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**TAFT BROOME:** OK, then what we'll do today is a recapitulation of the semester, a forward look into the rest of the semester, adjusting the syllabus to concerns, all concerns as best we can. And then I want to do an introduction to codes of ethics. And as long as we're not talking too much about hyperspaces, then I won't get carried off. I'll be able to talk about that that I don't want to talk about hyperspaces. But then we'll talk about codes of ethics.

We've all met our visitor today, and he is welcome to participate in the class. He's a colleague of Tony and mine, and it's an honor to have with us. But you will find, in this class, a motivation to say something, I think.

Tell you what, before we get started on this recap, we have two opportunities to make up our class with two lectures outside of the class. And Miss Bethke and I went to one of them. She's going to give a report on that particular lecture. And the other one comes up Friday.

And I got a note back from Nancy already saying, all come. Please, come. Looking forward to us the whole bit. So we can participate if necessary.

So you don't mind if I make sure I got everything up while you're talking.

**GUEST** No.  
**SPEAKER:**

**TAFT BROOME:** OK.

**GUEST** [INAUDIBLE]  
**SPEAKER:**

**TAFT BROOME:** Well, I plan to be surprised by what you have to say.

**GUEST** So on Friday, [INAUDIBLE] and in the 1980s, he was very active, in fact, a leader in developing internet protocol.  
**SPEAKER:** [INAUDIBLE] but I didn't. One of the chief architects of the internet.

So this talk [INAUDIBLE] how things have changed since then and how he's trying to have a new outlook on designing the internet for the future. So he started by saying, the code and protocol that defined the internet were originally created by a small group of computer scientists, many here at MIT. You called these, the Techies.

And in the 1990s, Clark realized that these techies were not in charge anymore of the internet, that instead, economic, social values, politics, this much larger social space was dictating the way the internet was developing. And in return, the internet was changing the social space. It was deeply affecting the way people lived and the way society functions.

And so now Clark's goals for his professional life are to understand this larger social space and how it interacts with the internet. And then, he said, back derive the technology for the future and [INAUDIBLE] of the internet. So instead of making incremental changes, really understand this larger social space.

He found that he needed a word to describe the ever-present and ongoing conflicts between different groups of users of the internet. And he calls these social conflicts tussle. So if you hear him talk or read one of his papers, you'll see this word tussle. And in his mind social phenomena, social structures are always being tweaked by us. There's never a final. There's never a final way. Public schools are going to be this way forever and ever. No, we're always changing. But engineers and computer scientists are used to designing for a final end, for a final outcome.

And so we have computer scientists who are really being called upon to do social engineering, to create the social space. But their training is computer science, and so there needs to be a rethinking of designing for tussle.

Let's see. So what Clark proposes is to try to predict these social tussles, these conflicts between different groups of users of the internet, and then create an infrastructure that is robust to those tussles. So you have to be creative, do a lot of predictive [INAUDIBLE] in his model. And he tries to predict these tussles by thinking about different groups of users, so interactions between one person and another person on the internet, interactions between different groups, interactions that are common to a whole country, and the interactions that are beyond country borders.

So some examples of tussles are over music sharing. Like, no one predicted that the way they can structure the internet would fuel this huge music sharing problem. Whether or not to enable encryption over the internet. For a long time, the government didn't want encryption to be enabled because then spies could use the internet.

Very recently, what Google is doing in China to make search engines tailored to the laws or practices of a specific country, he says, what we have is technology that is the same everywhere but policies and cultures that are very different. And we are used to designing technology for specific cultures. We don't know how to design technology in many different cultures at once.

So in conclusion, he says, part of predicting tussle is to think about the values that were embedded in the creation of the internet. The computer scientist who wrote the initial code and protocol did embed values, user empowerment, the ability to be anonymous, distrust of those in control, and the idea that what is not forbidden is permitted.

So whether we like it or not, they embedded those values in the way they wrote the protocol and code. So there's that in one set, and then there's values that we expect, that users expect, freedom from attack, stability, freedom of speech, access to information. So those values that the creators embedded, the values that users expect are in conflict. And then there's all these other conflicts [INAUDIBLE] cultures.

**TAFT BROOME:** Yes.

**GUEST** It was very interesting. He was a great speaker, in general.

**SPEAKER:**

**TAFT BROOME:** There were some good questions from the floor. One person-- let me see. How did he frame that question about happiness?

**GUEST** Someone asked if, in thinking about what the internet should enable or what its value should be, do you ever

**SPEAKER:** consider one of its purposes to be enabling the pursuit of happiness? That's kind of what the person asked.

**TAFT BROOME:** Yes, the way he asked it was a question in political science, the notion here in the United States that one should be free to pursue happiness. But we all know that that pursuit of happiness concept comes from the happiness principle in ethics, that you should be free to pursue happiness, all right.

And I think Dave Clark took it the way that it was put as a question of political science and didn't have much to say about it. I'm sure that I wouldn't have had anything to say about it. But the question, when you look at it from the standpoint of the happiness principle, now that is an intriguing question. Does the internet make people happy?

I'll tell you one way that I think we shouldn't answer the question. What would life be like if we didn't have it, all right? The reason I say that that's not a good way to answer the question is that a drug addict says the same thing. What would it be like if I didn't have my drugs?

We might be addicted to this thing called the internet. And if we are addicted to it, then I don't think that that kind of happiness is what John Stuart Mill was talking about.

OK, so let's not leave that as a rhetorical question. Let's pursue that for a second. Does the internet make anybody happy?

**AUDIENCE:** Well, that's a different question [INAUDIBLE]

**TAFT BROOME:** All right, how would you break it down then?

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** I'm asking, does it make people happy? Is it good? That's for everybody. Is it good? I mean, do we really like the internet?

**AUDIENCE:** [INAUDIBLE] personally, sometimes.

[LAUGHTER]

Yes, very much, very [INAUDIBLE]. And sometimes it's very constructive. [INAUDIBLE]

**TAFT BROOME:** OK, so you're saying that everything has a price tag attached to it, the price to pay for everything. And you're willing to pay the price for this thing.

**AUDIENCE:** Yes.

**TAFT BROOME:** Keep talking.

**AUDIENCE:** At its best, the internet is a technology that fosters connection, [INAUDIBLE] that [INAUDIBLE].

**TAFT BROOME:** So go ahead.

**AUDIENCE:** But it does that without [INAUDIBLE] which is really [INAUDIBLE] for being [INAUDIBLE] to be able to connect one another without actually [INAUDIBLE] Even with [INAUDIBLE] I don't think we [INAUDIBLE] what [INAUDIBLE].

**TAFT BROOME:** I have one advantage. I'm 63 years old. I can remember when there was no internet, or if there was an internet, nobody knew about it except the specialists. And I can put myself in a position of asking myself, if somebody brought an idea for the internet before me and showed me the price, would I buy it? Would I have bought it in 1960?

The only thing that I can think that would have given me pause about that whole thing was privacy, that a cost that I might have to pay for this whole thing is that my Social Security number, everything is right out for anybody to use.

And I'm putting aside-- no, I'm not putting aside, but I'm not focusing on the fact that they can get in my bank account, transfer funds. I'm really talking about how they can do all sorts of other things with things that are very private to me and things that I have a legitimate right not to tell you or anybody else.

Now, I'm still in 1960. I still have this thing in my mind before me what I wanted. Tell me all of the uses, all of the bad things. I'm not so sure what I would say.

[LAUGHTER]

I am not so sure about what I would say. That being unsure, makes a statement. Given that I was in that position and had all of these big choices and understood them like I do now, would I take this thing? And I probably would have a big difficulty with it. I would say, well, thinking right now, I would probably say something like, well, let's see if we can't work out the privacy issue. Then bring it back.

Well, we might not be able to work that out for two or three years, four or five years. Well, hopefully, I'll still be alive. Bring it back then. I probably wouldn't want to do it without that issue solved. I probably wouldn't want to go into it.

**AUDIENCE:** What David Clard was sort of saying is they didn't predict--

**TAFT BROOME:** They never saw it coming.

**AUDIENCE:** [INAUDIBLE]. No one knew that [INAUDIBLE] the main [INAUDIBLE] entity [INAUDIBLE].

**TAFT BROOME:** All right then, let's ask another question for this class. Can we find where any human being did anything wrong in terms of the internet or--

**AUDIENCE:** Right, that's what didn't come up very much during this talk. The word "ethics" never came up [INAUDIBLE]. We talked about the social [INAUDIBLE].

**TAFT BROOME:** OK, all right, any questions or-- go ahead.

**AUDIENCE:** I interrupted you. You asked if we could find a [INAUDIBLE].

**TAFT BROOME:** I remember now what I was going to say. What you had to say was more intriguing, but I was going to ask is the internet-- can we talk about the internet as being a moral agent? Is the internet itself bad?

Now, the internet becomes a very interesting question about a technology being bad because the technology is activated by human beings all the time. It's what human beings are doing. But now, Dave Clark comes in and says that it's fair to think about the internet as an object that has a life of its own, that the rest of us do not control this thing totally.

So can we think about it in moral terms? Let's leave that as a rhetorical question for right now. We'll come back at the end of class.

OK, that question's still on the floor, but I want to give a recapitulation of a talk that I gave yesterday, which I wrote for this class as well. It's a recapitulation of the course. And the class that I gave yesterday was for this course called Managing Nuclear Technology out of the nuclear engineering program here. And it was a graduate class, but not everybody in the class was a nuclear engineer. Some of them with TPP majors.

Another thing that made the class very interesting was that there were two students in there from France. That was interesting to me because France has embraced nuclear power, whereas the United States has had problems with it.

So the outline of the talk is as follows. We want to talk about, what were the times like? And I'm talking about mainly in the United States but not because the United States is more important than anything else but because we're here in the United States. And that brought about what we call the STS movement, science, technology, and society. You know we have an STS department here.

Our STS Department does have a focus and, not to the exclusion of everything else, but it focuses on history of technology. But STS in the beginning was a response to many issues in the American life, and I'll talk about those, which I call the times. And out of it came an engagement of two learned disciplines.

The engagements that we're talking about mostly are going to be with ethics and with engineering, which gives rise to engineering ethics. And we'll look at a particular case study of TMI, which is Three Mile Island nuclear-- they call it an accident-- that's the official term-- 1979. We'll look at a case study of that. We did look at it a little bit in class. We read a little bit about that, but I would like to go a little bit deeper into it today. And then let's talk about whether or not we're making a world for ourselves that we want.

And I'm asking the question about-- or do we really have a brave new world and if that's good. If you read Aldous Huxley's *Brave New World*, that was not a place that we would really want, human beings grown in hatcheries, they call them. OK, but nevertheless, this is a good term to raise the question.

So this is the outline. These are the main sections of this talk. And when it comes to engineering ethics, there were a number of issues that motivated the whole thing. One was in 1974, Spiro T Agnew, I was about to say, as you recall. Spiro T Agnew was vice president of the United States.

He was accused and resigned as a result of the scandal. Those are two terms of art for this particular case, an accusation and scandal, not conviction. OK, he was accused of taking bribes from engineers, and the scandal that broke out over it prompted his resignation and gave motivation for this thing called engineering ethics.

The Challenger accident was one that we have looked at, and in the Challenger accident we looked at the issue of whistle-blowing.

We looked at the question of what engineering really is. Is engineering inherently lethal? And this particular one was interesting to us from a number of reasons but not the least of which was that this was the first massive flight with a shuttle that had a person on board who was neither an employee of NASA nor of the military, which meant that that person was not an expert on this.

That was McAuliffe, who was a schoolteacher. And they were trying to make the case that space travel could be for ordinary people just like getting on an airplane. It's for ordinary people now, all right?

Bhopal introduced the issue of safety standards across cultures, that in the United States we had-- Union Carbide had some safety standards for its chemical plants. They went to India. There were different standards. An accident occurred, killed 3,000 people, children included.

And the question is, as you just raised the question about Google in China, what do we do about ethical standards? I'm not talking about legal standards, ethical standards across cultures raises that issue. And Three Mile Island is something I talk about in a little bit of detail because we haven't talked about it in detail in the class yet.

The STS movement did not include-- was not restricted to engineering ethics. There's a discipline called environmental ethics. There's a discipline-- and when I say discipline, I'm talking about a world view, a way of looking at the world-- we talked about that already-- how it is that a scientist looks at the world in one way, an engineer can look at the world in another way. That it has a body of learning, that it has a community of scholars that cultivate that cultivates that body of learning, and university degree-granting programs.

So if you do not get a degree in business ethics, you can certainly get a degree in STS, even the PhD, with a major in engineering ethics or business ethics. That's what my master's degree is. My master's degree is in STS. The major is in engineering ethics.

Bioethics, medical ethics, academic ethics. In the class yesterday, this issue here raised some questions. The students wanted to know how-- the student phrased the question, what ethical problems do faculty have? [CHUCKLES] I said, well, even if we put aside questions that-- ethical issues that faculty have with students, we have a lot of ethical issues among ourselves. And the biggest one probably-- I don't know what you would think about it, our faculty members here, but it's plagiarism.

That is the nightmare for us, for one faculty member to plagiarize another one. And that becomes a matter of irritation for students too, but I think the big issue for students in plagiarism is after the plagiarism has occurred. Actually, it's not so much plagiarism. It's falsification of data because you get this paper. You're going to build your master's thesis on this paper. And just before you go in for your defense, you find out that the data is corrupt.

[LAUGHTER]

What would you do in a situation-- the committee is sitting there saying, well look, we know it wasn't your fault, but we can't pass this thing, all right? So that can be pretty bad. And TPP, part of STS movement.

This picture up here, I think, best describes what the people, the scholars in the STS movement-- how we looked at ourselves in relationship to big business and big government. And there were big hopes back in those days for us. I say us.

I was one of the young people in those-- I was just being brought along and learning. This is 1972, '73. I was just being brought up by these people. They were cultivating me, and most of them were philosophers some were-- there were some engineers involved.

And one of the big hopes, as we will see in just a minute, for the philosophers was that this was now an opportunity, they thought, to put their names in the history of philosophy along with Aristotle and Plato and other people because now we have the opportunity to create a new ethic.

So now we can write things and be equated with the Immanuel Kant. And we can be equated with John Stuart Mill. And so what I'm trying to describe to you, the nice word for it is euphoria. The correct word for it, the correct word for it is high. We were all high on this whole notion of starting-- creating something that we said was going to be a learned discipline and getting our names in the history book with the greats. Not all that happened.

[LAUGHTER]

One of our hopes-- let's talk about what some of those hopes were. One hope was that we could borrow-- as we have discussed in class-- that we can borrow from United States law, which provides that an organization, particularly a corporation, has personhood in law, can commit a crime, and can be punished for the crime independently of the people in the organization.

So the hope was that maybe we could talk about an organization having personhood in morality and that a corporation could be bad or good. And we wanted to be able to write a scholarship on that. A paper came out by a man named John Ladd, who is a friend of mine now, who said that corporations cannot be moral agents because there is no way that you can assign to them feelings, moral impulses. And a corporation cannot care about you. So you cannot hold it responsible. It has a will, but it does not have an affect.

Well, that killed-- dashed the hopes a lot of people for a long time. But we had quite a renowned visitor in class, what? About two weeks ago, a week or so ago, who affirmed what many people affirm and that is that we just cannot throw away our sentiment that organizations, some of them, do-- are moral agents no matter what we say about it, that there's something still dissatisfying to us to leave them out of the moral space.

There were some other hopes. Now, we talked about this painting, Rafael's painting in the Vatican. We talked about how he wanted to characterize Greek philosophers. And we talked about how it's in the Vatican in these Roman vaulted ceiling-- under these Roman vaulted ceilings to show that in 1509, 1510, up to 1513. This is the same time where Michelangelo was painting the Sistine Chapel, same time, same place, different buildings-- that there was a place for Greek thought in the Western world.

And out of this thought we get two traditions in ethics. One of them comes from Aristotle. And Aristotle's tradition is a tradition that approaches ethics from a rational point of view. That is to say, we can use reason sometimes informed by facts to decide right and wrong action, good and bad behavior. That's the Aristotelian tradition, and that is based, as I said, on reason.

And out of that tradition we get two other traditions. One is that an ethical problem can be decided purely on logic. And we have thanks to Immanuel Kant for giving us that approach. That is to say that an act can be determined right or wrong or a thing can be determined good or bad based on principles. And for him, first principles were principals of logic, and that gives us one great tradition that still holds with us today.

The other one is empirical, and it says that an action can be judged good or bad, right or wrong depending on the happiness that it tends to either give people or take from people as a result of the action. So it's factual. And we have probably John Stuart Mill, not who originated this point of view but, who pretty much did more than anybody else, I think, to perfect it.

Frankly, I think that Jeremy Bentham is the person that made the greatest contribution because he saw it as a solution to a political problem. And not so much a political problem but a problem of political science that he was trying to really organize thinking about how to build a British society.

But nevertheless, Mill worked out all of the kinks. And when I say all of the kinks, you know what I mean by that, the major ones. We can still write a dissertation on this stuff, but he's the one that's remembered mostly for that.

There is another tradition that we have insofar as Greek antiquity is concerned that is given to us by Plato. And Plato's tradition is that really what is good and bad, what is right and wrong is determined by character.

There are certain people who are good people. There are certain people, he would say, are bad people. And what he would say makes the difference between a good person, a bad person, and an ordinary person or what he calls the possession of virtues.

And he can articulate those virtues, which means that, as we come into different cultures, we can articulate different virtues. But nevertheless, it's the notion that we're talking about good character. And he got his virtues from the kind of society that he came from, and that society was a warrior society, basically. And so good virtues meant good warrior virtues, heroic virtues.

Now, out of that in the United States-- and here's a point that we have not covered in class, but it's an opportunity for me to cover to cover it in class. In the United States, since-- let me put down a number. Tell me if you can correct this number.

In the United States, since about 1650, there was in the universities a concept called classical education. Do what number I'm looking for? When the first university in the United States was founded. Well, first of all, do you know which university that was? Harvard, yeah, right down the street.

It was 16 something. Remember? I don't remember the exact date, but it was after-- I remember this much. It was after 1620 when the pilgrims landed. [CHUCKLES] And I remember it was 16 something, OK?

Now, classical education was education for the clergy and for the aristocratic class. And the idea was that what a person needed from a college education, what these people needed from a college education was good character and that the virtues of good character were spelled out in Christian religion, and that the textbooks, the curriculum was taken from Greek antiquity. Trivium quadrivium, classical studies in philosophy, mathematics, science, rhetoric, dialectic, and literature.



Now, I have some numbers I've committed to memory. I trust my memory on these numbers, but that doesn't mean I'm going to ask you to trust these numbers. [CHUCKLES] So as a matter of fact, I'm going to ask you to look them up, but I have some other figures, some other numbers.

Before the Civil War, before 1861, there were 350 universities in the United States. It got up to about 350. Now, some had closed their doors. There were new ones that came in, but there were about 350 of them.

11 out of 12 of those universities over the entire periods of their existence up until the Civil War, 11 out of 12 presidents were clergymen. And many of the ones who were not clergy had studied for the ministry but decided either to go to law or otherwise not get ordained.

In 1833, a man by the name of John Quincy, not to be confused with John Quincy Adams, but I think was a relative of John Quincy Adams, a man by the name of John Quincy became president of Harvard. And John Quincy said his program is to get rid of classical education. He was not a clergyman. He was one of the first clergyman to become president of a university in the United States, who was not a clergyman at all, I mean, in any of his training, OK?

Now, why did he want to get rid of classical education, and what did he want to replace it with, and why? If you don't know, your speculation is invited because you will probably be right. We're talking about 1833.

**AUDIENCE:** Very beginning of the Industrial Revolution.

**TAFT BROOME:** Very beginning of the Industrial Revolution. Is classical education going to help you make a plant? No.

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** At least in his mind. And apparently, he was not alone.

**AUDIENCE:** Yeah.

[LAUGHTER]

**TAFT BROOME:** So what would get the United States into the Industrial Revolution, which had already started in Britain at that time? When did it get on the continent? Before us, I'm sure.

**AUDIENCE:** [INAUDIBLE] before [INAUDIBLE].

**TAFT BROOME:** Around that time, turned it, OK. John Quincy-- now, here's where you have to-- when you read any of this stuff, you have to read between the lines on some of the words they use. John Quincy said science and mathematics, OK?

So you can say, well, science and mathematics is already here. John Quincy meant applied science and applied mathematics. And he did not use the word engineering at the beginning, but that's who these people were. They were engineers, applied scientists, and applied mathematicians. That's what he thought we needed.

So a struggle ensued at that point that has not been resolved in the United States. John Quincy introduced a new curriculum that got a name 100 years later, OK? I'll tell you what the name of it is. Pragmatism.

So it went by different names. Still, you can talk about the alternative to classical education being pragmatic. Scholars of education have different names, but it's good for us in this class to use the philosophical name because we can now associate that with a person, John Dewey, OK?

Now, what was the nature of this? Why do you think people would do battle over replacing the curriculum, replacing classical education? And let's think of all of the reasons. , Well one of them starts out being that the religious institutions had funded a whole lot of colleges.

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** Yes, and if not anti-religious, definitely anti-religious people, or better stated, anti-religious control.

**AUDIENCE:** [INAUDIBLE] that there would have been they'll be ignorant in [INAUDIBLE].

**TAFT BROOME:** Right.

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** And if you go to the Midwest today, you see much of the same arguments about schools, today.

**AUDIENCE:** That's the reason why [INAUDIBLE].

**TAFT BROOME:** Well, what happened was-- the main reason I'm bringing this up, and I'm still going to go back do some more history. I'm still going to require you to get these numbers right. I'm still going to require you to say when you've got the numbers right to bring the right numbers back to class, OK? But nevertheless, I'm going to trust my memory, for right now.

No, the main reason for bringing this up is that character, this whole platonic tradition got wiped out in the United States. We never replaced it. If we had religious character at first, could we have another kind of character? It never was replaced. OK? Now, that's the reason I'm bringing it up, that Plato got wiped out. And in the end, I'm going to say Plato has got to be brought back, all right?

So I'm going to give you my thesis on it. You don't have to adopt my thesis on it. But if you don't adopt my thesis on it, you've got two responsibilities. Number one, tell me what thesis you do adopt, and number two, give me your justification, OK? But the fact is that we just won't see this tradition in the United States after the Civil War. OK?

We have what's called the Scopes trial in the United States where a schoolteacher-- this was in the 1920s-- was put on trial for teaching creationism in the class. And evolution? I said creationism? I didn't mean to say creationism. I meant to say evolution. It was against creationism in the classroom. It became national news and became a big-- they made movies out of it. So this battle continued.

Can you think of any other reasons that people would want to fight over this?

**AUDIENCE:** Possibly that the sentiment that the upper classes who were [INAUDIBLE]--

**TAFT BROOME:** Clearly.

**AUDIENCE:** --weren't supposed to stoop to their level [INAUDIBLE].

**TAFT BROOME:** John Dewey said, why have education just for the aristocrats and the preachers? Why don't the poor people?

**AUDIENCE:** [INAUDIBLE] that aristocrats [INAUDIBLE] special [INAUDIBLE]--

**TAFT BROOME:** Right.

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** Right. It was threatening to them in many ways. Can you imagine yourself an aristocrat in 1850 at Harvard, and there's some kid just coming off a farm from Iowa coming to Harvard? Uh, not a fit. You can see where somebody would object to that, teachers, students, everybody.

OK, so that was a class issue. And this whole thing filtered all the way down to first grade, not just the colleges, all right? Can you think of another issue, any other issue? I'll tell you one that's not-- that actually is like the-- it's actually one that's obvious when you think about it, but you might not be motivated to think about it.

Here's, to me, what turned out to be a battleground in the United States over these two forms of education that I think was paramount. And that was, here's the question. Here is the question.

We've talked about means and ends. We gave a name to it called teleology. And the question is, what is the end of education, the state or the individual? John Dewey's end was the state. [CHUCKLES] Classical education is the individual.

**AUDIENCE:** Are you [INAUDIBLE] that [INAUDIBLE] or did John Dewey himself say that this [INAUDIBLE]?

**TAFT BROOME:** I see what you're saying. This was a matter of open debate, and it was a matter that Dewey was charged with. And Dewey, and I think it's fair to say that in his mind his greatest work was one of his later works-- we got plenty of time-- was one of his later works called *Democracy and Education*.

So Dewey tried to defend himself against these claims of education for the state as opposed to the individual, all right? I happen to take the position that that defense is not strong. But the point that I want to make that I think we all will agree on it and be able to see the justification that this was a point of debate, that was a major point of debate, and it continues, OK? All right?

The classicists, the religious classicists would say that the ideal for the state is in heaven. More precisely, that if you're Christian, you're talking about the Trinity, that the relationship of God the Father, God the son, God the Holy Spirit is the model for the family, for government, for the community, and for business, all right? That's what they would say.

So they would say, yes, we are not just for the individual, but we're for the state. And John Dewey and the others would say that argument doesn't sound strong coming from you all. Democracy is by definition, as the Greeks put it, a community of free individuals. The individual is the primacy in democracy.

So everybody said we're covering both bases, and each side said you really aren't sincere about this.

[LAUGHTER]

All right? In 1945, a very important book was published. It was called *General Education in a Free Society*. Now, this book came out in 1945. That's auspicious. Second World War ended. The National Science Foundation was founded.

And it attempted *General Education in a Free Society*, this book, to make sense out of this debate, classical versus pragmatic education, tried to find a compromise. Now, who wrote it? All right? You ready for this? If you haven't heard of this book, you'd never guess who wrote it. I'll tell you why you'd never guess. It was a committee that wrote it.

[LAUGHTER]

It was a faculty committee at Harvard. Believe it or not, I mentioned Harvard three times already.

[LAUGHTER]

It was a faculty committee at Harvard commissioned by a very famous college president. You could name a lot of Nobel Prize-winning faculty members, but it's hard to name college presidents. But there's one that you ought to remember, James Bryant Conant, C-O-N-A-N-T. And he commissioned this committee, and the committee came back with this report. And the report actually tried to make a compromise out of all of this.

We can go through what the compromise meant. I'd like to take a minute or two to say what the compromise meant, but the compromise never stuck. And I'll tell you this-- let's see what this very important book is about.

It's a book that's hard to get. To my knowledge, you might be able to get it on eBay. You won't be able to get it on amazon.com. I'll tell you where else you will not be able to get it, Harvard's bookstore.

[LAUGHTER]

My copy was a gift from an older faculty member when I was a young faculty member. Now, here's what they tried to do. General education in a free society-- then I'm going to go back to these slides, and then we'll get on-- and we'll finish up the class.

*General Education in a Free Society* said that education has got to have two parts. One part is for the individual, and the other part is for the state.

[CHUCKLES]

The part that's for the individual is called general education, and you take many classical studies. And it's supposed to be-- to bring back character. I'm going to tell you why it never came back, but that's what the argument was. And that special education was the other one. And special education was to help you find a job and a career.

And given that the state pretty much determines what jobs are available and where your career is going, that's indirectly how you satisfy the people who say we need to have education for the state. At first, to get in the Industrial Revolution. Secondly, to defend ourselves against, guess what? Communism.

Why were we afraid of communism? We were afraid of communism because we were afraid of the Russians. We were afraid of the Russians because the Russians had a formula that said, if we need three million engineers, we will command that we shall have three million engineers. In the United States, if we need three million engineers, we say, well, we've got some scholarships.

[LAUGHTER]

In other words, could we compete with a culture like that? That was the question, all right? So a lot of people who wanted education for the state wanted us to be competitive. All of this free choice did not promise to be competitive, OK?

So this *General Education in a Free Society* said we should have two kinds, general education and special education. General education was what they put in the part of the curriculum we call the core curriculum. That is, the courses that everybody takes. Special education is what they call the major. You want to be an engineer, an economist, or whatever. That's what you specialize in and get your special education.

So you see, this book did have a formula, a lot of which that we live by, at least in the United States, today, all right? Then the book comes out its early pages, we're talking about before you get, I think, to page--

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** We have another-- we have until five minutes of, and this is a class, so--

**AUDIENCE:** [INAUDIBLE] five minutes. OK, [INAUDIBLE].

**TAFT BROOME:** Yeah, so at 10:55, yeah, we'll be out of here.

**AUDIENCE:** [INAUDIBLE]

**AUDIENCE:** [INAUDIBLE] 10:35.

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** Oh, this is right here?

**AUDIENCE:** Yeah.

**AUDIENCE:** Sorry.

**TAFT BROOME:** OK.

[LAUGHTER]

**AUDIENCE:** We'll be in there in a little bit.

**AUDIENCE:** OK.

**AUDIENCE:** All right.

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** I could have said that we could dispose of those pizzas, right?

[LAUGHTER]

It might not be ethical, but-- all right, let's finish up this thing here. That ethics was included and the-- I forgot to mention ethics when I was mentioning these courses. I don't know why I forgot to mention ethics, but ethics was included in all of this.

And what the *General Education in a Free Society* said was the big challenge to general education-- there were two challenges to general education. It said this in 1945. I'm sure that it sounds like it was said in 2005. They said there were two big challenges.

One of the challenges was that-- they called it the proliferation of knowledge. There's just too many things-- too much-- too many books being written. So out of all of these things, which ones do you choose to teach to everybody?

The second one was diversification of culture. The United States population between 1850 in 1950, I think increased by a-- of kids in school increased by something like 20 times. That's another number for you to verify, but it's a big number.

And the question then is how do you teach, once you've decided what to teach, how do you teach it to each individual given different tastes and abilities and all of that?

OK, so they said that what they needed was what was called a unity principle. And that is that after you have chosen from all of this wealth of knowledge and learning, better stated learning, which few things you're going to teach to everybody, and after you decided that you know how to teach it to each individual, what you've got to do is to say that what a person has learned in school has got to help them learn more when they get out of school.

So all of this stuff has to fit into some kind of pattern. Now, we did that in this course. We were [INAUDIBLE] to be able to show a pattern between the structure of ethics and the structure of science when we said talk about the empirical, the rational, and now-- which I have gone into any detail on because I'm waiting for the-- believe it or not, Three Mile Island piece to do it.

But the question is, how do you take learning from music and mathematics and art and physics, how do you make sense out of all of that? And what they went through were some formulas, and many proposals have come in but nobody has accepted any of them as a principle for general education. Let's name some.

The first one that came in was Christianity.

[CHUCKLES]

Well, not everybody is a Christian. So they threw that out. I'll name one or two-- cut me off. This is a good place to cut me off if you think of some others, some other proposals and if they came up, and why they were slashed down. One of them was cultural literacy. Back in the '50s, it was called the Chicago School. They dedicated themselves to-- well, that's been thrown out.

Nobody just seems to benefit from a vocabulary. You don't get meaning. Don't get context. There's too much of it. If it's technological, it changes too fast. Critical thinking, actually that was the Chicago School. Critical thinking, OK? That got thrown out.

Can anybody name any others? There were a whole bunch of others. The book said that it did not have a solution to this problem of a unity principle. It had the faith that somebody was going to find one. Nobody's found one to this day.

So that means we're struggling along with what was left out of this piece. And one of the big casualties of it still is character.

What is engineering? Oh, let's see now. I really wanted this to be a good picture. Can anybody tell what this picture is of?

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** Yeah, it's a nighttime view of the Stata Center. This building is right up here on campus, OK? Now, we did discuss some ideas about what really is engineering. Joel Moses, Dr. Moses came in, and he said that Plato and Aristotle gave us two ways of thinking.

Aristotle gave us a systematic way of thinking that was what we call analytic. And that is, if you want to understand something, you break it up into its parts and you understand the parts. And then you put the parts back together, and maybe you can understand the whole.

Plato said was synthetic. Plato said, well, if we want to understand a thing, we first say what it is, and then we say what it is not. And then somehow out of a synthetic approach, we're able to understand better what this thing is that we're talking about as a whole.

And when you bring these two approaches, traditions together into one, you get something different from the two. And we call it engineering. Now, the reason that we are going to take that idea very seriously is not because - simply because somebody is here to say it, not because it is compelling, but because there really isn't a philosophy of engineering out here. There really isn't.

I'm writing a book on it, so I have my views about it. And there will be a time towards the end of the class when I will share my views, which you will find very interesting. It doesn't really conflict with all this. It subsumes it. And what I will say is that engineering began when what used to be called the practical arts, road building, things like that, came together with the science and mathematics.

OK, we put those two together, and we're just about done. We had talked about-- did I do-- no, I didn't. It's just [INAUDIBLE].

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** Is she OK?

**AUDIENCE:** Remember, she said she had to go to a test.

**TAFT BROOME:** That's right. We talked about how engineering and ethics can engage each other. Sometimes, you don't really have to be an engineer. You really don't need to the technological system. What you do then, if this is technology and if these are people, then you study their interactions and how they relate themselves to technology. And you make a decision. We did that already in class, particularly, when we analyzed the A7D case. You really didn't have to a whole lot about airplanes and brakes.

In this case, and when we talk about like with Three Mile Island, you really have to know what a nuclear plant is to understand about how to make an ethical judgment about the situation. And there is this interdisciplinary mode.

Now, I want to take a minute to say something about that, and according to my watch, we've got six minutes and we're out of here.

Now, this slide here provoked a long and in-depth discussion yesterday both in the class and outside of it. I want to [INAUDIBLE] Lester's office, which is actually in the same suite that I'm in.

[CHUCKLES]

Went down and we talked for about-- I think-- we had lunch together in his office, and we talked for almost an hour. This one is the big issue here because what it says is that there's a possibility when you engage two learned disciplines that, in order to solve the problem, you have to throw out one of the fundamental principles of one of those disciplines. Now, let's see how that happens.

In ethics, here's what I did with this paper. When I said let's put a person in a situation-- in this case was my Uncle Roy. And other cases we called them [NON-ENGLISH]. The Nigerians called it [NON-ENGLISH]. Jews call it the [NON-ENGLISH]. You put a person into a situation who is not a virtuous person.

Now, once you do that, you're outside of the realm of everything that Western ethics has to say. You're outside of the realm because we're not looking to do the right thing. We're talking about a situation that is exigent. You have to make a decision right away, potentially lethal, so you have to make a decision. And the question is, after you've done it here, and even if you've done the wrong thing, will the rest of the society forgive you?

Now, when I brought this thing up with philosophers the first time, they were of one mind, in total agreement, total agreement that this was outside of the realm of anything we call ethics or moral philosophy. They finally accepted it, but it's outside the realm.

Now, here's what I want you to try to do. I want you try to do two things. First of all, I want you to try to imagine that you were doing this, but you're doing it for your dissertation. Your committee is going to say no.

[LAUGHTER]

Let's say that you're a faculty member and you want to do this. And you want to go up for tenure. Committee going to say no. All right, so there is-- I argue-- and I'm not alone in this-- that-- and Lester is a guy who does public policy and had been doing it when he came here along with nuclear engineering. And he had to deal with this problem in terms of getting rank and tenure, all right?



So the question is, when you're engaging two or more learned disciplines, what do you do if you encounter a problem that you can solve but at the expense of a first principle in one of the disciplines that you're bringing together?

What normally happens out of that is that you spawn a brand new discipline. What happens when you spawn a brand new discipline is that you're the only expert on the planet on that new discipline. And anybody who's going to make a judgment about it is outside the realm. It takes time. This is a cultural issue.

So I'm just going to conclude and just show you some of these other slides, actually, that the Three Mile Island case was aggravated by some real events and movies that were made of real events. And this particular case occurred-- this particular movie came out two weeks before Three Mile Island actually happened. It was almost as though it predicted the Three Mile Island case.

And what that meant was that people couldn't make good rational decisions about nuclear power in the United States. Those movies scared us to death.

And what happened here that is very important for an ethical class, a class in ethics, which is also an ethical class, I hope, [CHUCKLES] that when this pump went bad, it was just a mechanical, it was just a technological failure. It just went bad, did not pump.

And when it did not pump, it caused readings to be made in the control room that were deceptive. It did not say that the pumps were working. It said that something was overheating. And when they tried to compensate they did the wrong thing. And this almost could have-- this could have been the real scare of nuclear power, could have been a meltdown.

The important thing for ethics is that we could never assign moral responsibility to any individual. So the question is, is there something about the way we as a culture look at nuclear power that is wrong and maybe bad? And I would argue that that's true.

I went to work for the Nuclear Regulatory Commission June 1 of 1979. That was March, April, May, June. That was three months right after Three Mile Island. And this is a nuclear power plant. My job was to analyze what happens if a small aircraft crashes into a containment structure. That was in 1979.

I wound up being on a consultant list at the CIA for this kind of problem. It looks a lot like 911. So with that, then I conclude that we got some things to do. And those conclusions there, we've made all along. I think we need character development back. I think we need to define competency with good character. And the last part of it is that I think organizations have moral agency. And I will prove it before this class is over.

**AUDIENCE:**

I was going to say, you convinced me when we first started the class that I really had a problem that didn't bother me. But I'm convinced now that it's possible for this organization. And one of the things I [INAUDIBLE] just talking about the internet is whether these conflicts [INAUDIBLE] engineer and design can have moral agency.

I've been reading a lot of stuff on network neutrality. So you probably know a lot more about it and understand it a lot more than I do. So it kind of made me play with this idea of the internet being neutral and being ethical. It's fascinating.

**TAFT BROOME:** You going to write something on it?

**AUDIENCE:** Maybe. Maybe I will.

**TAFT BROOME:** All right, well, you got--

**AUDIENCE:** [INAUDIBLE] help me, Professor Broome, yeah, definitely.

**TAFT BROOME:** Well, two of us will help.

**AUDIENCE:** Yeah.

**TAFT BROOME:** Yeah.

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** Any questions, comments?

**AUDIENCE:** This is a little bit outside of the presentation [INAUDIBLE] when you mentioned the term interdisciplinary, this is a discussion I've been having with a lot of people. How would you define the difference between multidisciplinary, interdisciplinary, or--

**TAFT BROOME:** Cross-disciplinary.

**AUDIENCE:** Yeah. Transdisciplinary is a new one that I recently learned.

**TAFT BROOME:** Right, yes.

**AUDIENCE:** How are we going to define those terms?

**TAFT BROOME:** Yeah, cross-disciplinary is when you use the tools and methods of one discipline to study the other one. Multidisciplinary is when you want to study a problem when both of the disciplines interact together to give you the solution.

And interdisciplinary is when the two interact, but one has to give up a fundamental principle of it, of itself in order to solve the problem. In other words, the two disciplines do not remain intact. One of them loses something or is replaced by something else.

I have not talked about transdisciplinary, but only those three. And that's the way I have defined it.