with sufficient resolution to clearly see the details (including text). You also obviously need sufficient bandwidth, which may change for you over the course of a typical day, particularly if you use public portals.

Videos are indicated by a short description, followed by the channel name in brackets. If a particular video interests you, you might want to check out other videos on the same channel. All of the videos listed in the schedule are preceded by one of the following instructions:

> **Watch:** take the time to watch all or most of this video. You may find it helpful to 'pause' and watch key portions repeatedly, taking notes as you watch.

> **Examine:** You may watch the video in its entirety if you like it, but there is no immediate need to do so. However, you should watch portions closely. You might want to scrub through segments and watch only those portions that look particularly interesting, or that connect to the questions you need to address. Many of these videos have no narration, although they do convey a great deal of information. Some just provide a deeper sense of context. In any case, do NOT skip over these videos, since they nearly always connect with specific homework questions.

> **Recommended:** You are not required to either watch or examine this video, but I have found it to be of exceptional value or interest with regard to the topic at hand, so you might want to check it out.

It is important that you have clear audio with easily adjustable volume. The sound processing on some of the videos is binaural, meaning that it simulates the geometry of human hearing. This provides a more realistic, 3D experience than normal stereo processing, particularly if you use earphones.

Most of the videos that I require or recommend embed within Canvas. If you click on the video, it should play. However, it is possible that the channel supplying the video has prohibited embedding, in which case you will get a screen indicating that it must be opened in a separate browser. If you do open any video in a separate browser, you will find that many of them contain or are preceded by ads. Some of these ads are part of the video. But often, ads can be cut short by clicking on the Skip Ad button that might appear,, or by clicking on the **X** within the ad itself if it's a popup. YouTube reserves the right to place ads in front of, including my own videos, although I get no monetary benefit. By the way, I do not generally provide tags on my videos, and I sometimes disable comments. Views of my videos embedded within Canvas are not counted as views by YouTube. These are some of the reasons why most of my videos get few officially counted views, which is fine with me. Feel free to subscribe to any channel that interests you, including my channel, and to share these videos with others. If any of the videos for the course become unavailable over the course of the semester, don't panic. Check the Announcements to see whether I have recognized the issue yet and have provided alternatives. If I have not addressed it yet, please let me know about it. Otherwise, if time is short, do your best with the resources at hand, and if you're feeling resourceful you may searching for alternatives. In any case, videos disappear from YouTube only rarely.

Course Requirements and Assignments

Homework

Fourteen homework assignments should be completed on or before the due dates, as described in the course schedule below. They must all be submitted, even if late. Please submit all files via Canvas; never email them to me or as attachments to messages. If you are having difficulties, message me through Canvas. If personal life intrudes or if Canvas or the Internet are giving you problems, just be patient, try again later or the next day, and let me know about it in general terms. There is no penalty, obviously, if you let me know. For each homework assignment, I would prefer that you use 10 (or 12) point font with 1½ line spacing. Put your name, the assignment number, 'envs121-80' or 'geog121-80', and 'Fall 2023', arranged at the upper right of the first page.

Text, figures, and images copied from documents or screenshots may be embedded within your homework, but these should include full attribution (not just the URL). In other words, just be honest about which words, figures and images are yours, and which are from other sources. You will need to be especially careful about this if you decide to publish or post your work in an online portfolio. Most of the text in each homework submission should be your own. If you do upload anything to a platform like Portfolio, you immediately get basic copyright protection under Creative Commons. That is evidence that you published it, and when. So make sure that it's all really yours.

Regarding the length in pages or word count expected for each assignment: this depends on the topic, and also on your writing style. **I'm looking for evidence of understanding, substance, and a willingness to sufficiently pursue each point you are making until you've made it properly.** I understand that you only have a few days for each one. It is also perfectly reasonable to be unsure about topics that you are just beginning to understand. The ability and willingness to openly express one's own doubts and uncertainties is a virtue, since it often leads to further understanding. If your writing style is average, if you avoid redundancy, and you put in the time expected of you, each homework assignment should probably run at least three pages. The time and effort you spend on each question may vary, depending on your interest. **If you cannot find much to say about one topic, make sure you compensate for that with another one within the same**

assignment. Each of your submissions is graded relative to those of your classmates in the current and former semesters. I often look through each week's submissions repeatedly before deciding on grades. I may offer comments or advice in Canvas for each assignment. Check back on each assignment a week or more after the deadline for any comments that I may have tagged to it, even if it hasn't been graded. If you would like to begin or continue a conversation about an assignment, please do so with an independent Canvas message. I encourage you all to go back and expand and polish up some of your most interesting essays and **publish them online**, in Portfolium at a minimum. In my opinion, the work you are doing for this class and others should be used in support of your professional career. Please read **'About your instructor'**, below.

Final Evaluation

Instead of a comprehensive exam, I want you to write a thoughtful essay as described below in the Course Schedule.

Grading Information

Fourteen homework assignments and the Final Exam should be completed on or before the due dates, as described in the Course Schedule below. They must all be completed by the end of semester. Please submit these responses as either Word or pdf files via Canvas.

Homework assignments (6.5% each) x 14	91%
Final Evaluation	9%
Total	**100%**

98% and above	A+
94% - 97.9%	A
90% - 93.9%	A-
87% - 89.9%	B+
84% - 86.9%	B
81% - 83.9%	B-
77% - 79.9%	C+
74% - 76.9%	C
70% - 73.9%	C-
67% - 69.9%	D+
64% - 66.9%	D
60% - 63.9%	D-
below 60%	**F**

About the instructor

I grew up in a semi-industrial town in New Jersey, near New York City. Refinery flares lit the night sky. I attended public schools and held several untrained jobs in various settings, from our single-screen downtown movie theater to the reactor building of an active nuclear power plant. I began working professionally with a two-year degree in electronics engineering, on a team of about a dozen technicians that built and maintained the data acquisition and instrument control system for Princeton University's tokamak reactor TFTR, the largest nuclear fusion experiment in the world at the time. After six years at Princeton, with the reactor's successful completion and operation, I worked as an electronics technician for the science departments of Brooklyn College in NYC, where I also took evening courses and earned a master's degree in computer science. While in Brooklyn, I met Cheri, we married and had a child. We moved to Bethlehem, PA, where I worked as a technician for the Physics Department at Lehigh University, later as a geographic information systems engineer for Lockheed Martin. After a few years we moved to Minnesota, where I worked as a physical scientist at a NOAA facility called NOHRSC, which processes remote sensing, GIS, and hydrological models to produce online data products. I earned a PhD in Geography at the University of Minnesota, where I did tropical fire research, taught physical geography, and met and worked with some of the most well-known and highly respected scholars in geography and related fields. We finally moved to the Bay Area, and I've been at SJSU for over 20 years.

I encourage all students to participate in professional organizations or guilds and to make use of any truly meaningful learning opportunities or certifications that are being offered, at least until you are settled into a career path. Learn a few extra skills. Even if you don't end up using them all, you will have demonstrated to yourself and to others that you remain capable of learning. I've worked for business, government, and education, and everywhere the intentions and capabilities of individual people are the key to the success or failure of any given project. Before anyone serious hires you or decides to collaborate with you, they will probably want to know more about you than what your degree and GPA or even an interview or two may provide. I encourage you to revise and publish your best work (in whatever medium you use, but certainly including your most engaging text), within a setting that potential employers or collaborators can easily access, like Portfolium. Here's a little story to show what might happen if you just let people know what you're capable of doing. I worked for a few years as a technician for Lehigh University, where I also took the classes that I needed for a PhD in Computer Science. We moved away before I could make much progress on a dissertation, but I'd been working independently on something. Based largely on what I'd learned on my own and at Brooklyn and Lehigh, I developed a system in software that performed some novel analyses and visualizations (at the time) in remote sensing and GIS. I presented a paper explaining its function at an international conference in Vancouver. I paid for the membership, registration, flights, hotel, and everything myself. A couple of weeks later, I got a call from someone at Lockheed Martin Corporation who'd been to the conference and had read my paper. He described a position at a cutting edge GIS project within commuting distance of my home. They interviewed me and offered me a job as a systems engineer, which I accepted.

https://portfolium.com/garympereira/portfolio

EnvS121-80 and Geog121-80: Population and Global Change, Fall 2023

Please submit your homework responses as either Word or pdf files. Use 10 point font, with ~1 ½ line spacing and normal margins. At the top of the first page of each assignment, arrange your name, my name, the homework #, geog121-80 or envs121-80, Fall 2023.

Course Schedule

Week	Due Date	Topics, Videos, Readings, Assignments
1		If you haven't already done so, please **Watch**: General notes for my online classes [Gary Pereira] https://youtu.be/_AN8k0Ogwl0 It might be helpful in these first two weeks to discuss a few matters of general relevance to this course. You might find it helpful to come back to portions of these first two discussions later in the semester. I want to provide you with enough time to drop the class without penalty should you find what I have to say here to be objectionable or intolerable. In the years leading up to the COVID-19 pandemic, I'd devoted a week in this and other courses to pathogens, infectious disease, and epidemics. As the facts emerge regarding COVID-19, much of what I'd assumed to be true requires reevaluation. We will discuss some of this in week 5, so if you suspect that you might find any of that discussion to be problematic, I suggest you read it over now, while there is still time to drop the class without penalty. Topic 1: **The individual and the collective** Most discussions of the individual human experience are predicated on some commonly accepted categorizations: nationality, race, ethnicity, class, livelihood, income, net worth, religion, political affiliations, age, sex, gender, marital status, etc. Twenty-five years ago, while I was working with old books of census data at the University of Minnesota, I discovered that many of these presumably stable categorizations actually come and go over time, despite everyone's best efforts to keep them orderly and continuous. Any given category may emerge out of nowhere or disappear entirely, depending often on dynamically changing technological, cultural, and economic factors. This represented my first practical understanding of the fact that more care and contextualization are required than we might assume, when using social categorizations. In order to truly understand how and why human life changes on a local, regional or global basis, we need to recognize that it often depends upon multiple sources of agency at indeterminate scales, individual human beings, and ephemeral circumstances. Social dynamics are often observable, and possibly explainable, only at a much finer resolution of discernment than most social analyses manage to achieve. This semester, we will discuss some conceptual and technical ways to possibly bridge some of that gap. Most of us would probably accept the idea that every society, regardless of how large or complex it may be, is ultimately comprised of uniquely individualized human beings. Even within the largest of crowds, and even under the most oppressive of circumstances, there are no 'non-player characters'. Everyone is a player. Everyone, regardless of circumstances, has some sort of human agency. This message is often conveyed to the rest of us by people who have survived some of most horrific experiences imaginable. This access to an individualized human existence is pretty obvious to most of us as children, but as we

Week	Due Date	Topics, Videos, Readings, Assignments
		grow older we often shape our inner selves to match outer expectations, categorize people in various ways, and form impressions about ourselves and others that may not actually be true. We may even lose sight of our own essential nature. Regardless of how mysterious or undefined 'human nature' may be, and whatever it is, most of us would recognize it as being present in each of us. I think it's easy to recognize the presence of individualized agency in members of other species as well, but for the most part we will focus our attention on human beings. I just wanted to begin the semester with this simple point: we should keep in mind the significance of each of us as human beings, while we look at how our common needs and unique aspirations play out in space and time. **Watch** (or listen while reading): Humanity [Gary Pereira] https://youtu.be/IeT2AObKkJM As you take in the sights and sounds of this video (which I shot early one weekday morning from the deck of a boat on the Yangtze River), you might think that the absolute numbers of people on this Earth are just too overwhelming to consider in individual terms. Nevertheless, I'd like you to try to do just that. Behind those windows, thousands of people are waking up to another day. Each one of these people has unique experiences, attachments, dreams, ambitions, disappointments, successes, joys, and sufferings. Regardless of how distant much of the world may seem to be from our own experience, we also know instinctively, without having to be told, that each of these people's lives is just as important to each of them as mine is to me and yours is to you. If we keep that in mind, we can learn a great deal more than we otherwise might. In the syllabus, I basically describe my role as a pointer: bringing up what I think might be potential sources of insight. The characteristics of the person doing the pointing are unimportant, but in light of what I've just said about human individuality, and so that you might better appreciate my focus, it might be helpful to discuss a few of my own experiences from time to time. My father worked most o his life as an electronics specialist, working mostly in radio and TV. He had served in the Signal Corps in WWII, setting up transmitters on remote islands in the Pacific. As a kid growing up in the 1960s and 70s, I had access to shortwave radios, including a Heathkit GR-64 that I built myself. The shortwave bands were then a significant source of information and entertainment worldwide, filled with mysterious codes, conversations, and noises, like some kind of dark ambient music. Shortwave signals bounce off the ionosphere as they make their away around the world, so different stations fade in and out depending on the time of day, time of year, and current space weather. The precise heartbeat of Greenwich Mean Time was always there, and the chimes of Big Ben introduced each hour's news programming on the BBC. The Voice of America and Radio Free Europe provided (and continue to provide) people around the world with programming in English and many other languages. But some of the most powerful signals that I could pick up at the time came from the Soviet Union and associated Eastern Bloc nations. Particularly strong were Radio Moscow and Radio Sofia (Bulgaria), broadcasting in English. I often listened to socialist stations, since these broadcasts put a human face (or rather many real human voices) to a set of enemies that seemed evil and malevolent to the adults around me at the time. Hearing the utopian socialist line and its stirring music, I could understand how downtrodden people around the world might feel after hearing it. But even as a kid I was able to see the shortcomings in their arguments and develop a more critical understanding of Soviet socialism than I otherwise would have. There is often a lot to be gained from paying attention to what your antagonists have to say, as well as the dissidents among them. Although the Internet should make this easier, most Americans are probably unwilling to even look at what our nation's antagonists have to say, for fear that our own government might be watching them. The great thing about good old fashioned radio is that nobody knows you're listening.

Week	Due Date	Topics, Videos, Readings, Assignments
		Many people, including of course academics and intellectuals, like to theorize on a grand scale about societies and cultures. It is often said for example that Western societies have a more 'individualized' focus, while Eastern societies have a more 'collectivized' focus. You can find any number of videos with titles like "Me or We? Cultural Difference between East and West". I do not recommend that you accept any claims of this sort without first carefully examining the facts in a detailed way. When you do, I think that you will find, as I have, that assumptions of this kind are often misleading or just plain wrong, when you compare them to what you might witness directly in this rapidly changing real world. Unless you have personally examined these or any other social or cultural premises or claims very carefully, I do not recommend that you rely on them as fact. I've chosen our sources here carefully, rejecting dozens of videos for each one chosen, based mostly on their superficial and stereotypical rendering of human life.

As an illustration of the fundamental reality of individualized differences and similarities among people within a single culture, regardless of culture, I'd like you to watch the following video of short street interviews in Russia on a YouTube channel called "1420 by Daniil Orain", with question 1 below in mind. I've been watching Daniil's videos for some time now. They present a remarkable record of attitudes within Russia on a number of provocative topics.

Watch: 5 years in jail or going to war? [1420 by Daniil Orain]
https://youtu.be/krD3xySrwNk

Topic 2: **The particularities of place**

The notion of 'place' in the psychological sense is one of the principal themes that distinguish Geography from some of the other spatial disciplines. We all know what having a 'sense of place' means, so we don't need to formally define it here. I'll let you explore the idea in your assignments. It clearly involves our impressions and memories of physical locations at various scales, particularly if they have personal significance. Most of us can conjure up spatial memories of familiar places. Words can create a powerful sense of place, and this is one of the characteristics of great literature. But for purposes of this class, I would like you to consider the idea that recognizing the particularity of the actual places through which we navigate our lives will help us to appreciate the real human significance (down to the level of the individual) of some of our most difficult environmental and social challenges. These may involve the deterioration of what might be called place stability, often associated with economic collapse, human rootlessness, displacement, and migration, accompanied by urban, rural, and environmental decay.

For instructions on viewing videos in this class, be sure to read the section in the syllabus titled **Videos**. Since they are mostly on YouTube, you can either view most of them either within or outside of Canvas. If you click on the hyperlink above a video rather than the video itself, it should open up in a separate browser. If the video indicates that it cannot be viewed within Canvas, you will have to view it in a separate browser. You might also want to view the videos and other resources on a device separate from the one you are using to write with. There are lots of strategies you can use. Many of the 4K and 8K videos in particular look spectacular on a high definition screen. It is important that you have clear and easily adjustable audio. The default sound volume on videos can vary enormously. The sound on many of the street videos in particular is binaural, which simulates the geometry of human hearing, thus providing often a more realistic experience than ordinary stereo, particularly if you use earphones. |

Week	Due Date	Topics, Videos, Readings, Assignments
		As a reminder, a video labeled **Watch** should be watched (most of it) at least once. If a video is labeled **Examine,** it does not need to be watched from beginning to end, but I still expect you to look (and listen) carefully through parts of it. You might want to swipe through or sample segments at intervals to get an overall impression, and then go back and watch those segments that seemed to be most informative. Keep any relevant homework questions (listed at the end of each discussion) in mind, and get in the habit of pausing videos to write down notes. In order to address some of the questions, you might end up spending more time with a video I ask you to examine than one I ask you to watch. In week 4, we will discuss some of the world's current and future megacities and metropolitan areas, so let's start our consideration of the particularities of place by taking a look at one of the most famous neighborhoods of what has been and may still be the world's largest metro area. And I've chosen a video with weather conditions that we lack: summertime rain. The reflections of rain on the streets of a busy modern city seem to add another dimension to the scene. I'd like you to examine this and at least two more videos below from Japan and Korea, with question 2 below in mind. **Examine:** Tokyo Rainy Night Walk in Shinjuku [VIRTUAL JAPAN] https://youtu.be/SiryvrStb8E **Examine at least one additional video from Japan, and one from Korea:** Japan: Shinjuku in Tokyo [Japan Walk] https://youtu.be/i111Cpv2cBU Japan: Tokyo market street Sugamo [Ramblac] https://youtu.be/oWSwQ8ZtG1A Korea: Walk around Insadong Street, Seoul [4K Seoul] https://youtu.be/6IlNgT2TfAc Korea Ikseon-dong Hanok Street , Seoul [Seoul Travel Walker] https://youtu.be/R9hqsGFt00Q We need to honestly assess where we as a nation, state, and region stand with regard to our understanding and appreciation of urban life. We need to recognize the limited, incomplete, and often inconsistent nature of some of our common assumptions. Collectively, in and near several of our nation's largest cities, our understanding of the nature and possibilities of urban life is poor and getting poorer, but as an individual each of us can disentangle the truth from delusion. We might begin by engaging in a little self-reflection. I'd like you to watch the following videos with question 3 below in mind. **Examine:** Every Store is CLOSED in San Francisco Downtown [Nomadic Solo Travel] https://youtu.be/HV7F9YNxmWE **Examine:** Every store is CLOSED on Market St, San Francisco [METAL LEO] https://youtu.be/5UWIyGDnHmk Regardless of what your impression of San Francisco currently may be, you might assume that the Tenderloin is as bad as it might get. If that is your impression, please take a good look at Kensington

Week	Due Date	Topics, Videos, Readings, Assignments
	08/28/23	Avenue, Philadelphia. I am not presenting this in order to shock or impress. I thing that any serious student of the social sciences should be aware of this, happening at this time, in many locations throughout the US,. **Examine:** Kensington Philadelphia on a Friday Morning [GhettoMerica] https://youtu.be/pll0MaIIi3c **Examine:** Kensington Avenue, July 2023[StreetRecord] https://youtu.be/F0MWxbN89Aw **Homework 1:** 1. Did anything about the questions and responses in the video of spontaneous interviews on Russian streets surprise you? Why/why not? 2. Although they are not necessarily representative of each of these cities and nations, I'd like you to discuss a few things about the scenes from Tokyo and Seoul that you found particularly interesting or unexpected. Are there any clear differences between these cities, other than language? What seems to be the general mood among the people? How do they interact? Do you think you would feel comfortable in these surroundings? You may organize your response to this sort of question any way you'd like: in paragraph form, or as lists or developed bullet points, for example. 3. After watching the videos that were shot in San Francisco and Philadelphia, as well as contemporary scenes from Tokyo and Seoul, I want you to think about what precisely goes into forming or fostering a sense of place. Is it the buildings, roads, lawns and trees, existing in space and in history as if in a snapshot? To what extent is our sense of place dependent on the presence, absence, general mood, and behavior of the people that occupy that space? Do we retain a sense of place even in the dead of night, even if no people are around? Can our impression of a place be changed irrevocably by one tragic event, or by the sort of slow social malaise that some of us may see happening at present before our own eyes? I'd like to keep the contrast between what could be and what is ever present in your mind. We Americans pretend to be world leaders, particularly here in California, and particularly in California's state-run schools. But do we really have an understanding of what comprises healthful urban life? Might we have something to learn?
2		Topic: **Agendas** Reminder: check each week for any new **Announcements.** Having read last week's discussion, you might guess (correctly) that I believe more in an individualized basis for human intelligence and wisdom, than in the supposed benefits of a collective vision. It seems to me that we are living in a time when two trends in human social development are vying for recognition and support. On the one hand, there is the instinctual human desire for freedom from arbitrary constraint. Very few of us feel happy for very long when we are being constrained. We feel happy when we are free. A sense of freedom leads directly to the discovery of viable solutions to problems of all kinds. The psychological space that inner freedom generates is comforting in the face of life's terrors. It provides

Week	Due Date	Topics, Videos, Readings, Assignments

strength in times of need. My approach here is to try to expand, rather than constrain, that sense of freedom. On the other hand, there is the rational desire to design, build, and fix the systems of society itself by gently but firmly guiding its sources of agency, from individual human beings to corporations, businesses, and local, regional, and national governments. If society operates like a machine, it stands to reason that it can be most efficiently operated through the exercise of power in order to constrain others, and even our own selves. I see the former trend toward greater freedom as being in line with 21st century understanding of the complexities of reality (see week 6), and I see the politics of power as representing the persistence of 19th century machine thinking. Let's look at some of its manifestations.

1.1: **The manipulation of reality**

I attended public schools in a semi-industrial city in New Jersey in the 1960s and early 70s. My junior high school and high school offered hands-on instruction in wood shop, metal shop, print shop, and automotive technology, as well as drafting, chemistry, physics, biology, photography, and electronics labs. My chemistry teacher, Mr. Salzer, was a middle aged man whose family had perished twenty-five years earlier, in the Holocaust. One day, he introduced to us a short book of essays called *Brave New World Revisited*, by Aldous Huxley, which had been published a few years earlier, in 1958. Mr. Salzer introduced this little book to us more than fifty years ago. In case you haven't heard of it, let me introduce it to you now. Along with Orwell, Huxley was one of the first authors to influence my perspective on the world. The video below is a contemporary discussion of the book.

Recommended: Do We Live in a Brave New World? - Aldous Huxley's Warning [Academy of Ideas]
https://youtu.be/aPkQ57cXrPA

One method that tyrants have used to control their populations throughout history has been the generation and manipulation of distrust and fear of some perceived enemy, whomever that enemy happens to be. If no such enemy exists, one will be chosen for you. That sort of manipulation is certainly apparent in our politics, education, and entertainment to anyone who cares to look, and its effect on the wider world is consistently deadly. I have lived long enough to have witnessed our own nation become involved in several cycles of manufactured conflict and war. It doesn't really matter who the enemy is, so long as there is one. This was embedded within a famous novel that was written by George Orwell back in 1948:

> "Actually, as Winston well knew, it was only four years since Oceania had been at war with Eastasia and in alliance with Eurasia. But that was merely a piece of furtive knowledge which he happened to possess because his memory was not satisfactorily under control. Officially the change of partners had never happened. Oceania was at war with Eurasia: therefore Oceania had always been at war with Eurasia. The enemy of the moment always represented absolute evil, and it followed that any past or future agreement with him was impossible…"

> "To know and not to know, to be conscious of complete truthfulness while telling carefully constructed lies, to hold simultaneously two opinions which cancelled out, knowing them to be contradictory and believing in both of them, to use logic against logic, to repudiate morality while laying claim to it, to believe that democracy was impossible and that the Party was the guardian of democracy, to forget whatever it was necessary to forget, then to draw it back into memory again at the moment when it was needed, and then promptly to forget it again: and above all, to apply the same process to the process itself. That was the ultimate subtlety:

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		consciously to induce unconsciousness, and then, once again, to become unconscious of the act of hypnosis you had just performed. Even to understand the word 'doublethink' involved the use of doublethink." -George Orwell, *1984* We have certainly been hearing a lot about disinformation and misinformation lately. It doesn't take a genius to notice that the people who are shouting the loudest about the dangers of disinformation are often the very same people who are intentionally practicing it. It's just like people with sex on their minds, always obsessing about it and always accusing others of thinking or acting inappropriately. It's called psychological projection, and it's very common. A great deal that has been labeled disinformation and banned from the Internet with regard to COVID has turned out to have been true, and nearly everything we have been told was true about COVID (and about any number of other things), has turned out to be false. Draw your own conclusions. 3.2: **Social credit** The quantification and commodification of virtue is not new, of course. The priests of the past made a living of it, and some still do. But these days, the quantification, commodification, and enforcement of virtue have become the arm of public education, business, and government, rather than of religion. Even with the absence of any sort of God or higher being in their lives (or perhaps because of it), people are obsessing over, judging, and ranking one another's thoughts, emotions, and personal lives in terms of a very Western, neoliberal, post-puritanism. Accelerated by the Internet and other technological changes, the forms that this movement can take in the modern world are frightening. The concept of 'social credit' is being applied now with increasing ferocity not only to people, but also to corporations, education, law enforcement and other public services, health care providers, anything in fact that provides a paycheck. In fact, social credit scores are being generated for every possible sort of social organization. The panels of judges applying these rules tend to be unelected bureaucrats and IT professionals for now. With the advent of AI, this may be transitioning soon over to nameless, faceless algorithms. The quantification of virtue in Western countries like the United States often takes the form of something called ESG, which has its origins and finds elaboration among United Nations officials and bureaucrats. We will get to the UN shortly. **Reference:** Environmental, social, and corporate governance (ESG) [Wikipedia] https://en.wikipedia.org/wiki/Environmental,_social,_and_corporate_governance Environmental, social, and corporate governance (ESG), also known as environmental, social, governance, is an approach to investing that recommends taking environmental issues, social issues and governance issues into account when deciding which companies to invest in. Since 2020, there has been accelerating incentives from the United Nations (UN) to overlay ESG data with the Sustainable Development Goals (SDGs), based on their work, which began in the 1980s. One tactic often used by members of our own government, a complicit press, and even much of the so-called alternative media, is to exaggerate the degree to which those governments of which ours happens to

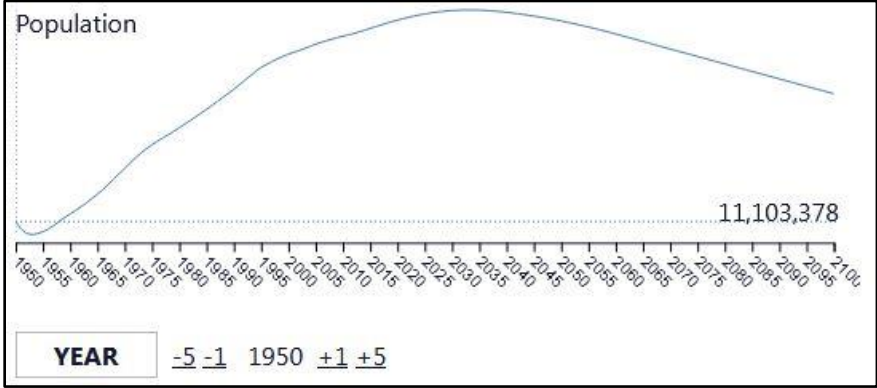| Week	Due Date	Topics, Videos, Readings, Assignments
		currently disapprove manage to control their own populations through the use of social credit. Take China, for example. To what degree has China succeeded in quantifying virtue? Let's take a look. **Watch:** The Truth About China's Social Credit System [PolyMatter] https://youtu.be/Kqov6F00KMc ### 3.3. **Stakeholder capitalism** Environmental, social, and corporate governance scores are at the heart of what many members of the World Economic Forum (WEF) call 'stakeholder capitalism', which is based on 'stakeholder theory': **Reference:** Stakeholder Theory [Wikipedia] https://en.wikipedia.org/wiki/Stakeholder_theory > "The stakeholder theory is a theory of organizational management and business ethics that accounts for multiple constituencies impacted by business entities like employees, suppliers, local communities, creditors, and others. It addresses morals and values in managing an organization, such as those related to corporate social responsibility, market economy, and social contract theory." But how important are the different stakeholders in a society? And who decides how such concerns are addressed? Social credit scores of some kind are clearly required in order to make such judgements. Who decides that? Stakeholder capitalism is loudly encouraged by the WEF, at every opportunity. And the WEF is comprised of business, industry, financial, and governmental officials from around the world, most of them unelected by the people who would be most affected by the policies they are doing their best to implement. The World Economic Forum conducted a meeting in Tianjin, China in June 2023. They called it: ANNUAL MEETING OF THE NEW CHAMPIONS. Seriously. **Reference:** https://www.weforum.org/events/annual-meeting-of-the-new-champions-2023 **Examine:** Chinese Premier Li Qiang delivers plenary address at WEF [South China Morning Post] https://youtu.be/cJkV8F92h4o **Watch:** Is stakeholder capitalism building a better world, or just empowering the rich? [Financial Times] https://youtu.be/nrk-8KfLY98 The PRC has traditionally considered the principal, if not only legitimate stakeholder in society to be 'the people'. Not corporations or even government, which should be there to serve the people. By the way, "of the people, by the people, and for the people" is a favorite American quotation among many older people in China. So what about these other 'stakeholders' that the WEF is talking about? Have things changed in the PRC regarding the primacy of the people over capital? I wonder.

Week	Due Date	Topics, Videos, Readings, Assignments
		### 3.4. **Digital health certification** The World Health Organization (WHO) is in the process of implementing a Digital Health Certification system, based on and in cooperation with a system that has already been developed by the European Union. The goal of this system is to maintain real-time vaccination and other health related records for all people on Earth, so that vaccinations, isolation, lockdowns, vaccine passports, and travel restrictions, and other emergency measures deemed appropriate by the WHO could be more universally and efficiently implemented in the future. The leaders from 20 countries at the recent G20 Summit signed a declaration which states they agree to adopt vaccine passports, in order to "facilitate" international travel. The current membership of the G20 accounts for more than 66 percent of the world's population. **Reference:** Digital documentation of COVID-19 certificates: vaccination status [WHO] https://www.who.int/publications/i/item/WHO-2019-nCoV-Digital_certificates-vaccination-2021.1 **Watch:** How a Digital Health Passport Could Work [Wall Street Journal] https://youtu.be/wz-nq2mxnaA **Recommended:** WHO's Global Digital Health Certification Network [Dr. John Campbell] https://youtu.be/ixnqF6vEufA Microsoft founder Bill Gates and the Gates Foundation have a huge influence on the WHO. They are its second biggest contributor, after the US. Big advocates of jabs, big pharma, and big agriculture. Why is this man so influential? **Reference:** How is the World Health Organization funded [Euronews] https://www.euronews.com/next/2023/02/03/how-is-the-world-health-organization-funded-and-why-does-it-rely-so-much-on-bill-gates > "While the shape of WHO's total budget has changed over the years, the Gates Foundation has consistently remained among its top contributors. In 2018-2019, the United States was the largest donor at \$893 million, accounting for around 15 per cent of WHO's budget. The Gates Foundation came only second, with \$531 million. Germany briefly overtook the US as the largest donor in 2020-2021 during Trump-era funding cuts, but the Foundation kept its second place. Other top donors include the UK and the European Commission." ### 3.5. **Central bank digital currencies (CBDC)** **Reference:** Central bank digital currency [Wikipedia] https://en.wikipedia.org/wiki/Central_bank_digital_currency The topic of government-issues digital currencies should be included in this discussion because of its obvious potential for abuse. Troubling also is the lack of recognition or admission of this potential. For example, the Federal Reserve claims that CBDC "might affect financial-sector market structure, the cost and availability of credit, the safety and stability of the financial system, and the efficacy of monetary policy", but there is no mention of its effect on individual liberties.

Week	Due Date	Topics, Videos, Readings, Assignments
		Many governments are looking into implementing their own CBDCs, including our own, and they all claim to have no interest in controlling people through their money and possessions. They already make assurances about systems that will be put in place to make sure this never happens, etc. However, it has already happened, even without requiring CBDCs, in Canada. Trudeau's government shut down the back accounts and credit of people they accused of participating in the Canadian truckers' strike, often on the basis of a license plate number alone. **Reference:** Central Bank Digital Currency (CBDC) [The Federal Reserve] https://www.federalreserve.gov/cbdc-faqs.htm "With technological advances ushering in a wave of new private-sector financial products and services, including digital wallets, mobile payment apps, and new digital assets such as cryptocurrencies and stablecoins, the Federal Reserve and other central banks around the globe are exploring the potential benefits and risks of issuing a CBDC." What are the **potential benefits** of a CBDC? "A CBDC could potentially offer a range of benefits. For example, it could provide households and businesses a convenient, electronic form of central bank money, with the safety and liquidity that would entail; give entrepreneurs a platform on which to create new financial products and services; support faster and cheaper payments (including cross-border payments); and expand consumer access to the financial system." What are the **risks** of a CBDC? "A CBDC could pose certain risks and raise a variety of important policy questions, including how it might affect financial-sector market structure, the cost and availability of credit, the safety and stability of the financial system, and the efficacy of monetary policy." ## 3.5. **UN global goals** Often cited as justification for global campaign to assign social credit scores and health scores, create digital currencies and enforce any suggested or required restrictions on agencies, businesses, banks, farms, and individuals, and, are the United Nations' Sustainable Development Goals. The Sustainable Development Goals (SDGs) or Global Goals are a list of seventeen interlinked global goals designed to be a "blueprint to achieve a better and more sustainable future for all". The SDGs were set up in 2015 by the United Nations General Assembly and are intended to be achieved by 2030. They are included in a UN-GA Resolution called the "2030 Agenda", or Agenda 2030. Like many UN documents, the descriptions and discussions surrounding Agenda 2030 are open to interpretation. These goals can therefore be many things to many people. We should not disparage the economic focus on lifting people out of poverty, and all that entails, while recognizing the value of individual or group freedom from excessive control, which is perhaps not so often discussed. **Reference:** Transforming our world: the 2030 Agenda for Sustainable Development https://sdgs.un.org/2030agenda

Week	Due Date	Topics, Videos, Readings, Assignments
		Here are the shortened titles of each goal.
		1: No Poverty
		2: Zero Hunger
		3: Good Health and Well-being
		4: Quality Education
		5: Gender Equality
		6: Clean Water and Sanitation
		7: Affordable and Clean Energy
		8: Decent Work and Economic Growth
		9: Industry, Innovation and Infrastructure
		10: Reduced Inequality
		11: Sustainable Cities and Communities
		12: Responsible Consumption and Production
		13: Climate Action
		14: Life Below Water
		15: Life on Land
		16: Peace and Justice Strong Institutions
		17: Partnerships to achieve these goals
		The following site contains descriptions and discussions of each goal. **Reference:** Sustainable Development Goals https://en.wikipedia.org/wiki/Sustainable_Development_Goals
		In the following interview, Nobel laureate in economics Professor Amartya Sen discussed the past and future challenges to development. I recommend any of Sen's published works. He is absolutely brilliant, and he argues in a very reasonable and convincing way. When asked about the Sustainable Development Goals, Sen emphasized that democracy and human rights are key factors for such goals to succeed. He talks about what makes for good development goals, which might not always be quantifiable.
		Watch: Amartya Sen on the Sustainable Development Goals [UNU-WIDER] https://youtu.be/LggTrGMygFY
	09/04/23	**Homework 2:**
		Reminder: check each week for any new **Announcements.**
		1. What are the different kinds of social credit systems that operate (or have operated) in China? How have the Chinese people responded to efforts to implement such systems? Would it be fair to say that all such programs are centrally or governmentally controlled? Why or why not? Watch the video carefully. If you just repeat mainstream (and alternative) media assumptions regarding the power of China's social credit systems, I will know that you did not watch the video.

Week	Due Date	Topics, Videos, Readings, Assignments
		2. Do you think it would be possible to achieve agreement between nations on the implementation of the UN's sustainable development goals? Which goals do you think might be more difficult to legislate across cultures? Which might be interpreted differently by different nations and cultures? What might result, for example, from the enforcement of some of these sustainable development goals as interpreted by authoritarian regimes? What do you of Dr. Sen's argument that democracy is a key requirement for successfully sustainable development? Has this been properly addressed by the UN? 3. Respond to **any two** of the following our questions. Identify your responses as 3a, 3b, 3c, 3d. 3a. Discuss arguments for and against 'stakeholder capitalism' as discussed in the Financial Times video. 3b. What general impressions or specific points did you get from Klaus Schwab's introduction and of Chinese Premier Li Qiang's address at the World Economic Forum's June 2023 meeting in China? What might these speeches indicate about the relationship between the CCP and stakeholder capitalism as represented by the WEF? 3c. How might an international Digital Health Passport be implemented, and for what reason? Given the World Health Organization's own response to COVID, do you think digital health certification as administered by the WHO would prevent, stop, or help to find and eliminate the cause of any future epidemics? Why or why not? 3d. Do you think digital currencies, particularly those issued by governments, are a good idea? Do you think we may already have become over-dependent on electronic currencies and transactions? What would happen, for example, if the Internet itself stopped working? We will return to this in week 6.
3		Topic: **Demographics** Reminder: check each week for any new **Announcements.** This week, we look at some demographics and learn how to use one of its graphical tools. The following short video provides an excellent introduction to the importance of this work: "Professor Sarah Harper, Director of the Oxford Institute of Ageing, explains how the different age profiles of different societies around the world impacts on issues such as economic development, health care, and migration, and also on individuals' life opportunities." **Watch:** How will population change transform our world? [Oxford Academic] https://youtu.be/hDoGq3BaR8M The following video provides a more detailed discussion by Professor Harper. **Recommended:** How population change will transform our world [Oxford Martin School] https://youtu.be/el7_v86HQcc **Examine:** Current World Population http://www.worldometers.info/world-population/

Week	Due Date	Topics, Videos, Readings, Assignments
		1.1: **Working with population pyramids**

1.1: **Working with population pyramids**

This week we introduce demographics. I will ask you to access demographic data for two nations of your choice, and to discuss each with the aid of population pyramids. In addition to viewing a few videos, please use as a reference Chapter 2 of the textbook *Introduction to Human Geography*, edited by David Dorrell and Joseph P. Henderson. We can use this book freely because it is licensed for such purposes under a Creative Commons Attribution 4.0 International License by the University System of Georgia. Please download it from Canvas **Files**.

Reference: *Introduction to Human Geography*, Chapter 2: Population and Health, by David Durrell, pdf pages 28-50.

The population of any spatially defined region can be said to be the sum of four processes: birth, death, in-migration, and out-migration. This sounds simple, but the results you get depend of course on where you draw the boundaries in space and time. Things can become difficult to disentangle when they play out in the real world. How we compile, summarize, and chart data are of fundamental importance. You should all become familiar with population pyramids. You will generate a few for the homework.

Watch: Population pyramids: Powerful predictors of the future [TedEd]
https://youtu.be/RLmKfXwWQtE

Watch: 7 Billion: How Did We Get So Big So Fast? [NPR]
https://youtu.be/VcSX4ytEfcE

The NPR video physically simulates world population with flasks of liquid categorized by continent. Did you notice at the end of the video that the water is on the verge of spilling out over the top of the flask? Besides neglecting the effects of migration, this model suggests an upper limit to the world's population (where liquid spills out) somewhere above 10 billion. It doesn't explain what this is meant to represent, although the spill apparently deserved a 'close-up' shot. I see this video as manipulative. The "Population pyramids" video is more informative, but it also doesn't discuss the influence of in-migration and out-migration on the pyramids themselves. For small countries, and even lately for large countries, migration can be a significant factor.

For the homework, I will ask you to choose a nation and create a set of population pyramids from an interactive website. Here is a set I selected for the Democratic People's Republic of Korea (commonly known as North Korea). It portrays the male (blue) and female (red) populations, at thirty year intervals, from 1950 to 2070. The last two charts are obviously projections, based on expected trends.

Week	Due Date	Topics, Videos, Readings, Assignments
		These graphs can be very instructive, but they must be read properly. First, always keep in mind that they show relative distributions, not raw numbers. The area enclosed by each of the distributions (the total red and blue shaded regions) remains the same regardless of the actual population size and how it changes. The actual total is indicated as a number at the bottom, and if you hover over any age group bar (when using the actual website), the numbers for that group pop up. The website also provides graphs of the actual population, as shown below. The value of a population pyramid lies in its shape. For example, the leftmost graph above portrays the population distribution in 1950. The Japanese occupation had ended, families were reunited, and despite the prevailing poverty, babies were being born. However, as the crosshairs at 1950 in the population graph below indicates, the population of North Korea in 1950 was only 11.1 million. But the Korean War (1950-1953) resulted in a significant decrease in births. While this does not appear in the 1950 pyramid, this becomes immediately apparent in the website's 1951, 1952, and 1952 pyramids, which I haven't portrayed. However, the effects of the Korean War can be seen in the 25-29 age group of the 1980 pyramid, which is the second from the left, above. A decline among newborns also appears in the 1980 pyramid. Wikipedia provides detail discussions of the demographics of many nations, which can shed light on data that are not easily explainable by historical events. It also provides valuable discussions regarding data reliability. Consider the following excerpt regarding North Korea's birth rates. **Reference:** Demographics of North Korea [Wikipedia] https://en.wikipedia.org/wiki/Demographics_of_North_Korea "Assuming the data is reliable, reasons for falling growth rates and fertility rates probably include late marriage, urbanization, limited housing space, and the expectation that women would participate equally in work hours in the labor force. The experience of other socialist countries suggests that widespread labor force participation by women often goes hand-in-hand with more traditional role expectations; in other words, they are still responsible for housework and childrearing." As we can see from the population graph above, the population of North Korea is expected to peak after about 2030, at 26.6 million, and slowly decline thereafter. The shapes of the projected pyramids for 2040 and 2070 are consistent with this trend.

Week	Due Date	Topics, Videos, Readings, Assignments
	09/11/23	**Homework 3:** Reminder: check each week for any new **Announcements.** 1. Describe some of the ways population change will transform our world, according to Professor Harper. 2. What is the current population of the world, rounded off to the nearest 100,000? 3. **Access the following website:** Population Pyramids of the World from 1950 to 2100 https://www.populationpyramid.net/world/ Choose any country (other than the Democratic People's Republic of Korea) whose recent history can be connected to its demographic distribution, possibly through war, migration, family planning, etc. Having first researched its demographics (for example, through Wikipedia), you will find that country using its proper name from the alphabetical list to the right and click. The population pyramid for that country for the year 2022 or so is portrayed. Also shown is the population graph from 1950 to 2100. If you change the year in the original window by clicking on -5 or -1, the year and corresponding pyramid will change. Click repeatedly, and you get an on-the-go movie. The crosshairs on the corresponding population graph also shift, and exact numbers involved become available. You can thus maneuver through time to display and download a series of pyramids describing that nation's demographics. Future trends are obviously projections, based on current assumptions. Your task is to capture population pyramid images for at least three different widely separated years for the country you have decided to examine. These years chosen should reflect interesting historical realities of that country.. You can also explore the future, but be aware that these numbers are speculative. If you click on 'Download' below the bottom left corner of the pyramid, it appears in a separate window and you may copy it or save as a file. There are different strategies you can use in order to get a sequence of at least three pyramids in your document as a single image, as I did above with five for North Korea. Or you may keep them separate but arrange them carefully on the page. Microsoft's snipping tool can work well for things like this. Please adjust the size and placement of the images so that the pyramids themselves are readable but fill no more than 1/3 of a page. Discuss the imprint that history has left on the nation's demographics: war and famine, recovery and boom, family planning, etc. Wikipedia may have a page on the demographics of your chosen nation. Using this or other resources, research that country's history before, during, and after the time periods you have chosen, and discuss the historical developments that helped shape that particular nation's pyramids.

Week	Due Date	Topics, Videos, Readings, Assignments
4		

Topic 1: **Urban growth**

Reminder: check each week for any new **Announcements.**

Probably the most common trend throughout the world is the massive, relentless move of people away from rural areas and into cities of ever increasing size. Cities do often grow in part from the pressure of population growth, but economic, political, and cultural forces influence their growth as well. In other words, cities are growing even within nations that are not experiencing population growth. Urbanization often co-occurs with the depopulation of the rural countryside, which is a co-phenomenon that is often neglected. In addition, many rural areas around the world (including prime farmland) are being urbanized.

New urban development is often growing upward, into the third spatial dimension. This represents an astonishing change in the lives of a great many people. Imagine moving from a village or even a five-floor walkup into a new apartment on the 38th floor? The largely unwritten history of the development of reliable elevators and other construction technologies is enabling the creation of neighborhoods where people have **walking** access to restaurants, shops, parks, and entertainment. It does seem possible that people in highly populated urban spaces can actually feel a greater sense of freedom and open space living in these communities. On the other hand, a respectful and law-abiding population is a prerequisite for this to work. I do not think it would work here, and anyway no one would want it. Maybe in another 50 years.

Examine: Huaguoyuan, Guiyang, China, one of the largest residential area in Asia [Wang's record]
https://youtu.be/Zvq9pybXg-4

Examine: An apartment complex for 500,000 in Guizhou Province, China [CN Walking]
https://youtu.be/YuwZLyQEIh0

Examine: Songdo Central Park in Incheon, South Korea [Seoul Trip Walk]
https://youtu.be/XP36tRBFbbU

The following two videos present some extraordinary predictions regarding the likely locations and sizes of the world's largest cities by 2030 and 2100. Keep in mind that these projections do not necessarily discern cities from the often much larger contiguous metropolitan areas. So these numbers might grow much bigger, depending on a number of factors.

Watch: Top 10 Largest Cities by 2030 [The B1M]
https://youtu.be/N-_a0TCWb6E

Watch: Top 10 Largest Cities by 2100 [The B1M]
https://youtu.be/9OulEjWI-bE

Recommended: MEGACITIES of the World (Season 1 - Complete) [TDC]
https://youtu.be/0ULzxD3w_c8

Recommended: Top 10 Largest Cities in the World by Population (1400-2023) [RankingCharts]
https://youtu.be/Vo50_k0uP64

Week	Due Date	Topics, Videos, Readings, Assignments
		Life in large urban centers can be peaceful and charming, when done right. I'd like to begin with a few examples of what has been done with urban rivers and streams in East Asia. In the United States, many urban rivers, and in particular the smaller streams, are often hidden and fenced off. They are made to be inaccessible to law-abiding people. As a result, these potentially fun places are often poorly maintained and both physically and socially dangerous. Let's take a look at how the Japanese have been treating their urban waterways. Next we will look at Korea.

Japanese urban rivers and streams are often channelized, as are many of ours. The streams themselves are often inaccessible, and the channels are deep, in order to accommodate flooding. Nevertheless, Japanese urban streams and the neighborhoods around them can be very attractive. Some of them are particularly popular during cherry blossom (sakura) season. Examine the following videos with question 3 in mind.

Examine at least two of the following five videos, for question 1 below:

Rainy night Sakura cherry at Tokyo Meguro River [Ramblac]
https://youtu.be/wuXmlyS3pVw

Cheonggyecheon and surrounding scenery at sunset [Bau Walk]
https://youtu.be/YNEymTSjpYA

Cheonggyecheon in the Evening (Sep.2021) [4K Korea]
https://youtu.be/LqEnkG5LY9k

Peaceful evening walk in Seoul, Danghyun Stream [Walk Together]
https://youtu.be/H61dOkJfEW0

The waterfront of Liangma River at night, Beijing, China [Beijing Walking]
https://youtu.be/gJCJQwGi5MU

Topic 2: **Urban decay**

Often, urban growth is accompanied by urban decay. Although decay of urban infrastructure, homes, and businesses can be found nearly everywhere in the world, their circumstances can vary widely. Urban decay is often the result of local or regional economic collapse, as production shifts elsewhere and jobs are lost. It would be dishonest of us to focus our attention right from the start only on emerging global trends without also examining at least briefly our own nation's current conditions, about which many of us remain unaware. The street scenes listed below are from major cities and small towns. We certainly could have included many examples from California, but I wanted to underscore that this is a national problem. So-called 'flyover country' is where much of our food, energy, and manufactured goods come from.

You should notice that most of the homes in these videos were very well-built, and many of them were quite beautiful. Under more prosperous circumstances, they should all still be in good condition.

Examine: at least three of the following videos |

Week	Due Date	Topics, Videos, Readings, Assignments
		Detroit, Michigan [Hoods N Hollers] https://youtu.be/RL8ME09602E Cleveland, Ohio [Hoods N Hollers] https://youtu.be/NxaruDP7HDc Chester, Pennsylvania [Hoods N Hollers] https://youtu.be/vYDdaOdVnHw Philadelphia, Pennsylvania [Hoods N Hollers] https://youtu.be/r5ECaCBCboU Philadelphia Pennsylvania at night [Hoods N Hollers] https://youtu.be/vKPI8vvw3uA Steubenville, Ohio [Hoods N Hollers] https://youtu.be/_tXgZyEynNA Cincinnati, Ohio [Hoods N Hollers] https://youtu.be/5wNqgn9RJ24 Brownsville, Pennsylvania [Hoods N Hollers] https://youtu.be/ptcgdJyE4g8 Camden, New Jersey [Hoods N Hollers] https://youtu.be/szRfMq-_614 Youngstown, Ohio [Hoods N Hollers] https://youtu.be/MQoc0pnwRKI East Liverpool, Ohio [Hoods N Hollers] https://youtu.be/OpyF_iq6d74
	09/18/23	**Homework 4:** Reminder: check each week for any new **Announcements.** 1. After viewing some street scenes from high-rise neighborhoods in Asia, describe the general vibe and whether you think you could get used to living in a place like this. 2. List the projected numbers of people that will be living in each of the ten cities listed for 2030, and comment on at least three of them. Do you find this trend surprising in any way? Compare them to the numbers living in the world's largest cities today.

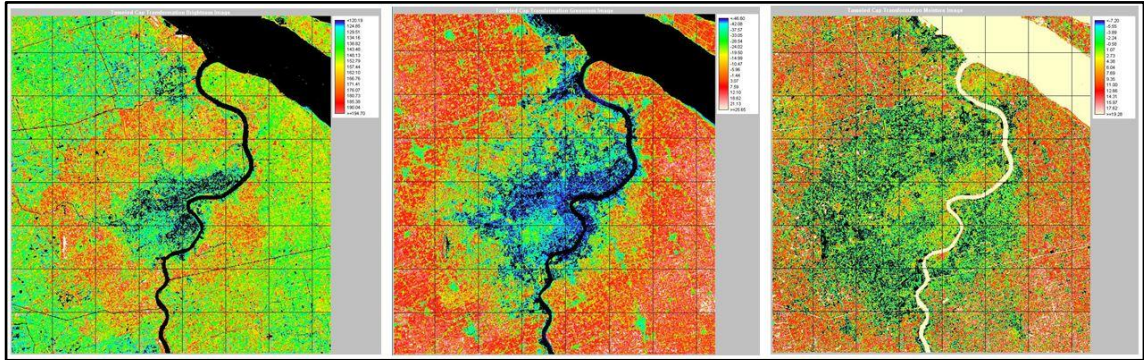| Week	Due Date	Topics, Videos, Readings, Assignments
		3. List the projected numbers of people that will be living in each of the ten cities listed for 2100, and comment on at least three of them. How have things changed since 2030? Has there been a shift, geographically? 4. Discuss any impressions you may have formed of three or more of the neighborhoods portrayed in the thirteen 'Hoods N Hollers' videos. To what degree do you think people are aware of the extent of this neglect? Do you think such circumstances may still be growing in the US or elsewhere?
5		Topic: **Family, community, health, and well-being** Reminder: check each week for any new **Announcements.** We cannot honestly study public health in a course on population and global change without addressing the elephant in the room. The available evidence strongly indicates that the COVID-19 virus and resulting pandemic had their origins in a viral selection and enhancement research program that was (and remains) active in the US, China, and other nations. US research shifted to China when it was discouraged here by law. Regardless of where these activities took place, the record shows that they received encouragement, participation, and funding from US scientists and administrators, and ultimately, unknowingly, from the American taxpayer. All of this occurred under the direction of the same people who were subsequently tasked with responding to the consequences. One of the most troubling aspects of the COVID-19 pandemic has been the lack of genuine interest by our own political, managerial, scientific, and media elite in determining the origin of this virus, or in making any genuine effort to prevent it from ever happening again. This suggests that the same thing could happen again, and quite soon, for similar reasons, possibly involving pathogens that may already have been developed and that happen to lie dormant (for the time being) in a freezer somewhere in the world. We are being encouraged by the medical/ pharmaceutical industry to prepare for 'the next pandemic' and for a lifetime of synthetic vaccines and treatments for a potentially endless sequence of emerging pathogens (currently labeled and planned for by the WHO, calling them disease 'X'). Is this state of affairs now expected to become routine? If so, why? The continuing dull-witted disinterest in these fundamental issues of survival by people who should know better indicates to me that most of the people involved in managing things in this nation and elsewhere are cowards. They would rather look the other way than jeopardize their own comfortable lives and careers, even at the potential cost of many more millions or billions of deaths. Instead, they attack their fellow citizens for political and cultural wrongthink. Many of the people managing things now would have done quite well for themselves working for Joseph Stalin, who reputedly said that, although a single death may be tragic, a million are merely statistical. How many of us are aware of the astonishing numbers of excess deaths that have occurred, and continue to occur, in the wake of the pandemic and the jabs we endured, deaths that are not directly attributable to COVID-19. I wonder how many of us are aware of the astonishing numbers of adverse reactions and deaths that have occurred that **are** clearly attributable to the experimental vaccines we were expected to endure. Unproven, untested, new technologies that we are told not only to accept for ourselves and others, but, amazingly, at this late date, despite all the evidence, still being advised by our very own governments to inject into our children. If that is not dystopia incarnate, I don't know what is. If that does not illustrate a crisis in science, I don't know what does.

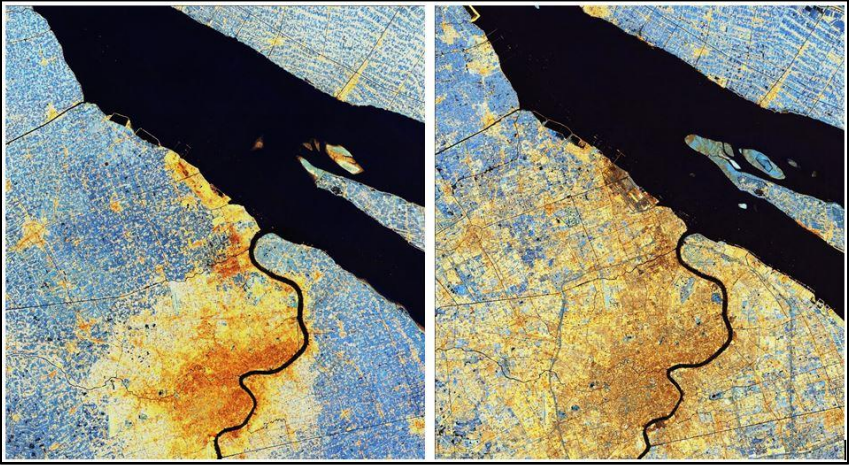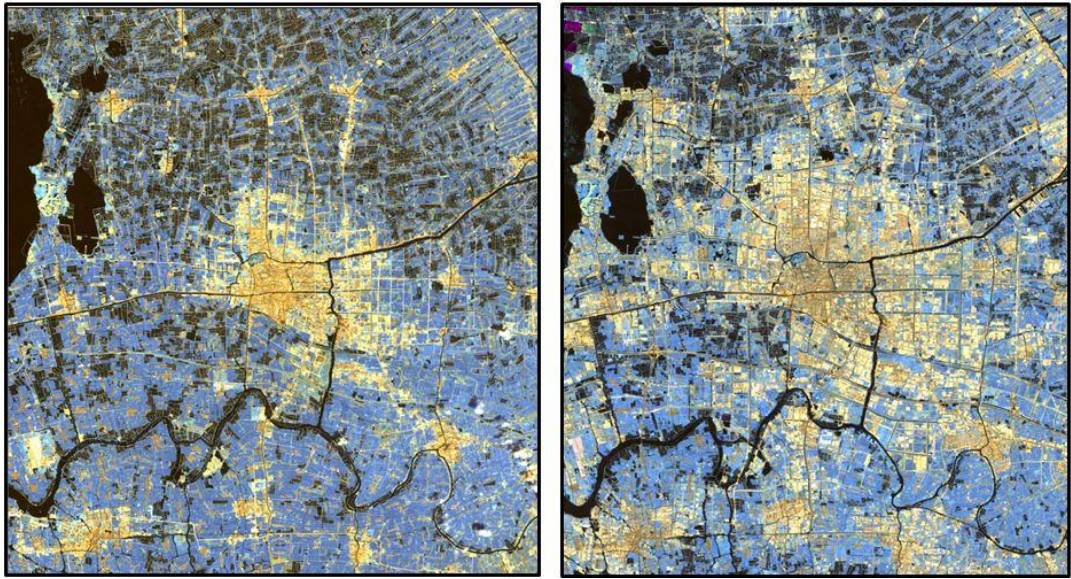| Week	Due Date	Topics, Videos, Readings, Assignments
		While the topic of pathogens and pandemics is central to this course, I no longer feel confident in presenting the same material that I used to present. The human influence in either deliberately or accidentally creating monsters through genomic manipulation or enhanced evolution may have overwhelmed any of the isolation and protection that used to be afforded by natural ecological systems. **Recommended:** Excess deaths, lack of debate [Dr. John Campbell] https://youtu.be/jB0Tp1oM_t0 1.1: **Human development** We looked briefly at how the UN and other supranational organizations approach human development and well-being in week 1, **Reference:** Human development (economics) [Wikipedia] https://en.wikipedia.org/wiki/Human_development_(economics) **Reference:** Human Development Index (HDI) [UN Development Programme] https://hdr.undp.org/data-center/human-development-index#/indicies/HDI The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and having a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions… The HDI simplifies and captures only part of what human development entails. It does not reflect on inequalities, poverty, human security, empowerment, etc. **Watch:** What is Human Development? [UNDP Kosovo] https://youtu.be/HwgZQ1DqG3w **Watch:** How can countries measure the well-being of their citizens? [TED Institute] https://youtu.be/4PkD4JebMAY **Recommended:** The economics of human well-being	Jan-Emmanuel De Neve [TEDxINSEAD] https://youtu.be/DV1ks-TLYoM **Watch** any three of the following seven videos about family life, intergenerational issues, and demographics in East Asia, for question 3: The Dark Side of Japan: The Lost Generation [Explained with Dom] https://youtu.be/tgGvUNiykyU Population Crisis/The divorce rate is surprisingly high in post-90s in China [China Insights] https://youtu.be/24H7ltivcSY China's Falling Birth Rate: Can It Sustain The Rise To Superpower? [CNA Insider] https://youtu.be/r7dFoCbE5zU

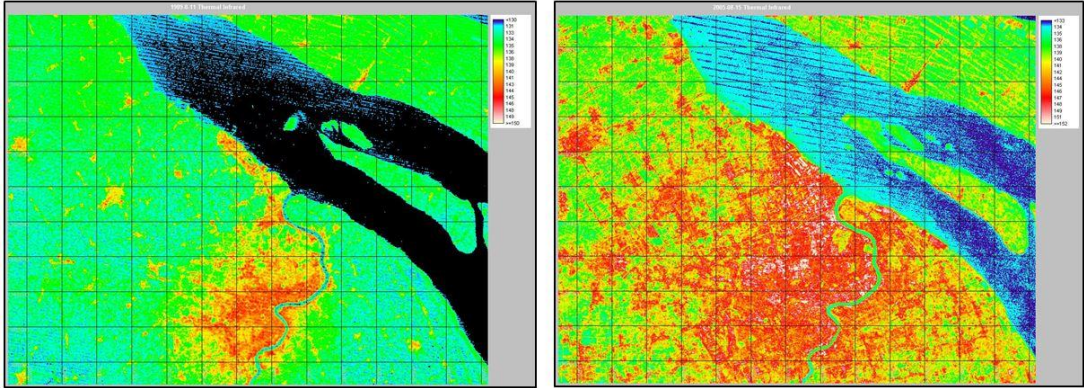| Week	Due Date	Topics, Videos, Readings, Assignments
	09/25/23	Japan's population drops by 644,000 in a single year [South China Morning Post] https://youtu.be/vFfNoqdnUGU Why South Korea's Seniors Are So Poor [Asianometry] https://youtu.be/fvkGOeLoZG4 How Japan Keeps Clean [Life Where I'm From] https://youtu.be/BOGMkgnc2YY What a Japanese Childcare Centre is Like [Life Where I'm From] https://youtu.be/1qRfqboYWNo Peter Calthorpe is one of the most well-known people in urban planning. **Watch**: Peter Calthorpe: Seven principles for building better cities [TED] https://youtu.be/IFjD3NMv6Kw **Homework 5:** Reminder: check each week for any new **Announcements.** 1. What is human development? What is human well-being? What are some ways in which these social characteristics have been or might be measured? Do you think it is fully possible to accurately quantify human well-being across all cultures identically? 2. Summarize and discuss any three of the seven videos about family and demographics in East Asia listed above. Identify each by its title. This counts as three questions. 3. What are Peter Calthorpe's seven principles for building better cities.
6		Topic 1: **Observing the world** Reminder: check each week for any new **Announcements.** Unfortunately, given the events of the past three years, I feel compelled to discuss the nature of science. Let's start, as we often do, with a metaphor. Suppose a group of people walking through an unfamiliar dense forest without a map, phone, or access to GPS, and the group gets lost. If they need to rely on their own wits, what might happen? Depending on who makes up the group, someone might claim that they should follow him, in one particular direction, but, he can't explain his reasoning to everyone's satisfaction. Someone else might make the same claim for a different direction. Even if most are unsure, everyone begins to feel pressured to accept one course of action or the other. What should the members of the group do? Should they stick together and follow the majority, or should they split up? I would argue that they should probably get down to basics and form a coherent picture of the situation before deciding upon a particular course of action. If they don't know something that they should know, they should

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admit it and try to find out. Where is the sun? Could someone scout out higher ground, local terrain and possible pathways, and report back? Which way does water flow, into what? Becoming aware of the precise circumstances within which a challenge presents itself is the first step toward meeting it.

But observation is an inherently discriminatory, subjective act. If we as biological creatures couldn't filter out most of the information presented to our senses, even in everyday life, we might become overloaded and even lose our minds. Observation of complex systems like the Earth and, embedded within it, human societies, requires from the start that we have the ability to transform raw data into useful information. This week, we briefly look at some of the tools we used in previous years to provide precisely that sort of education. First, however, we need to look at the practice of science in the past and in recent years.

1.1: **On science**

Science as an **approach** to understanding reality must always include a willingness to be proven wrong. But representatives of science as a body of knowledge and the institutions of science in particular are often unwilling to be proven wrong, or even to be second guessed. As a result, science is experiencing a number of crises at all levels, including a lack of successful replication and an explosion of unjustified or barely justified claims and counterclaims. Established publications favor established incumbent or fashionable opinions and topics, and funding is increasingly based on an ever-changing set of irrelevant political and cultural concerns. The tools, methods, skill sets, and good-natured disagreements that everyone knows lies at the heart of healthy science are ignored and set aside as unqualified people in positions of authority think and believe their own opinions and impressions fully represent what we all should think and believe. Which they most certainly do not.

Our often unjustified trust in the institutions of accumulated knowledge is not new. Consider the story of Galileo's telescope; or rather, the story of two of Galileo's contemporaries who became famous throughout history for one thing, and one thing only: their refusal to even look through it. Galileo did not invent the telescope, but he improved its design and demonstrated its usefulness for port and military operations via visual communication. When Galileo began building telescopes at higher magnifications specifically to view the night sky, and when he described what he saw, people were astonished. If you haven't viewed the night sky through a telescope yet, you really should try it sometime. Even with a relatively inexpensive telescope, it is easy to see the three dimensional contours of mountains and craters on the moon, particularly near the current limb of illumination, and on clear nights (and far away from the 'light pollution' of the city) you can see the moons of Jupiter and the rings of Saturn. By watching Jupiter over time, Galileo was the first to see that these moons orbited that distant planet, just as our moon orbits us.

But for formally educated people of Galileo's time, and particularly for university educators, this was disturbing news. The contradiction between what they had assumed must be true based on accumulated knowledge (all presumably scientifically or rationally derived), and what any common, uneducated person could see by just looking through an eyepiece, led to some rather famous examples of self-delusion and stupidity. Two stand out.

Cesare Cremonini was a friend and colleague of Galileo at the University of Padua. When Galileo announced that he had seen mountains on the Moon, Cremonini and others denounced the claim and refused to look through the telescope. The evidence refuting Aristotle's theory that the Moon was a

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		perfect sphere would have made his position as Professor of Aristotelian Philosophy at the University untenable. In other words, people would no longer believe and respect everything he said, and this made Cremonini sad. Many seemingly complex and difficult but entirely false academic arguments that students are often recruited into joining actually come down to such simple-minded self-righteousness, even in our own time. Giulio Libri was a Professor of Aristotelian Philosophy at Pisa, and he was an open opponent of Galileo. Libri was particularly vehement in his denunciation of the telescope, which he considered to be a parlor trick, refusing to look. When Libri died, Galileo commented of him that "never having wanted to see Moons of Jupiter on Earth, perhaps he'll see them on the way to heaven." To us, Galileo represents science, and Cremonini and Libri represent anti-scientific views, but this is not what it seemed like to people at the time. To most, Cremonini and Libri represented the consensus regarding what was true. Now consider (for question 1) the following quotations from George Orwell's essay "What Is Science?' that was published in the London Tribune on October 26th, 1945. In Orwell's view we can all see that many non-scientists also keep rationality and objectivity, and even a willingness to be proven wrong, as their guideposts in their lives, even if they have nothing to do with the science of their time. On the other hand, scientists have often shown themselves to be unreliable practitioners of the scientific approach to knowledge and to life. One obvious example of this, according to Orwell, involves the history of scientific nationalism. The full essay can be found online in pdf form, if you are interested. "This confusion of meaning, which is partly deliberate, has in it a great danger. Implied in the demand for more scientific education is the claim that if one has been scientifically trained one's approach to all subjects will be more intelligent than if one had had no such training. A scientist's political opinions, it is assumed, his opinions on sociological questions, on morals, on philosophy, perhaps even on the arts, will be more valuable than those of a layman. The world, in other words, would be a better place if the scientists were in control of it. But a 'scientist', as we have just seen, means in practice a specialist in one of the exact sciences. It follows that a chemist or a physicist, as such, is politically more intelligent than a poet or a lawyer, as such… But is it really true that a 'scientist', in this narrower sense, is any likelier than other people to approach non-scientific problems in an objective way? There is not much reason for thinking so. Take one simple test — the ability to withstand nationalism." "Clearly, scientific education ought to mean the implanting of a rational, skeptical, experimental habit of mind. It ought to mean acquiring a method — a method that can be used on any problem that one meets, and not simply piling up a lot of facts. Put it in those words, and the apologist of scientific education will usually agree. Press him further, ask him to particularize, and somehow it always turns out that scientific education means more attention to the sciences, in other words — more facts. The idea that science means a way of looking at the world, and not simply a body of knowledge, is in practice strongly resisted. I think sheer professional jealousy is part of the reason for this. For if science is simply a method or an attitude, so that anyone whose thought-processes are sufficiently rational can in some sense be described as a scientist — what then becomes of the enormous prestige now enjoyed by the chemist, the physicist, etc. and his claim to be somehow wiser than the rest of us?"

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		Textbooks often give the impression that the scientific body of knowledge contained within is relatively complete and settled. But as I said in the syllabus for this course, we need to distinguish the finger that is being used to point at some object of study, from the object itself. The tendency for educators and publishers to write with absolute self-assurance is often misleading. There is often a great deal more legitimate diversity of thought on even the most basic questions that you might find in the different fields of science than most textbooks would have us believe. That does not mean that anything can be valid. Mathematical representations, for example, are often essential to understanding, and they cannot simply be replaced by words. And texts that accurately represent scientific realities cannot be replaced by other texts just because those other texts seem to 'feel right' to someone. The practice of science requires rigorous understanding of what already exists within a given discipline, and this cannot be replaced by an active imagination alone. It always requires a lot of hard work.

The politicization of science has certainly become apparent in recent years, to anyone who cares to look. Science works slowly to reform itself once it has been corrupted. The good news is that the scientific (as opposed to the political) approach to life generally succeeds, often many years later, in setting the record straight. Former CDC Director Robert Redfield recently testified before Congress and sat for several interviews. This one is from March, 2022:

Watch: Dr. Redfield interview [the Hill]
https://youtu.be/3N676CD1rlw

1.2: **Perceiving a changing world**

It should be obvious that situational awareness is critical for success. This is particularly true of our desire to understand and shape the human experience on this Earth. Watching and understanding the many natural processes and patterns that help to shape the human experience has always been a requirement for human success. It has been chilling to me, as an educator, to see this basic strategy belittled and ignored by many of the very people who claim to 'stand with' and represent science.

Particularly near universities, bookstores throughout China remain filled with many intermediate and advanced books in the so-called STEM fields, in both Chinese and English. These books provide an education in the sorts of scientific, mathematical, and computational tools that anyone truly knowledgeable about the challenges we face will know are of central importance. These topics are seen by serious educators in China, India, and much of the developing world as key components in effectively understanding and influencing most of what we will cover over the next few weeks: urban life, agriculture, water security, infectious diseases, climate, etc. Much of my professional work and research has been in Remote Sensing, and I will briefly describe a program we had developed in what used to be the Department of Geography at SJSU.

Watch: What is Remote Sensing? [CIRESvideo]
https://youtu.be/xIsUP1Ds5Pg

Watch: What NASA Knows from Decades of Earth Observations [NASA Scientific Visualization Studio]
https://youtu.be/dzmktnXUZag |

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		Watch: How can earth observations help predict next pandemics? [NASA Scientific Visualization Studio] https://youtu.be/01OkR1Q-2KY In order to understand the world, we need to be able to recognize patterns. A real understanding of the methods of pattern recognition and data transformation is quite helpful in many domains, not only Earth observation. For example, it is usually possible to boil down most of the information contained in higher-dimensional data into two or three transformed dimensions, through a shift of perspective based on the statistics of the data itself. By 'dimension', we don't necessarily imply spatial dimensions. A dimension is any characteristic of a thing that can change independently of other aspects, at least in principle. An n-dimensional system can be represented by vectors and matrices, or by tables. A well-established statistical method of helpfully shifting one's perspective on higher-dimensional data is called principal components analysis. Many more sophisticated systems of AI utilize this and similar tools. **Recommended:** Principal Component Analysis (PCA) [Serrano Academy] https://youtu.be/g-Hb26agBFg Transformations of this kind are routinely used to reveal important characteristics of the Earth's surface region. For example, I used a transformation similar to PCA, called Tasseled Cap, and Landsat TM data, to generate the following images of Shanghai, China, at around 10 AM one day in August, 1989. The Tasseled Cap transformation reveals information about the reflectance (brightness), photosynthetic activity (greenness), and wetness (moisture content) of each location on the landscape. The same color palette was used for each image, with white and red representing the highest values, and blue and black representing the lowest values. Brightness Greenness Wetness The brightness dimension represents the overall reflectance of sunlight from the landscape. The rivers are least reflective, and the older downtown areas are also low reflectance, due to the buildings and their shadows. A more reflective newer region forms a ring around the central city, followed by relatively less reflective agriculture. The highly reflective vertical white feature at the lower left (third row up from bottom, second column from left) is a highly reflective airport tarmac. Using the same color palette for the greenness dimension, we can visualize relative photosynthetic activity. Most active are the surrounding agricultural region, in red. Wetness portrays moisture, mostly in the soil, and it is highest in the agricultural regions, with significant variability within the city. By including the infrared portion of the spectrum, which human eyes cannot see, we can visualize in

Week	Due Date	Topics, Videos, Readings, Assignments

better detail the differences between rural and urban regions. For example, I formed the following images of Shanghai in 1989 (left) and 2005 (right) from of Landsat TM and ETM+ data by assigning the colors red, green, and blue to the near and mid infrared bands. Urban locations are in shades of gold and yellow, while rural regions are in blue. Open water is black.

1989   2005

Here is a pair of images portraying the growth of one of Shanghai's suburbs, along with the retreat of agriculture (in blue) and aquaculture (in black), from 2000 to 2005.

2000   2005

The thermal infrared portion of the spectrum is at a much longer wavelength than the visible and mid infrared, and is an indication of how much sensible heat is being emitted from the landscape. The expansion of Shanghai's urban heat island from 1989 to 2005 is portrayed in the following pair of images. Warmest regions (at 10 AM on a clear day in August for both years) are in white and red. Cooler regions are in green and blue. The warmest neighborhoods on this particular day in 2005 are the white dots

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		around the center of the image, in Shanghai's northern suburbs: the same region that had been relatively cool just a few years earlier on a very similar day. <table><tr><td>1989</td><td>2005</td></tr></table> A number of Masters Theses in Geography at SJSU included substantive work with remote sensing from our lab in the former Department of Geography. Here are just a few of them. Karen used Landsat data to look at how changes in snow cover in the Sierra Nevada mountains over the course of a year (the American River basin in particular), might affect reservoir storage, as reflected in lake levels. This sort of work illustrates how remote sensing is used to monitor and control the flow and distribution of freshwater resources (which we shall discuss in week 11). **Recommended:** Examining the relationship between snow cover and reservoir storage in the American River basin, by Karen McGillis-Moskaluk https://scholarworks.sjsu.edu/etd_theses/4291/ Classification is the process of assigning a land cover or land use category for each perceptible patch of ground. The spatial resolution depends on the instrument being used. Landsat data is multispectral, freely available, covers the world, and goes back to the 1980s.In her thesis, Avivit used a form of approximate reasoning to classify a mixed rural/urban landscape in terms of partial membership in several broad categories, and validated her results with USGS classifications. **Recommended:** Landsat image classification using fuzzy sets rule base theory, by Avivit Shani https://scholarworks.sjsu.edu/etd_theses/2978/ The use of remote sensing in assessing ecosystem and agricultural health is well established, and vegetation mapping is particularly interesting and productive with multispectral data. Julie performed classifications of the island of Palau using two different classification methods and compared the results. **Recommended:** Comparison of two classification methods for vegetation mapping in Palau, by Julie K. Andersen https://scholarworks.sjsu.edu/etd_theses/2938/ The use of remote sensing in agricultural economics is well established, particularly in developing countries. In her work, Tapasi used multispectral data to estimate yield on particular tea plantations in

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		northeastern India, and compared her results to actual market data for that region at the time. Work like this can help farmers make long-term agricultural decisions, like the planting of tea bushes in India, or of wine grapes in California. **Recommended:** Tea bush health determination and yield estimation, by Tapasi Barman https://scholarworks.sjsu.edu/etd_theses/3514/ In his thesis work, Joseph used multispectral data to derive actual evapotranspiration within portions of Las Vegas. Evapotranspiration is the transformation of soil moisture or open water into water vapor through the physical process of evaporation, as well as the biophysical process of transpiration from leaves. The City of Las Vegas has begun to implement a policy intended to reduce the degree of evapotranspiration from the landscape. Joseph carefully compared the timeline of how this policy was implemented to actual evapotranspiration rates during this period. This is an example of how remote sensing can be used to assess the relative success of government policies. **Recommended:** Effects of Water Conservation on Evapotranspiration in Las Vegas, Nevada, by Joseph Belli https://scholarworks.sjsu.edu/etd_theses/3911/ Topic 2: **Modeling a changing world** Any higher organism, if it is to survive, has no choice but to model the world. Models of one kind or another have always been used to advance understanding. Now, in the computer age, models can be formed that are more complex, abstract, explicit, and unambiguous than ever before. They are no longer limited by physical properties, but only by the human imagination, if that. Models can be powerful. They can reveal things about the real world that you may never have suspected to have been true. I have had this experience many times myself. This is one of the places where creativity in art and science can come together. But computer models can also mislead. They can obviously be designed to mislead. They can be inaccurate. They can be interpreted inappropriately. Their shortcomings can be significant. The list of problems with computer models is endless. I won't dwell on them here. I want instead to discuss emergent properties of the real world that even many computer models, particularly those based solely on past history, have a great deal of difficulty in capturing or simulating. The current debates over models in climate change research should address the ability of climate models to accurately simulate and possibly predict or forecast such emergent properties. Change of any kind, including social change, remains largely mysterious and notoriously difficult to predict accurately. This even applies to much of physics. At the very least, some degree of randomness is nearly always present, and this can affect the course events, particularly over the long term. Regardless of their source, unknown factors, often in the guise of randomness, must be taken into account if we are going to deal with life more soberly. The perpetual presence of human ignorance regarding what the universe may throw our way should not surprise us. Evolution may be a universal property of nature that guarantees the emergence of novel forms and functions (not necessarily biological) whose interactions with what already exists had never been predefined anywhere, or anytime, and what emerges from these interactions may also be entirely new. If this emergent property of nature is real, it has its potential down

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		side, which is interestingly echoed by many ancient beliefs. The fundamentally evolutionary nature of all reality guarantees that, from the human point of view, troublesome forms or events that no one could have ever predicted will eventually appear. We often manage to recognize and avoid similar situations down the road, and that's obviously good. Nevertheless, some entirely new, unanticipated situation will always eventually arise. Unanticipated solutions to what may seem to be insurmountable problems can also appear, seemingly from nowhere. If nature is evolutionary, then even the most advanced future AI system, encompassing all of science, could still not possibly anticipate everything that will happen, including processes and events that, for good or ill, may affect our future survival. That this is indeed a universal property of nature is demonstrated in various ways by the uncertainty principle, quantum indeterminacy, and deterministic chaos in physics, by the Incompleteness Theorems of Kurt Gödel, and by additional indeterminacy results by Alan Turing and many others in the domains of computation and mathematics.

Computer models do exist that capture, replicate, and accurately predict the circumstances under which emergent behavior occurs in populations of independent agents, like human societies. Given our discussion of human individuality and agency in week 1, I'd like you to learn a little about so-called agent-based models.

Watch: Agent-Based Modeling: An Initial Exploration [Complexity Explorer] https://youtu.be/Z8Wf1vF_xgQ

The Complexity Explorer channel has a series of connected videos on agent-based modeling, including descriptions of NetLogo, the system that we used in the Geography lab. They also have additional series on NetLogo itself, dynamical systems and chaos, the origins of life, machine learning, etc. The source of this channel, the Santa Fe Institute, has long been at the forefront of complexity research.

Recommended: Agent-Based Modeling: What is Agent-Based Modeling? [Complexity Explorer] https://youtu.be/FVmQbfsOkGc

Reference: Creating an Agent-based Model to Examine Spatial Behavior of *Eriocheir Sinensis*, by Michelle Fong https://scholarworks.sjsu.edu/etd_theses/4089/

Watch: An agent-based model of *Eriocheir Sinensis* https://youtu.be/Zr7qOvs35H0

Let's take a look at Michelle's Masters' thesis of 2011. The low resolution of the video makes the graphs difficult to read, but you should get the idea. This is the system described in. But the general operation is clear, and the process is not difficult to understand. The video portrays a dynamical agent-based simulation of an invasive crab species in San Francisco Bay. At each time step of the simulation, each simulated crab moves around in search of food or spawning grounds, depending on its age. Adult and juveniles are indicated in the model by black and red dots, respectively. Each simulated crab is born and interacts with its environment, moving in response to a local sense of conditions. If it meets those conditions and survives, it may reproduce, and all eventually die. The age of each natural death and other variables in the system are chosen randomly from normal distributions based on observations of real data. The simulated environment is a space-filling grid of values derived from remotely sensed or directly recorded data regarding water temperature, sediment content, chlorophyll content, etc. These values change throughout the entire bay each month, based on the corresponding month's typical values derived |

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	10/02/23	from twelve Landsat TM data scenes spanning a typical year. Each simulation cycles repeatedly through this typical year. Due to an intentionally introduced degree of randomness, each simulation is different. Many simulations can be run in batches and their statistics compiled for so-called Monte Carlo analysis. You can imagine how the data and techniques involved in this sort of model may be applied to a wide variety of settings, using human beings for example as mobile agents. I'd like to leave you with an old video of mine that portrays sample simulations of a model I wrote in NetLogo in order to explore how a distribution of velocities among independent consumer agents moving about on a producer landscape can result in wave-like patterns like those often found in nature. **Recommended:** Functional diversity in geospatial domains (1) [Gary Pereira] https://youtu.be/rEb9XZyMsBQ **Reference:** Investigating the effects of functional diversity https://portfolium.com/entry/investigating-the-effects-of-functional-diversity **Homework 6:** Reminder: check each week for any new **Announcements.** 1. Based on the quotations provided above, do you think that Orwell's essay "What Is Science?' might still describe our general perception of science and its institutions? This essay was written only a couple of months after the atomic bombings of Japan, and after the US and USSR had both recruited German weapons scientists with the Nazi defeat. 2. What is remote sensing? Describe some associated technologies (satellites, sensors, methods)? 3. Describe some of the ways our understanding of the Earth and of society is improving through remote sensing (other than to help predict pandemics). 4. How might earth observations help predict pandemics? 5. What is agent-based modeling? How does it work? Can you think of some examples of how these sorts of models may help us to understand human behavior?
7		Topic 1: **Nonlinearities** Reminder: check each week for any new **Announcements.** The significance of nonlinear phenomena (that is to say, most things) cannot be determined by simple addition or multiplication. Imagine bumping into a wall at 1 mile per hour. No big deal. Now imagine doing that same bump 10 times in a row. It would be kind of OCD but still, no big deal. Now imagine running straight into the wall just once, at 10 miles per hour. Obviously, a very different result from

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		bumping into it 10 times at 1 mph. Also much greater than what you would get at 1 mph and just multiplying that insignificant effect by 10. At 20 or 30 mph, it could easily result in death. In order to translate velocity into significance, you would need to at least raise it to some power, rather than just multiply it by some value. That is the basis of nonlinearity. The events that often carry the most significance, possibly the only real significance, might happen very seldom, but they are often extremely powerful, carrying everything they interact with into uncharted terrain. These are the sorts of events that actually change lives, nations, and civilizations. **Watch:** Long Tail Distributions [Systems Innovation] https://youtu.be/vIp1kY0H0yw Agents of change exist at every scale. They can be far smaller or far larger than anything we as human beings can directly perceive. They can occur far more quickly than we could ever have time to respond to, and they can happen far more slowly than we might even notice. The respiratory version of the virus that marked the beginning of the pandemic illustrates this point. Each virus particle is approximately 50–200 nanometers in diameter. Let's say 100 nanometers, typically. That's four orders of magnitude smaller than a millimeter, which is the finest mark that you might find on a common ruler. Ten thousand individual virus particles can be lined up between each of those millimeter marks. Roughly a hundred million particles could cover a square millimeter of surface. Now compare that to the surface area of a pair of human lungs, which is the primary target of most variants of this particular virus. The alveolar surface area of a pair of human lungs is enormous, somewhere between 50 and 75 square meters! It is possible for Nature to fit such an enormous surface area into such a compact volume because lungs exemplify a fractal branching pattern, terminating in hundreds of millions of alveoli for gas exchange. If a hundred million virus particles can cover a square millimeter, and there are fifty square meters of surface available, you can imagine the sorts of battles that are being fought within the vast terrain (from the virus's point of view) available within a single human being. Now think about the spread of that virus to billions of people. The potential power of anything cannot be determined merely by its size or by our current awareness of its potentialities. This is one of the things that nonlinearity implies. Next week, we will look at how nonlinearity can lead to 'chaos', which has a very different meaning in science than it does in common usage. Topic 2: **Network science** Reminder: check each week for any new **Announcements.** Unless we happen to take a course in graph or network theory as part of a computer science, math, or engineering curriculum, most of us are never expected to learn relatively little of any real significance about networks. Even in technical or theoretical courses, it is difficult to find detailed analyses of how networks exist and operate in the real world, outside the specific domain of analysis. I expect that to change, since we all participate in networks of all kinds: ecological, biological, communicative, financial, trade, energy, etc. If we could understand networks better, we might be better able to guide their development, and reduce their fragility. These are some of the topics we will introduce today, but I encourage you to read further and study on your own. There is a substantive science and mathematics of networks, and many valuable insights have emerged

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only recently. And as I've indicated, much of it has not made its way into popular understanding. Nevertheless, much of it is not really that hard to understand. Albert-László Barabási happens to be one of the most important figures in network sciences. He discovered and explored so-called scale-free networks, which dominate the natural and human worlds, and which share a characteristic with nearly all of nature, regardless of whether networks are involved. That is, rather than following a bell-shaped distribution of characteristics, populations of things and events in nature and in the human world often follow power law distributions. Earthquakes, for example: many, many small ones, up to only a few very large ones, which obviously have the most significance. Here is a clear introduction to network science by the man himself.

Watch: The hidden networks of everything | Albert-László Barabási [Big Think]
https://youtu.be/RfgjHoVCZwU

The Systems Innovation channel provides a nice set of introductory videos on networks. You can check out the channel itself for a great deal more than what's listed here.

Watch: Network Paradigm [Systems Innovation]
https://youtu.be/9XEvXNrc-dg

Watch: Network Robustness & Resilience [Systems Innovation]
https://youtu.be/_ztNkmDg0mw

Watch: Globalization - Rise of Networks [Systems Innovation]
https://youtu.be/x1wLbJoSmR0

Watch: Global Cities: Globalization [Systems Innovation]
https://youtu.be/B76KE1IFVj4

Recommended: Network Theory Overview [Systems Innovation]
https://youtu.be/qFcuovfgPTc

Recommended: Network Diffusion & Contagion [Systems Innovation]
https://youtu.be/bTXUJQhEqL0

Recommended: How Networks Can Change Everything [Computational Social Science ETH]
https://youtu.be/PWx91zUnBVU

Topic 3: **Vulnerabilities**

> Barnhardt: *Tell me, Hilda, does all this frighten you? Does it make you feel insecure?*
>
> Hilda: *Yes sir, it certainly does.*
>
> Barnhardt: *That's good, Hilda; I'm glad.*
>
> (from "The Day the Earth Stood Still", 1951)

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		In the 1951 film, an emissary from space pressed his demand for an audience with the world's political leaders by temporarily disabling everything that requires electricity, including military defense. A similar thing could happen quite naturally, and few people seem to be aware of it. Some things about a severe Coronal Mass Ejection (CME) would be different, and probably much worse than the fictional film. Some of its effects might pass with the event itself, but a great deal of permanent damage would be inevitable, requiring time-consuming repair. I wonder, would even our governing bodies, which seem increasingly to live on the Internet, survive disconnection for very long? Bear in mind, an event of this kind could very well be global in its effects. Can you imagine what a severe disruption of communications would do to international relations and trade? **Reference:** https://en.wikipedia.org/wiki/Coronal_mass_ejection **Watch:** The Carrington Event - A Short Documentary [Fascinating Horror] https://youtu.be/C9tfx6rfAIo **Watch** at least one of the following three videos: How Solar Storms Could Knock Out Our Power Grid [NOVA PBS Official] https://youtu.be/7nkC8SXzHls The Grid vs. The Next Big Solar Storm [Real Engineering] https://youtu.be/LLO9WxVO9s8 What If a Massive Solar Storm Hit the Earth? [What If] https://youtu.be/q2kDvrs2VEs
	10/09/23	**Homework 7:** Reminder: check each week for any new **Announcements.** 1. The Systems Innovation videos claim that economic globalization could only have reached the scale it has once certain thresholds in technology, innovation, and cooperation were crossed. What do you think may have been some of the historical developments that got us over these thresholds? The Internet as one of them, for sure, but you'll need to think back much further. 2. Is it possible for the global economy to shift from one dominated by agriculture and industry, to one based on services and information (3:15 in the Global Cities: Globalization video)? Don't people still have the same material needs? You may explore reasons both for and against this idea. 3. If we sustained a direct hit from a powerful Coronal Mass Ejection, what do you think might happen immediately? What might happen over time? What do you think could be done, given the technologically networked nature of the world we live in, to reduce and overcome the impact of such an event?

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8		Topic 1: **Agriculture and food security** Reminder: check each week for any new **Announcements.** Although the ecological sciences are not explicitly covered in this course, it is important to underscore the ecological basis of all of human life. Although the ecological sciences are relatively new, much of it was understood, in some form, since ancient times. It was only by drawing from and working coherently with existing ecosystems that human beings managed to survive at all. The complexities and nonlinearities of the natural world must be known and understood, when your task is to find or produce food. Currently, we have two general trends at play. We have planners and their agendas. They see themselves as having an important mission: to keep the Earth's population fed. This has thus far required, and may continue to require, according to this view, large amounts of artificially produced fertilizer, large scale production, and global shipping of grains and other foods. Soil health is generally expected to continue to decline, and crops may continue to be genetically modified in order to tolerate pesticides. Robotics and electricity are expected to further reduce the need for human labor. Vertical farms, hydroponics, and other technical means of producing food near urban centers may be used to generate local easily perishable produce. The following video describes some of the innovations that may be required in order to double production in the near future, according to this vision. **Watch:** The Future of Farming [The Daily Conversation] https://youtu.be/Qmla9NLFBvU Just a few seconds into the video, the narrator describes the changes described as allowing most of us to "do other things with our lives". The assumption among planners seems to be that most of the Earth's population will no longer be interested in being directly involved in producing its own food. Nearly all of us, presumably, have better things to do. This is tied to the generally favorably attitude shown regarding the migration worldwide of people from dispersed rural communities to dense urban centers, which we've already examined. On the other hand, we have a significant and growing trend among some agriculturalists to produce food locally whenever possible, with maximum nutritional value, and as naturally, cleanly, and ethically. Soil health and carbon content are maintained and improved over time. Ecological principles are used to control pests and maximize yield, and chemical pesticides and other toxins are avoided entirely. When these two worldviews collide, we can expect to see political and economic disruption. A recent example of this occurred in Sri Lanka, whose former government had made some radical decisions. **Watch:** Why Sri Lanka is Collapsing: the Coming Global Food Crisis [PolyMatter] https://youtu.be/W5zxYDHwf-Y **Watch:** Sri Lanka economy: Fertilizer ban contributes to food crisis [Al Jazeera English] https://youtu.be/-qsEvaZYGeo **Watch:** Sri Lanka's economic crisis leaves tea farmers struggling [BBC News] https://youtu.be/dse7Xwlqt64

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		Recommended: Why Sri Lanka Is Approaching Its 'Worst Man-Made Disaster' In History [Roar LK] https://youtu.be/XBXQtGwZGxw

Recommended: How did Sri Lanka's organic dream turn into chaos? [SBS Dateline] https://youtu.be/YWw5wlAf27g

The OECD video below briefly describes a rather optimistic globalist vision of the future. The second video, from the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), provides a more sanguine and far more detailed analysis of the path ahead.

Watch: The Future of Agriculture [OECD Trade and Agriculture] https://youtu.be/uAM4Si_WhDk

Watch: How to feed the world in 2050: actions in a changing climate [CGIAR] https://youtu.be/gjtIl5B1zXI

From the heading of the following document: We, 50 organizations focused on food sovereignty and justice worldwide, want you to know there is no shortage of practical solutions and innovations by African farmers and organizations. We invite you to step back and learn from those on the ground.

Read: An Open Letter to Bill Gates on Food, Farming, and Africa [commondreams.org] https://www.commondreams.org/views/2022/11/10/open-letter-bill-gates-food-farming-and-africa

1.1: **Rural wellsprings**

The following video is about a farming program here in the US run by the highly respected author and farmer, Wendell Berry. You might think of this as a distinctly American approach to a more distributed, truly diverse revolution in agriculture. In fact, the true cultural roots of agriculture are beginning to be appreciated throughout the world. The assumption among nearly all planners that people would rather occupy their time doing anything other than producing food is one of the factors driving the relentless growth of cities. But what if the planners have got it wrong?

Even a gardener, over a period of years, develops a sense of coexistence with natural ecological phenomena that have existed long before us. A gardener might get a sense of how the soil itself changes , becoming rich with its own organisms and retaining moisture and nutrients over time. Over the years, a gardener might find a greater diversity of beneficial organisms, fewer troublesome ones, and synergies begin to develop between them. The garden might become less difficult to tend as it naturally becomes more attractive. The same thing can happen with larger scale agriculture, if the right people are involved.

Watch: Wendell Berry Farming Program [Religion and Ethics NewsWeekly] https://youtu.be/vGG5BED6dZI

Watch at least two of the following:

Ashland's Story | Wendell Berry Farming Program [Sterling College] |

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https://youtu.be/wS9HrvIlOGk

Lizzie's Story | Wendell Berry Farming Program [Sterling College]
https://youtu.be/iIoKiv-zQB8

Emily's Story | Wendell Berry Farming Program [Sterling College]
https://youtu.be/c50alkjVSdo

Gabriel's Story | Wendell Berry Farming Program [Sterling College]
https://youtu.be/pJEVG6EN1Ww

Hannah's Story | Wendell Berry Farming Program [Sterling College]
https://youtu.be/UIqR6zwrs7s

1.2: **Agricultural work in northeast China, 1968 - 1972**

Now I want to take you to the other side of the world, fifty years ago, and an entirely different approach to agricultural education. I recently documented the reunion of junior high school classmates who had been sent off as a group to be agricultural workers and to learn from the peasants as part of the Chinese Cultural Revolution. The intention was that these younger students learn directly from the farmers, while helping with labor. The part of the reunion portrayed in the film occurred at the spot in China's Northeast where they had been sent beginning in1968. The archival film below shows a similar group of students from Changchun who left at about the same time as our group, from the same station. This video also shows groups of others who continued to live in the city but who took day trips to nearby farms to help with the planting and harvesting.

Watch: 1960s China, Students Leave City to Help on Commune Farms [thekinolibrary]
https://youtu.be/t4Dpo__a-Bg

The discussion below accompanies my video:

Watch: Down to the Countryside: a fifty year reunion [Gary Pereira]
https://youtu.be/d1nywzYowiI

Once the train deposited our group in the rural agricultural town of Dehui in 1968, they were conveyed to their designated village by horse-drawn wagons. After the students arrived at their destination, members of the village gave them temporary quarters and helped them build a home. The countryside around Dehui, in northeast China (midway between Changchun and Harbin) is largely agricultural. Winters are brutal, and temperatures routinely stay below 10^0 F for long periods of time. It's kind of like northern Minnesota. As you can see from the video, homes in the region follow the same general plan. The front door is generally in the center at the front, and once inside you can go straight through to the kitchen, or you can go off to either side, which for our students was where the men's and women's sleeping quarters were located. The kitchen is often in the middle of the house because it is the source of heat. Exhaust from the oven and stove is channeled through sealed stone beneath the bed platforms, or 'kangs', before being vented outside. This is a safe and efficient system, since the exhaust is vented completely after giving up most of its heat to the brick and masonry kangs, which slowly release it over the course of the

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night. The region around Dehui is not excessively hot in the summer, due to its latitude and the presence of vegetation and water. Passive solar building techniques help to keep the inside air temperate and clean.

The floor plans of the homes in the village haven't changed much since 1968, but some of the building materials have changed. In 1968, only dried mud bricks were available for building homes. Baked bricks were a luxury. Since mud bricks tend to crumble and break at the edges, they often had to be lined with wood to keep the edges intact. These days, permanent fire-hardened bricks and masonry are used. Roofs in 1968 were made of thatch. This worked well in insulating homes from both heat and cold, but it had to be replaced quite often. Thatch is no longer used for roofing homes, although it is stored and used for other purposes. There was limited access to electricity in 1968, but now everyone is on the electrical grid, and cellular internet access is available. The outhouses remain outdoors.

During the Cultural Revolution, the number of years each person was required to stay in the countryside depended on that person's class and family background. Very little other than food was available locally. The members of our group were friends from school, and Dehui was a long difficult day's journey from their homes in Changchun. Individuals would make the journey periodically and return with supplies and treats not available locally. Young people were sent into the countryside in order to have them participate in agriculture and other labor-intensive activities, and to learn from this experience. Since very little agricultural machinery existed in China at the time, a great deal of human labor was required. The main source of energy, transportation, and non-human labor at the time in the region around Dehui was horses. Horses pulled wagons, and horses pulled plows. Crops were picked by hand, without gloves. The main crops were corn and soybeans. Some of the corn would be consumed locally, but the soybeans were sent off to the cities. Soybeans are particularly difficult to pick by hand, since they grow low to the ground and the leaves are abrasive. Nearly all of the corn plant was utilized, including the stalks and husks. The students often ate sorghum, or 'kaoliang'. As you can see from the video, sorghum is a very tough grain; it can also be difficult to digest. It is no longer being grown deliberately in the region, but it continues to grow wild by the side of the road. So does hemp, which was once grown locally for fiber.

In 1968, each household produced its own vegetables, meat (generally poultry) and chicken and duck eggs. Many still do. Our host was one of the villagers who had originally helped the students get settled and accustomed to farm life. He still lives in the same house with his family. They call him 'second brother'; he is the gentleman wearing the white shirt in the video. As you can see from his home garden, he has a green thumb (with lots of beneficial ladybugs in his garden and no visible chemicals). He appears to be in excellent health, and is well into his 70s.

Wintertime meant different kinds of work for the students 50 years ago. Since the watery bogs and depressions were frozen and could therefore be worked under the right conditions in the winter, the students hauled out organic material that would be worked into the fields later in the spring, when the ground was fully thawed. Snow in that region accumulates all winter, but the roads were never plowed by machine 50 years ago; they had to be cleared by hand. Fuel had to be gathered and dried to supplement their allotment of coal. There was always something that needed to be done throughout the year. Currently, many of those activities no longer occur, or they are done with machinery.

In 1968, home and personal goods were hard to come by, and there were no stores nearby. You would have to walk or hitch a wagon ride from a friendly villager to a government depot some distance away for basic necessities. Even today, these households remain relatively isolated from the nearest stores, but as you can see from the video, merchants now travel up and down the road peddling various things.

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	10/16/23	**Homework 8:** Reminder: check each week for any new **Announcements.** 1. Describe the agricultural and economic crisis in Sri Lanka. 2. Do you think it may be necessary to continue to intensify agriculture artificially by chemical and industrial means in order to continue to feed the world? Why/why not? 3. Would a move toward more organically grown food and sustainable agricultural practices necessarily involve shortages, higher prices, or an expansion of farmland? Why/why not? 4. Describe the Wendell Berry Farming Program and the experiences of a couple of its students. 5. After reading the text and watching the videos on agricultural work during the Cultural Revolution, do you think that a similar program asking young people to work outdoors (with monetary compensation, insurance, and health care provided) could succeed in the US? What if a large scale tree planting program were initiated, for example, in locations likely to be successful long term? Would that be the kind of experience young people (and their parents) might appreciate or learn from?
9		Topic: **The global climate system** Reminder: check each week for any new **Announcements.** It has been said that climate is long-term weather, but that's not strictly true The climate system directly involves far more than just the atmosphere. The oceans, the cryosphere, and the continents all have a huge influence on the world's climate. Climate can be measured and defined over a wide variety of scales. The microclimate of a forest, a farm, a city, or of a park within a city is real and measureable, and it can be influenced both by any number of factors, many of which we have some control over. The paleoclimate record, found in Antarctic ice as well as many other sources, makes it clear that the Earth's climate has experienced many wide and often rather sudden shifts. Much of this change occurs as the Earth's oceans, ice, land, and biogeochemistry respond in complex ways to subtle shifts in the Earth-Sun system (Milankovitch cycles). But during our most recent climatic period, the Holocene, the world's climate has been remarkably stable. Coincidentally, human civilization blossomed. We should try to keep in mind that nearly everything we have accomplished as a species has occurred under an unusual stable climate regime. Even without our influence, the Holocene will come to an end. Under human influence we cannot be sure of what lies ahead, although rather abrupt changes are inevitable. The Earth's climate system is permeated with deterministic chaos, and long term prediction may be fundamentally impossible. Nevertheless, we should keep in mind that biological organisms, ecosystems, and humankind in particular have shown a remarkable ability to adapt to radical environmental change, a characteristic attributable in part at least to the antifragility we looked at earlier. Humankind has the additional proven ability to shape and control

Week	Due Date	Topics, Videos, Readings, Assignments
		aspects of the physical environment to an extraordinary degree. Despite the challenges, as understanding increases, we may find that the Earth's climate is controllable, to some degree, in possibly subtle ways that we still haven't discovered. **Watch:** What is a Climate Model? https://youtu.be/bkcrH9tYv8g As an example of how neglected connections in the climate/biosphere network may be some of the keys to successfully addressing climate change, I'd like you to learn something new about whales: **Watch:** How Whales Change Climate [Sustainable Human] https://youtu.be/M18HxXve3CM The focus has been on emissions through combustion, but more deep rooted processes have huge influences that are often ignored: for example, land use itself. **Watch:** Climate Change : How Land Use is accelerating the crisis [Just Have a Think] https://youtu.be/Scm46Ctn0Ig Regardless of the relative validity of the various assessments and projections of the state of the global climate system, the importance of global, regional, and local climates and their associated systems to human well-being should be self-evident. The associations of climate with the rise and the fall of past civilizations are undeniable. There is abundant historical evidence, from all parts of the inhabited world, of people having had to struggle with changing climates. No divorce from nature is ever possible. We can probably expect this relationship to continue and to grow more difficult in the near future. Let's consider the idea that the climate is approaching a global tipping point that may challenge or even extinguish civilization. This is a popular claim, and it should be taken seriously. For more than ten years, I've been assigning readings and lectures from researchers themselves regarding tipping points in the Earth's climate, ecosystems, and biogeochemistry. For this course, I've pared it down to one lecture. Please watch it carefully. Regardless of how much you already know or manage to understand, I'm sure that you will learn something important. Hopefully, you can help others to deepen and broaden their understanding as well. **Watch:** Early Warning of Climate Tipping Points [Understanding Climate Change] https://youtu.be/5yTJZzQzdYI Here's a pdf of the slides from the lecture. https://sustainabledevelopment.un.org/content/documents/3487lenton.pdf Here is the latest news from one of the most troubling potential sources of sudden sea level change. You will find that ice shelf dynamics are, like many things, complex and difficult to assess, but that the trend may be one of accelerating sea levels in the near future. Think about this if you are even in the market for a house near an ocean or bay. **Watch:** Antarctica latest research: Doomsday Glacier ice shelf gone in 5 years [Just Have a Think] https://youtu.be/49NPdyUEos8

Week	Due Date	Topics, Videos, Readings, Assignments
		Tipping points exist at all scales, even in everyday life. But it can be difficult to extrapolate the idea to much longer time scales. Sea level rise is one of those topics. People will generally assume that a slow rise in sea level might be something relatively easy to adapt to, since it is likely to occur relatively slowly. But specific readjustments can in fact be quite rapid, due to tipping points in glacial dynamics. And even if the average change is slow, the effects can be quite sudden, as when they are triggered by a storm. New York City and adjacent coastal regions discovered this with Superstorm Sandy. Many such events, while not directly attributed to some global change, exemplify the sort of 'flickering' that may occur as a tipping point is being approached. Topic 2: **Shifting climatic indicators in America's heartland** While some other regions of the world are likely to be at greater risk of disruption, I believe it would be helpful for us to briefly consider one of the changes taking place within America's heartland. **Reference:** The Future of Supercells in the United States, Bulletin of the American Meteorological Society, volume 104, issue 1. Online Publication: 04 Jan 2023 https://journals.ametsoc.org/view/journals/bams/104/1/BAMS-D-22-0027.1.xml This recent publication analyzes changes in tornado activity and violent storms in the United States: "A supercell is a distinct type of intense, long-lived thunderstorm that is defined by its quasi-steady, rotating updraft. Supercells are responsible for most damaging hail and deadly tornadoes, causing billions of dollars in losses and hundreds of casualties annually." "Results reveal that supercells will be more frequent and intense in future climates, with robust spatiotemporal shifts in their populations. Supercells are projected to become more numerous in regions of the eastern United States, while decreasing in frequency in portions of the Great Plains. Supercell risk is expected to escalate outside of the traditional severe storm season, with supercells and their perils likely to increase in late winter and early spring months under both emissions scenarios. Conversely, the latter part of the severe storm season may be curtailed, with supercells expected to decrease midsummer through early fall. These results suggest the potential for more significant tornadoes, hail, and extreme rainfall that, when combined with an increasingly vulnerable society, may produce disastrous consequences." Although people in what has been known as 'tornado alley' are generally prepared and educated regarding tornados and availability of underground shelters, people further east are not. **Examine:** at least two of the following six drone videos showing the aftermath of recent tornados: Whiteland, Indiana [ABC7 Chicago] https://youtu.be/BVTzCVCq9FU Little Rock, Arkansas [THV11] https://youtu.be/bazeywcX4U0

Week	Due Date	Topics, Videos, Readings, Assignments
		Wynne, Arkansas [StormChasingVideo] https://youtu.be/BOFQXp_r7GQ Wren, Mississippi [StormChasingVideo] https://youtu.be/LGnLc3AKN9g McNairy County, Tennessee [Live Storms Media] https://youtu.be/F45NYmQWPI4 Sullivan, Indiana [Live Storms Media] https://youtu.be/JSGMXh3GhJc **Homework 9:** Reminder: check each week for any new **Announcements.** 1. How do climate models work? 2. How do whales affect the global climate? 3. Explain the importance of nonlinearities, thresholds, tipping points, and surprises in the relationship of humanity with the Earth's natural systems. What are some of the challenges we face in trying to avoid unpleasant surprises? How might government become more responsive to such changes? Do you think that popular understanding of these issues matches their known realities? Include in your discussion anything else you have found to be interesting or surprising about Dr. Lenton's lecture. 4. What is the latest news from observations of Antarctic ice shelves? 5. A shifting pattern of tornados, environmental issues often involving toxic substances, an economy in decline, psychological despair, drug use, and other issues now plague the heartland of the United States. It would be disingenuous of us to ignore these facts, as we examine the rest of the world. It would be easy for us to slide into a political discussion, which is not what I want from you. What I'd like your initial thoughts about is this: to what extent do you think we as a nation are self-aware of our environmental vulnerabilities? What in a practical (rather than wishful or political) sense needs to be done?
	10/23/23	
10		Topic 1: **Addressing climate change** Reminder: check each week for any new **Announcements.** Proposals and activities that are intended to address climate change can be said to fall into two general categories. There are proposals and activities that are intended to **mitigate** global warming through the direct reduction of greenhouse gas emissions at their sources, or possible later reabsorption of these gases from the atmosphere into some kind of long term storage. There are also a great many proposals and activities intended to enable human and ecological **adaptation** to climate change, whatever that might

Week	Due Date	Topics, Videos, Readings, Assignments
		imply, from local to global scales. Clearly, a great deal of normal human planning in the future will necessarily fall into what we now think of as the latter category. I think that most of us would agree that rational, self-consistent but open-minded, adaptive, long-term thinking would probably help to create a future in which human beings and as many other species as possible continue to live on through the centuries in healthy ways. We hope that this can be achieved without the sorts of regional catastrophic histories that have occurred so often in the past, magnified to the immediate, global scales of modern life. But despite our hopes, catastrophism grabs attention. It grabs minds, so it's inherently political. We are entertained by it. Whenever it comes up, it takes over the stage, and people who proclaim it are considered sages and prophets by many. It's as if we are collectively preparing ourselves for, or distracting ourselves from, something big. Catastrophism makes us fearful. It turns people against one another. Last week, we saw how changes in complex systems like the climate can be difficult to understand and predict. Tipping points can be sudden, but warning signs might exist, and careful attention is required if we are to detect them. Back in week 6, we talked about the insufficient attention paid to observation and modeling, focusing on remote sensing. Hopefully, you can see now why I think this is important. Proclamations from educators, journalists, and politicians always seem to ignore the background issue of scientific, technological, and educational competence, and of seeking out and obtaining practical results, focusing instead on personalities, slogans, and power. We shall see over the long term who was right and who was wrong about what they'd decided to stand for. I'd like you to just consider the possibility that the wisdom and human energy required to overcome our difficulties need not come from any centralized leadership. If it comes at all, it is more likely to come from the distributed intelligence that exists within us all, regardless of our status. How many times have you or someone you know expressed concern about something, or offered an interesting solution, but were ignored because of your low status? And even if it turned out that you were right, you continued to be ignored. How much better might things work if ideas were actually considered on their merits, rather than on the status or identity of the people who express them? There is so much wasted human intelligence and creativity out there. Being human is not easy, even under the best of circumstances. It can be very hard. Many of us are not inclined to live our lives politically. But as much of the world is finally rising above extreme poverty, the desire to live meaningful lives is becoming stronger than ever. If people are allowed to become aware of one another's ideas and activities, local success can be duplicated and failures avoided under similar circumstances around the world. Successful solutions evolve over time. But mass coercion or even too firm a control by any elite, even in pursuit of a greater good, only wastes the creativity that naturally exists in all human societies. **Watch**: The Way We Talk About Climate Change Isn't Helpful | Chris Jordan [Sustainable Human] https://youtu.be/4CaCsZKECB8 Energy sciences and technologies are yielding results that may change things dramatically if they pan out. I would like you to be aware of a YouTube channel called 'Just Have a Think', one of the few places to find discussion of new technologies and techniques that may turn out to be very helpful in addressing climate change. Always educational, and particularly helpful to people at the beginning of their careers. Also a potential source of future investment.

Week	Due Date	Topics, Videos, Readings, Assignments
		Watch: How to capture 2 billion tons of CO2 AND fix our oceans [Just Have a Think] https://youtu.be/zr6CYS9ie5E Topic 2: **Regional vulnerabilities and climate-related migration** When large numbers of people migrate from one region or nation into another, serious incompatibilities between the respective cultures can often create tensions, suspicions, tribalism, and violence that threaten the integrity and sometimes the very existence of the host nation. This has happened throughout history, and it is taking place in parts of Europe right now. This particular legacy of colonialism, which happens to be inflicted largely upon the former colonizers, is seldom mentioned. Often, just mentioning problems associated with uncontrolled immigration gets people in trouble. We even seem to be expected, as good-hearted people, to reject the very idea of nationhood, at least with regard to our own nations. Wouldn't it be nice if there were no borders? Wouldn't it be nice, while we're at it, if human beings were some other species, from which all the bad stuff has been removed? Since no one seems to have found a better way of organizing a diverse array of often incompatible societies nonviolently upon the surface of the Earth, pretending to be 'post-national' in my opinion is just like pretending to be 'post-human'. Unless you are absolutely sure that a time-tested safety net exists out there, you and a whole lot of people would be jumping off a rocky cliff into an unknown, terrifying, dark, and possibly bottomless, chaotic void. Large numbers of people are now or may soon be at risk of losing their homes, communities, livelihoods, or even their very lives, at the hands of forces that are well beyond their control. Everything from armed conflict, civil collapse, criminality, and deliberate genocide, to floods, drought, crop failure and disease can drive massive numbers of people to flee their homes, often in desperation. Too often, there is no return from places of temporary refuge. Many populations have continued to live in refugee camps for generations. Add to this the flow of people who leave their homes in order to escape localized or regional economic difficulties, and rely instead on the good graces of people residing in what at the time happens to be more prosperous. This is doubtless an old story, but with the populations in existence today, it is accelerating, I am unaware of a general solution to the problems of mass migration. Social and environmental problems associated with migration itself are real, and unless we address them, they will only get worse. Although I think we should be careful about how much we attribute to climate change, most of the discussion has taken place in this context. **Watch:** at least three of the following six videos. Climate Refugees: Nations under threat [CBS News] https://youtu.be/4MXoUbsswHY Fleeing climate change — the real environmental disaster [DW Documentary] https://youtu.be/cl4Uv9_7KJE Exploring the relationship between Climate Change and Human Migration in Africa [USFGsAL] https://youtu.be/HtUw_jvv3GU Climate Change: Rising Sea Levels + Coastal Megacities = Forced Migration [Big Think] https://youtu.be/s4UgekcYg2o

Week	Due Date	Topics, Videos, Readings, Assignments
		Changing Climate, Moving People: A film on climate stress related migration [TERI] https://youtu.be/NjYR3LohMM0 Even if severe storms and flooding were not increasing, and even if sea levels were not relentlessly rising, the very fact that ever greater numbers of people are living and working pretty much at sea level results in unprecedented challenges regarding emergency evacuation, long term migration, and economic and political stability worldwide in coming years. Dhaka, the capital of the South Asian country Bangladesh, has a population that is booming. However, it stands as one of the world's poorest mega-cities, with some of the world's most challenging long term climate-related issues. Within the next 30 years, up to 20% of Bangladesh will disappear beneath the water as rivers and sea levels rise. This will put as many as 30 million people on the move. **Watch:** Climate Change Impacts in Bangladesh [World Bank] https://youtu.be/V3IL6Y1TDHo **Watch:** Climate refugees in Bangladesh [DW Documentary] https://youtu.be/co5uywe-1Z8
	10/30/23	**Homework 10:** Reminder: check each week for any new **Announcements.** 1. What do you think of Chris Jordan's suggestion that the way we talk about climate change isn't very helpful? 2. According to the Just Have a Think video, how might we capture 2 billion tons of CO2 and fix our oceans? Discuss one or two more specific technologies currently under development that may help us globally, regionally, or locally to deal with changing climates. You can get some ideas by looking through the videos in the 'Just Have a Think' channel on YouTube. Perhaps, if you or someone you know were interesting in investing in stocks, this might give you a few ideas. 3. Describe the situation in Bangladesh and neighboring portions of India regarding the consequences of climate change, and what may happen over the next few decades. 4. Where and why in the world might we find largest numbers of climate refugees in the coming years? Does most of the migration currently taking place seem to occur within or across national borders? As climate-related migration becomes increasingly international, which other states are or might become involved? What if those states have their own internally displaced populations to deal with? I've already asked about Bangladesh and India, but there are several other examples of difficult political situations arising from climate migration.

Week	Due Date	Topics, Videos, Readings, Assignments
11		

Topic 1: **Water resources**

Reminder: check each week for any new **Announcements.**

Reference: Fundamentals of Physical Geography CHAPTER 8: Introduction to the Hydrosphere
http://www.physicalgeography.net/fundamentals/chapter8.html

Fresh water availability is certainly at the top of any realistic list of social concerns for a great many people on this planet. Water is central to both agriculture and industry, and we cannot survive for long without it. Since it is often possible for people to withhold water from one another, water availability can and has become a source of violent conflict throughout history.

Watch: The Water Cycle [National Science Foundation]
https://youtu.be/al-do-HGuIk

Watch: Is the world's fresh water supply running out? [PBS NewsHour]
https://youtu.be/iVcTQdOJMMw

Recommended: Inside Story - What can be done to stop global water scarcity? [Al Jazeera English]
https://youtu.be/JIlBBWSQMds

Watch: For 15 Years, GRACE Tracked Freshwater Movements Around the World [NASA Goddard]
https://youtu.be/MaxBOvQ2a_o

Watch: Water Resource Management [ThinkTVPBS]
https://youtu.be/odngssDFMrU

I worked for a couple of years at National Operational Hydrologic Remote Sensing Center (NOHRSC) (https://www.nohrsc.noaa.gov) which is NOAA's "source for snow information" and other hydrological data products and models. Every winter day, several satellite datasets are downloaded to this facility and analyzed, and by evening a variety of maps and graphs are generated and uploaded onto the Internet for use by regional hydrological agencies, businesses, and others to inform their own work and decisions. One important variable that has to be mapped and used to forecast springtime flooding is called Snow Water Equivalent (SWE), which gauges the volume of liquid water that would result from melting a given area of snow cover. This can be checked manually on the ground at various points using automated 'snow pillows' and other devices, but it can also be checked from above. NOAA pilots run low altitude flight-lines over snow with instruments that estimate SWE by measuring the degree to which the natural radioactivity of the ground beneath is dampened, or attenuated by the snow. These NOAA Corps pilots travel all over the world gathering data and assisting researchers; one of the pilots in our office had overwintered at the South Pole.

Recommended: NOAA Commissioned Officer Corps
https://www.omao.noaa.gov/noaa-corps

Let's take a brief look at our local water. The reservoir closest to us, from which some of our water might be drawn, is the Calaveras Reservoir. Unfortunately, the reservoir and the land around it are closed to

Week	Due Date	Topics, Videos, Readings, Assignments
		recreation. Here's a drive-by I shot. **Watch:** Calaveras Reservoir [Gary Pereira] https://youtu.be/_EqehbxjfUk **Reference:** Bay Area: Do You Know Where Your Water Comes From? https://www.kqed.org/news/11886536/bay-area-do-you-know-where-your-water-comes-from-2 Topic 2: **Urban rivers and streams** We can certainly look more closely at the connections between fresh water availability, population, and climate. California for example will soon face the challenge of diminishing (and eventually nonexistent) snowpack in the Sierras. Snow is a wonderful storage mechanism, since it can recharge aquifers and improve soil moisture as it slowly melts. Without it, most of our winter precipitation would be lost to the ocean. But I'd like to connect the topic instead to our stated interest in the particularities of place. Open water (as well as trees) within a city can make it significantly cooler in the summer, reducing or eliminating the Urban Heat Island effect. Evaporation and transpiration are our friends. I studied the situation rather closely for Beijing and Shanghai, and although I haven't published the results, I think it is clear that these and other cities in China and elsewhere would have been significantly hotter without the re-establishment of healthy, flowing bodies of open water. When I was a graduate student at the University of Minnesota, in Minneapolis, several of my classmates had come from Korea just to study in the Geography graduate program. They were all interested in designing cities with nature in mind. One resulting dissertation for example concerned the creation of greenbelts around and within Korean cities. I'm sure that the subsequent appearance of parks and greenbelts around Seoul and other cities in Korea was at least partly due to their personal efforts. **Watch:** How a City Demolished a Freeway to Restore an Ancient River System [Leaf of life Films] https://youtu.be/-I5qMDCcvTI **Examine:** Cheonggyecheon and surrounding scenery at sunset [Bau Walk] https://youtu.be/YNEymTSjpYA **Examine:** Cheonggyecheon in the Evening (Sep.2021) [4K Korea] https://youtu.be/LqEnkG5LY9k

Week	Due Date	Topics, Videos, Readings, Assignments
		Topic 3: **The oceans**

Topic 3: **The oceans**

The importance of the oceans themselves to world population cannot be overstated. Nations hungry for sea food troll the world's oceans, largely unhindered. One by one, the more desirable species are taken to near extinction. There is a great deal we haven't covered. However, given humanity's current thirst for minerals (some of which we will consider over the next two weeks) I think we should look at the recent discovery of some of these resources on the ocean floor and the development of technologies to exploit those resources, and what this implies for international relations and ocean ecosystems.

Fissures along plate boundaries and near hotspots bring valuable minerals up from deep beneath the crust. Over time, these minerals precipitate and form nodules on the seabed. These environments also host some of the most fascinating and vulnerable ecosystems on earth. Forms of life that we have barely begun to understand exist within environments that we may soon begin using large machines to dredge up.

Watch: 2023 ISA assembly: Deep-sea mining debate intensifies in Jamaica [Al Zazeera English]
https://youtu.be/-ES2ItUHOGw

Watch: The Next Frontier in Mining: Deep Sea Exploitation in the Pacific
https://youtu.be/PuEXmFQEJpw

Reference: Deep Sea Mining [Wikipedia]
https://en.wikipedia.org/wiki/Deep_sea_mining

Reference: Seabed mining is coming [Nature news feature, 24 July 2019]
https://www.nature.com/articles/d41586-019-02242-y

Reference: International Seabed Authority [Wikipedia]
https://en.wikipedia.org/wiki/International_Seabed_Authority

Reference: United Nations Convention on the Law of the Sea [Wikipedia]
https://en.wikipedia.org/wiki/United_Nations_Convention_on_the_Law_of_the_Sea

Recommended: Deep sea gold rush [Al Jazeera English]
https://youtu.be/s1b4xVTAKcI

Recommended: Mining the Deep Sea [Massachusetts Institute of Technology (MIT)]
https://youtu.be/MWvCtF1itQM

Recommended: Deep Sea Mining: Searching for the Next Mineral Boom [Roundtable]
https://youtu.be/-UPjsuuyvD4

Recommended: Seabed Mining in the Deep Sea [University of California Television (UCTV)]
https://youtu.be/ePm3Wbw2tyc

Recommended: Introduction to the International Seabed Authority and Seabed Mining [dyaguilfoyle]
https://youtu.be/Tlumf1ivuPg

Week	Due Date	Topics, Videos, Readings, Assignments
	11/06/23	**Homework 11:** Reminder: check each week for any new **Announcements.** 1. What is the general state of the world's freshwater supplies? Which regions are most vulnerable? What important source of fresh water worldwide do we know the least about? 2. How do GRACE and other innovative remote sensing technologies help in the search for sustainable freshwater supplies? 3. Water resource management is something that needs to be done well everywhere in the world. I wanted to include a video on these sorts of careers and occupations because they are among the unsung heroes driving civilized life. What are some of the tasks and concerns of water resource managers? 4. What are your impressions of the Meguro and Mama Rivers in Japan, and of the Cheonggyecheon River in Korea? Discuss the history and benefits of the Cheonggyecheon River restoration. How do they compare with urban streams with which you may be familiar, or perhaps may have ignored until now? 5. Discuss the status and prospects f deep-sea mining. What (if anything) is being done or should be done to regulate the exploitation of the seabed for minerals? Discuss the history and significance of national claims of exclusive rights over offshore resources.
12		Topic: **Energy: uranium, thorium, plutonium** Reminder: check each week for any new **Announcements.** Minerals and metals found in the lithosphere have been central to the success of civilization since ancient times, and this continues to be true. Energy production is the most significant task at hand at this point. Fossil fuels remain important, but we will concentrate our attention here on some of what comes next. Improvements in energy storage are required in order to fully utilize discontinuous technologies like solar and wind. It has been argued that nuclear reactors are offered as a way around such difficulties, since they are designed to operate continuously. Both approaches are likely to be pursued with increasing intensively in the near future. Each approach requires different sets of metals and minerals. Nuclear technologies yield power without directly generating atmospheric carbon, although the mining and refining of uranium and the building and decommissioning of reactors are processes that remain carbon-intensive. One of the biggest concerns remains the toxic nature of the fuel, partly because of the nuclear power and weapons industries' often ignored history of mistakes, disasters, and near-disasters, and partly because of its vulnerability to malevolent intentions. New reactor designs claim to address some of these issues. In addition, there is currently no closed-loop recycling of spent fuel and other waster in the United States. I'll leave these things for you to consider. Whatever ends up happening with uranium, plutonium, and thorium, much of it will probably play out in your lifetimes.

Week	Due Date	Topics, Videos, Readings, Assignments
		Watch: Thorium and the Future of Nuclear Energy [PBS Space Time] https://youtu.be/ElulEJruhRQ **Watch:** Could Advanced Nuclear Power Replace Fossil Fuels? [Journey] https://youtu.be/eg613DFBR8s **Watch:** Small Modular Reactors. Are they now unavoidable? [Just Have a Think] https://youtu.be/yofGtxEgpI8 The events of both Chernobyl and Fukushima should be familiar to every educated person on this Earth. Unfortunately, awareness of issues surrounding nuclear power has decreased, rather than increased, in recent years. Our media and educational establishment seem to have decided that such things are too complex for people to understand, so they should probably be decided for us. Having asked students for several years now about their prior knowledge of the Fukushima disaster, I remain unsurprised at how little discussion has taken place in the classroom or on the news. I have to give the Japanese reporters at NHK credit for having dug so deeply into the causes and consequences of placing nuclear reactors with fatal design flaws on one of the most seismically active coastlines in the world. **Watch:** Understanding the accident of Fukushima Daiichi [IRSN] https://youtu.be/YBNFvZ6Vr2U **Watch:** Fukushima's ghost towns https://youtu.be/xKfnsYzQWjw ### 1.1: **Memories of the Oyster Creek Nuclear Generating Station** I'm probably one of the few people who worked as a technician on projects in both a commercial Nuclear Fission reactor and an advanced Nuclear Fusion project (many engineers and physicists must have worked in both domains, but I just played a minor role). I was hired to fill out a work team at the Oyster Creek Nuclear Generating Station, in Forked River, New Jersey. The reactor is in the cube-shaped building in the center of this picture.

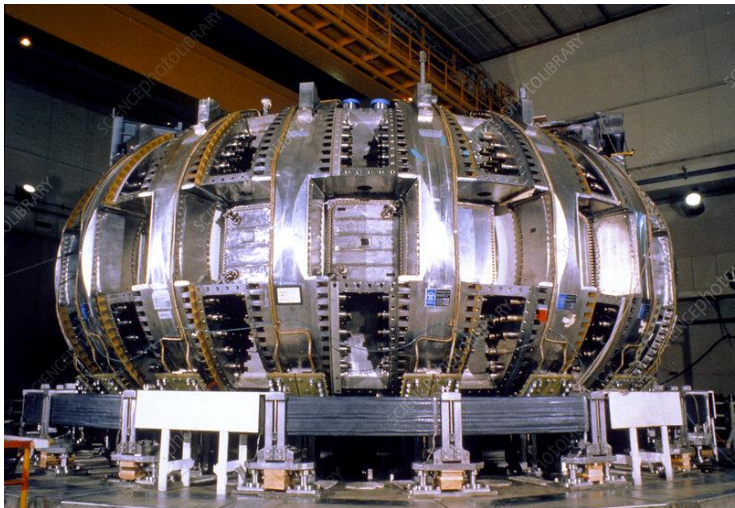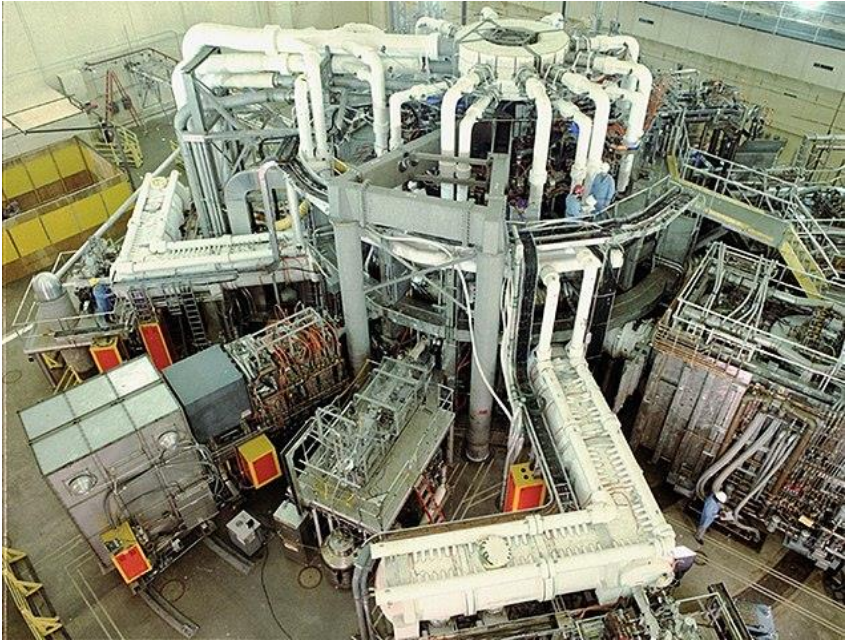| Week	Due Date	Topics, Videos, Readings, Assignments
		The upper portion with the cladding around it is one large room, with the reactor embedded in the center and pools full of water to either side. Above on girders, a large industrial crane can lift the lid off the reactor, and remove the 'spent' fuel rods. The crane immediately lowers each rod into one of the refrigerated pools, where it continues to emit heat (and more dangerous forms of radiation) for many years. They are left there at least until they are sufficiently cooled. After the spent rods are removed, the crane can reload the reactor with new rods. The problem then was (and this continues to be a problem for the nuclear industry), where to then put the spent fuel (and any other contaminated material) more permanently. Since there is no reprocessing industry in the US, and since federal storage proposals are being challenged by states, the rods from such reactors often remain is sealed casks somewhere on the grounds. **Recommended:** What If You Fell Into a Spent Nuclear Fuel Pool? [What If] https://youtu.be/mM-5DhIhYmQ Our team worked in that big room above the operating reactor. Our job was to rearrange brackets that had been installed on the floor of the pool in order to accommodate a higher density of fuel rods. Even in the 1970s, storage had become a problem. The technology we used was very basic: wrenches on long poles handled by technicians at the edge of the pool, as guided by other technicians with binoculars to screw and unscrew brackets that were deep underwater. You would not otherwise want to get anywhere near that water. Anything coming out of the pool would need to be wiped down with acetone to reduce their potential toxicity. That was my job. The plant that I worked in is now shut down, but when I was there in the 1970s, it was in full operation. The room was physically hot, regardless of the season, as the result of its proximity to the reactor itself. The disposable outer clothing and booties that we wore were similar in style and effectiveness to the gear used in semiconductor manufacturing clean rooms today, but they had to be disposed of as 'low level waste' after just one use. In a nuclear reactor this gear is required to keep contaminants away from your personal clothing and body. It's just the opposite in semiconductor manufacturing, which I've also briefly worked in. At the time I worked there, the plant was fully on and generating electricity. There was one guard with a handgun at the entrance to the room above the reactor. The place made me uneasy, and I didn't keep the job for very long. When I left the plant for the last time, I was given a full body scan in a trailer that the NRC kept on site. They detected the signal for radioactive iodine that I had absorbed in my few weeks on the job. Much later, I discovered that if I had taken iodine supplements prior to working there, my thyroid might not have absorbed the bad stuff. As part of its civil defense plan, the federal government had distributed iodine pills throughout the US during the Cold War in anticipation of a potential nuclear attack. Don't be surprised if it happens again. 1.2: **Nuclear energy and conflict** **Watch:** At least three of the following five videos. How likely are nuclear disasters and cyber warfare in Ukraine? | DW News Mar 2, 2022 https://youtu.be/zOng3E4hzpo Russian forces take control over Europe's largest nuclear power plant | DW News Mar 3, 2022

Week	Due Date	Topics, Videos, Readings, Assignments
	11/13/23	https://youtu.be/QrBP3sydgXg Ukraine: Nuclear power plants under Russian control | DW News Mar 7, 2022 https://youtu.be/_QjTgF_c_nk Shelling at Ukraine nuclear power plant puts world on edge | DW News Aug 6, 2022] https://youtu.be/aTxJpfbh2ko Shelling Zaporizhzhia would cause a disaster 'worse than Fukushima' [Times Radio, Aug 9, 2022] https://youtu.be/YnbPKdZJAmE **Homework 12:** Reminder: check each week for any new **Announcements.** 1. Describe some of the prospects for nuclear power around the world. Be region-specific if you can. What are some of the differences between traditional reactor designs and fuels and current generation designs, including 'small nuclear reactors' and those that use thorium? 2. Describe the circumstances leading up to the Fukushima Daiichi disaster. You might begin with the decision to site nuclear plants on Japan's eastern shore. What precisely is the situation now? Why did Japan decide to go so strongly with nuclear energy? Has anything changed? 3. Nuclear power plants, regardless of whether they happen to be active at any particular time, are vulnerable in many ways. In addition to the reactors themselves, there are backup generators, load balancing circuits, spent fuel storage casks, etc. that can be damaged, leading potentially to massive releases of radiation and fallout, hundreds of thousands of deaths, and the permanent evacuation of vast regions. Given the current situation regarding Ukraine's nuclear power plants, for example, do you think the world is ready for the risks involved in a large increase nuclear power generation?
13		Topic: **Minerals: lithium, cobalt, rare earths, etc.** Reminder: check each week for any new **Announcements.** We continue our discussion of energy resources with a couple of minerals that are playing an increasing role in energy production. Lithium, cobalt, and the so-called rare earths are critical ingredients for batteries in cars, homes, and electronic devices, and they may soon begin to provide large capacity storage for utility companies that are increasingly dealing with the intermittency of solar and wind energy sources. The demand for these resources is therefore anticipated to outgrow that for pretty much any other resources, over the short to near term future. And much of this is being mined from some of the poorest, most insecure places on Earth. **Watch:** Companies race to mine lithium, a battery essential [PBS NewsHour] https://youtu.be/su_UC9ZCD-0

Week	Due Date	Topics, Videos, Readings, Assignments
		Watch: Here's Where the Juice That Powers Batteries Comes From [Bloomberg Quicktakes] https://youtu.be/50rXYrFCQMw **Watch:** India discovers $410 billion lithium deposit [CaspianReport] https://youtu.be/auvqexcfVRo Cobalt seems to be the more problematic substance, in human and environmental terms. **Watch:** Whose Wealth? Cobalt from Congo [SOMO Researcher] https://youtu.be/37iLD41vfdI **Watch:** How do we solve the Cobalt problem? [Just Have a Think] https://youtu.be/-WOOZYlLyXI Rare earths have unique electromagnetic properties that make them valuable for a variety of technologies. There are several such substances, but they are usually found in the same deposits, at various locations within the lithosphere, including the sea floor. **Watch:** How These Rare-Earth Elements Could Change Our Future [Spark] https://youtu.be/88jpgxSRVZU **Recommended:** How the US plans on rivaling China in the production of critical earths [CNBC] https://youtu.be/CW4TnJDIQUw **Recommended:** Impact of Materials on Society- Rare Earth Elements [Materials Research Society] https://youtu.be/C-b1NacN3lY
	11/20/23	**Homework 13:** Reminder: check each week for any new **Announcements.** 1. Describe the mining and processing of lithium, its uses, and opportunities for recycling. 2. What are some of the current social and environmental issues associated with the mining of cobalt? According to the narrator of the 'Just Have a Think' video, is the cobalt problem being solved? 3. What are rare earth elements used for? Where are they found? Are there likely to be undiscovered deposits? Which nations are most involved in increasing the production of rare earth minerals?
14	**11/27/23**	**Thanksgiving break**

Week	Due Date	Topics, Videos, Readings, Assignments
15		Topic: **Innovation** Reminder: check each week for any new **Announcements.** I'd like to end the semester by returning to our very first topic, that of individual human beings and their effect on the world. Regarding the challenges that human populations face regarding energy, food, climate, and human nature itself, from what sources might effective solutions emerge? Do they emerge from committees, from 'the top' of various organizations, from individual human imaginations, or somewhere else? These are variations on questions that we've considered throughout the semester, and just how you see things is up to you. Regardless of where and how it emerges, innovation will doubtless be key to finding our collective way forward. I'd like you think about the history of technological innovation, a couple of topics of particular relevance, and my own memories of working for a few years within a highly innovative environment. We all know the myth of the scientist or artist working alone and unappreciated, but developmental advances seldom occur that way. Look closely and you'll find that innovative people are nearly always part of a community, at least if they expect their work is to be appreciated within their own lifetimes. Invention and innovation are almost always group efforts. The following video provides an illuminating look at how Edison and others approached the challenges of their time. **Watch:** The battle of the bulb: How the first lightbulb was built [Fox Business] https://youtu.be/-yXWL1hCKjc **Watch:** The War for AI & Chip Supremacy is Underway. [Good Times Bad Times] https://youtu.be/A45WuwfUK8o The Systems Innovation channel is actually full of interesting videos that may be helpful to you in your professional career. There are few other sources of introductory information regarding complexity, networks, agency, and related topics that I can recommend to the beginner. You might find the following videos to be of particular interest with regard to the topic of innovation and invention. **Watch:** Systems Innovation Overview [Systems Innovation] https://youtu.be/rVGoeFAW0FM **Recommended:** Emergence [Systems Innovation] https://youtu.be/QItTWZc7hKs **Recommended:** Synergies [Systems Innovation] https://youtu.be/rsn5EQoAhUc

Week	Due Date	Topics, Videos, Readings, Assignments
		1.1: **Nuclear fusion**

1.1: **Nuclear fusion**

Nearly all of the energy powering life on Earth is ultimately derived from the nuclear fusion process occurring within the sun. If we could create similar processes here on Earth, huge amounts of energy could be released through the use of a few very light, relatively safe substances. But this presents an enormous set of engineering challenges. Many of these challenges have already been met, or they soon will be. The developmental costs of the technology might mean that fusion energy might not be cheap or plentiful at first, but it as it scales up, it could go a long way toward reducing atmospheric carbon and solving our energy supply issues. The golden age of fusion energy research may be approaching. We've recently seen news from the Lawrence Livermore Lab with laser-induced fusion. We will concentrate here on the more likely pathway to power, magnetic confinement.

Watch: Nuclear Fusion 3.0: Real World Electricity is Coming [Electric Future]
https://youtu.be/4GJtGpvE1sQ

Watch: Why Private Billions Are Flowing Into Fusion [Bloomberg Quick Takes]
https://youtu.be/Dp6W7g9no0w

Helion is an interesting company with a unique approach to magnetic confinement fusion. Electricity is stored in capacitor banks between strokes of the 'engine', with the excess charge that is hopefully created by the fusion reaction bled off directly for immediate use. There is no need to convert heat or some other form of radiation into electricity; it is produced directly. This is real life steampunk. Can you imagine working for this company, particularly if they become successful?

Watch: A New Way to Achieve Nuclear Fusion: Helion [Real Engineering]
https://youtu.be/_bDXXWQxK38

There's some redundancy among the following five videos, but each one shows something different, particularly with regard to the history of magnetic confinement, so I didn't want to remove anything of potential interest. You are not required to watch them, but I would like you to read my personal memories of one of the ancestors of these new machines.

Recommended: Nuclear Fusion Breakthrough Rewrites Laws of Physics
https://youtu.be/G27M0eRTRZE

Recommended: Major breakthrough on nuclear fusion energy - BBC News
https://youtu.be/0fYiNVRmOA4

Recommended: Scientists New Nuclear Fusion Breakthrough Changes Everything! [Tech Space]
https://youtu.be/fqBD8Cs4oWQ

Recommended: We Went Inside the Largest Nuclear Fusion Reactor [The B1M]
https://youtu.be/4BkOUOK0XzM

Recommended (beginning at minute 1:10)**:** Wendelstein 7-X fusion device [Max Planck Institute]
https://youtu.be/51Hji5NfkdA

Week	Due Date	Topics, Videos, Readings, Assignments
		### 1.2: **Memories of the Tokamak Fusion Test Reactor**

I'd like to end with another little story of my own. One the reasons I feel justified in describing this part of my life is my secret desire to question the pride people in academia seem to have in their educational, and presumably their intellectual, accomplishments. I had a two-year degree in electronics engineering from the much-maligned DeVry when I did the work I'm about to describe. I'd also grown up learning about and building electronic circuits and devices, just for fun. Try to keep this in mind: the significance of your participation in some of the most important developments of the modern world does not necessarily correspond to the level of your formal education.

Science is often a cooperative endeavor involving many non-scientists. I was fortunate to have been in the right place, at the right time, and with the right qualifications to have been hired onto a team of about a dozen electronics technicians that helped built, install, and maintain the instrumentation for the largest, most elaborate nuclear fusion device in the world at the time. The Tokamak Fusion Test Reactor (TFTR) was built on the grounds of the Princeton Plasma Physics Laboratory, amid the woods and cornfields just outside of Princeton, New Jersey.

Just a bit about Princeton, as a final illustration from me of the particularities of place. I lived for a while there with some graduate students in an old house a couple of blocks from the heart of downtown, which is along on Nassau Street. Shops and restaurants are one side of Nassau Street, with the University on the other. We lived on a leafy, very quiet old side street called Greenview Avenue. Across the street from our home was Princeton Cemetery, which holds dozens of notable graves, including those of Aaron Burr and Grover Cleveland. Among those buried there of particular interest to me are mathematicians Kurt Gödel, Alonzo Church, and John von Neumann, all of whom inspire my current work. They and many others had lived and worked in Princeton, which served as a haven for European scientists at the time. Gödel had lived in a newer development at the time a couple of blocks east of the University, in an ordinary ranch house on a sunny street. Despite his poor health, he had apparently walked over a mile past the University, back and forth to his office at the Institute of Advanced Study. Part of this walk he took with Albert Einstein, whose home was on the way, on Mercer Street. The University neighborhood was and still is charming. Seasonal changes can be dramatic in central New Jersey, particularly in the rain among the trees in the Fall. As you walk through many of the university's older buildings, you can easily imagine being transported into a magical, more civilized past. During my time there, I went to concerts, attended public talks and lectures, made friends among Princeton students and townies, and generally had a wonderful time, all while working in one of the university's most ambitious projects.

Recommended: Princeton Downtown Walk (early winter) [No Talk]
https://youtu.be/IEROVnEl4Qo

Initial construction on TFTR began in 1980. Operation began in 1982, and TFTR remained in use until 1997. It was dismantled in September 2002. I was hired prior to the initial construction, and I stayed through the first few years of operation. In the early stages of construction, the vacuum vessel was still visible. It was made of stainless steel, it was doughnut-shaped (a torus), and it was huge. The internal diameter of the vessel itself, within the body of the torus, was eight feet. Technicians could open it up and work on it from within. |

Week	Due Date	Topics, Videos, Readings, Assignments
		  Soon, however, the vacuum vessel was buried within a maze of instruments, magnets, and cryogenics. TFTR was the largest, most elaborate nuclear fusion device of its kind at the time. It was intended to test a the idea of whether confining a particular cloud of hydrogen isotopes within the tokamak, a torus-shaped vacuum vessel, heating it with microwaves and squeezing it magnetically, could ignite fusion reactions to the point of 'break even' energy generation. The name 'tokamak' sounds Russian because it is. The idea was originally proposed by the Soviet physicist, tsar bomba designer, and human rights campaigner, Andrei Sakharov. His story, by the way, is a fascinating one.

Week	Due Date	Topics, Videos, Readings, Assignments
		I was one member of a small group of electronics engineers and technicians that was called by the self-explanatory name with a cool acronym, 'Central Instrumentation Control and Data Acquisition' (CICADA). Most of the time, we worked in our own fabrication and testing labs upstairs and in the computer and control rooms downstairs. This was all in a fancy building with an auditorium and lunch and conference rooms several hundred feet away from the building that actually contained the tokamak device. These buildings were connected directly by means of an underground tunnel navigable through which we walked, and through which we installed the fiber optic bundles that were used to communication with the device. Optical fibers, which were new at the time, were used to communicate with the tokamak because of their improved bandwidth but also in order to keep the control and computer rooms electrically isolated from the pulsed high voltages and currents that were used by the device itself. The power required to operate the device could not possibly be drawn from the electrical grid directly. In yet another building, two absolutely massive dynamos would draw current from the grid to gradually spin up to high speeds, like tops, on vertical axes in huge cylindrical pits. The current required by the tokamak would then be drawn off suddenly from these dynamos. As they experienced the resulting breaking action, those dynamos would scream, and the images on CRT screens near any resulting strong magnetic fields would bend for a few seconds. No one was allowed near the tokamak while it was in operation, and I was assigned to install and maintain the card readers and cameras that made sure of that. Through this task, I got to know the head of security, an old gentleman who had flown missions over the Himalayas to China during WWII. But that's another story. Anyway, this little discussion is important, for a number of reasons. One of the most significant, I think, is in demonstrating how each of us can participate in history, in our own way. If you are lucky enough to reach old age, such memories and achievements are indeed precious. Although I have nothing specific to ask of you about this, I want to be sure you haven't skipped it. I'd like you to put at the top of Homework 14 the following quotation (it makes the most sense if you know who he was). "Fast is fine, but accuracy is everything" – Wyatt Earp.

Since a great deal of customized fabrication was required at the component level (with lots of soldering iron action), each technician often worked closely with particular engineers. I worked for several years with an absolutely brilliant engineer, Jane Montague, who was just a few years older than me (with her degree, I think, from Stanford), on some of the project's most critically important systems. Among the many systems we built, one of the most important was a complex master clock that synchronized a suite of operations involving control of the sensory instrumentation, and the acquisition of data during a run. All of these operations occurred within just a few seconds, and most in under a second, which was about how long stable plasma conditions could be maintained at the time. Since our master clock assessed conditions and performed operations with microsecond precision, it was built with fast, ultrareliable components and an extremely fast internal clock. The observational data resulting from the operation of the tokamak was processed and stored on large frame computers in a separate computer room (I was sent to Ft. Lauderdale in the August heat for training), but these computers were not sufficiently fast or isolated from outside influences to do the work required of our master clock, as well as many, many other real-time specialized functions. The devices we built were integrated into crates, on racks in the control room.

For most of our projects, Jane would first meet with physicists and other engineers in order to determine what the requirements were. The circuits she then designed were built by me with the most reliable military-grade devices that were available at the time. I would solder them onto circuit boards, which would then be initially plugged into testing crates in order to connect them to computers, displays, and other customized circuits. Jane and I often sat for hours, testing and modifying our circuits using mostly logic analyzers and oscilloscopes. Meanwhile, other teams would be doing similar things. It was actually |

Week	Due Date	Topics, Videos, Readings, Assignments
	12/04/23	very challenging work involving personal inventiveness, innovation, and craftsmanship on a scale that few people outside of such endeavors get to witness (along with, in my case, a willingness to be on call 24 hours for emergency technical services). The following is a promotional video from 1989 about the Plasma Physics Lab and the Tokamak Fusion Test Reactor (TFTR), with footage of the interior, machines, and scientists at work. **Recommended:** Plasma Physics Lab and the Tokamak Fusion Test Reactor, 1989 [princetoncampuslife] https://youtu.be/TamkP8QrZak **Recommended:** The Princeton Plasma Physics Laboratory [WebsEdge Science, Feb 28, 2014] https://youtu.be/b8iH1930p2s **Homework 14:** Reminder: check each week for any new **Announcements.** 1. Describe the approach that Edison took to the invention, production, and distribution of incandescent lighting. Why was it more than just finding the right filament and inventing the bulb? 2. Outline the basis for what the 'Good Times Bad Times' channel describes as a war for AI and chip supremacy. 3. Do you think innovation in business or technology can be achieved by using some of the ideas expressed in the Systems Innovation Overview video? Why/why not? 4. Magnetic confinement nuclear fusion may soon be achievable, after many decades of work by people from all over the world. The project I worked on seemed enormous to me at the time, and yet there is hardly a mention of it online. I could find no photos of the control and computer rooms, for example, or of any of the people who worked there. There were no reunions, as far as I know. And yet, we achieved something remarkable in the history of energy technology. Can you think of another example of group innovation in the modern world that may not have received the attention that it should?
16	12/11/23	**Term paper (Final Evaluation)** Choose one of the topics we've covered (or something directly related) and write a thoughtful term paper. This will serve as your final evaluation. Provide at least four citations. It doesn't matter what format you use, so long as you are consistent. I suggest that you choose a serious topic that is aligned with your interests or career plans. The resulting paper's text should be at least four pages long, easily more. Use the same font and spacing as for the homework, please. You may also include graphics and extended quotations, if you provide citations. I encourage you to produce some of your own graphics if you are so inclined. You will find these to be useful if you upload your work to Portfolium. There is no upper limit to the length of the paper, but please don't lengthen it with unnecessary repetition. I expect all of you to produce a paper that you can publish online yourself without further editing.