

The following content is provided by MIT OpenCourseWare under a Creative Commons license. Additional information about our license and MIT OpenCourseWare in general is available at ocw.mit.edu.

TAFT BROOME: This setup, where a person could get a contract from the city to put a plow on the front of their SUV--

AUDIENCE: Oh.

TAFT BROOME: --and plow people out of their driveways--

AUDIENCE: Yeah.

TAFT BROOME: --and that was free for [INAUDIBLE]. And they would get paid for it.

AUDIENCE: They would get paid for doing that. Yeah.

TAFT BROOME: So nobody was ever late for work by reason of the--

AUDIENCE: Because you could just call someone who had an SUV with a plow.

AUDIENCE: Well, even better than that, you'd just go down, knock on the person's door, tell them when you want to go, and they would just automatically--

AUDIENCE: Yeah.

TAFT BROOME: --come and-- OK. Why don't we get started with some housekeeping issues. And first of these will be your reactions to the updated syllabus. I had that. Sorry, go ahead.

AUDIENCE: Oh, no. With the grading scheme at the end?

TAFT BROOME: With the grading scheme at the end, and took off the midterm.

AUDIENCE: Oh, I didn't notice that. OK.

AUDIENCE: I noticed that. I don't have any objections. I thought it was pretty fair, the grading.

AUDIENCE: There's a lot of weight at the very end. I mean, that's my-- I'm not saying that's a bad thing, necessarily. But 65% is the project, which I guess just reflects the importance that you place on our independent work on that project.

TAFT BROOME: Yeah.

AUDIENCE: [INAUDIBLE]

TAFT BROOME: Yes. For a graduate class, for graduate students, I just don't see a whole lot of point in asking you all to memorize a whole lot of terms for a midterm because anybody can do that.

AUDIENCE: Right.

TAFT BROOME: It'll come out, and you'll-- it'll come out in this paper. What I want for you to do is to walk away from this class with as much of what we put into the class into one coherent whole that is your choice of topic. And we're going to work-- if I say work with you, that is not right. We're going to work on you--

[LAUGHTER]

--to get that thing right. So that is the importance that I put on that. Keep talking. You still got the floor. We're still doing some housekeeping issues on the syllabus. Yes. This is not exactly yours. Yours is hardback. I couldn't buy a hardback. But I want to keep the one that is property of-- is that OK? Can I give this one back to you?

GUEST Oh, I see. Because you wrote stuff in it?

SPEAKER:

TAFT BROOME: No, you wrote stuff in it. And I want to keep it.

GUEST Oh, I see. I see. Stolen from me.

SPEAKER:

TAFT BROOME: Stolen from you.

GUEST Right.

SPEAKER:

TAFT BROOME: Yeah. But when I ordered it, they didn't order-- they didn't give me the hardback.

GUEST That's fine.

SPEAKER:

TAFT BROOME: It's OK?

GUEST [INAUDIBLE] Thank you.

SPEAKER:

TAFT BROOME: OK. So the percentage that we're going to-- and let's see. Open up again to--

AUDIENCE: [INAUDIBLE]

TAFT BROOME: You have it in front of you? The part where-- yeah-- the early presentation and the final presentation. Do you have any questions about that? So the early presentation is on the same-- it was draft one of the same thing. And there are two prep classes.

So I want to have a class that pretty much gives you a higher order explanation of how to give a verbal presentation. Now, what's going to be very helpful with the prep classes are the other two faculty or any other faculty that are here. They're going to have different styles. You may want to use one of these instead of one of mine. Or instead of-- yeah, I have several styles. But please take advantage of that opportunity to work with them.

We're going to be able to do, at some classes, more than one case study in one period. So that would be ad hoc. Some of them we'll get stuck on. Some we'll move straight through. But you're ready to do two of them today, right? Three of them-- A7D, Challenger. And what was the other one? Pinto.

Let's see. There's another housekeeping issue. I was not able to consummate a person who-- to take over class on Thursday. I'm going to be out of town.

Now, we have some options. We can get a volunteer to take the class. We can schedule a makeup class, which is what I'm accustomed to doing at Howard. We scheduled makeup classes on some time that's convenient. Any ideas?

AUDIENCE: So there's a few of us, we can probably find a time to do it.

TAFT BROOME: Like for example, a Friday, or for example, during the final week. Either one?

AUDIENCE: I probably prefer a Friday earlier in the semester, if that makes--

TAFT BROOME: OK, why don't we do this? You all are talking to each other outside of class.

AUDIENCE: She emails me, yeah.

TAFT BROOME: Come up with a couple of options.

AUDIENCE: OK.

TAFT BROOME: And then, when we get together the next time, we'll explore those options, see how many people we can get in. There's one other day when I'm going to be on travel. But that day I will promise to have somebody come in take the class. And that's all for me. I won't-- I have no other plans to miss any other classes.

AUDIENCE: So this Thursday?

TAFT BROOME: This Thursday, there is no class. Let's see. Are there any other housekeeping issues? A couple of-- before we get involved in the case studies, let's have a revisit of the last class. Let's have a revisitation to the last class. And revisit means several things. One, are there any questions you want to bring up? And second, are there any corrections that need to be made?

There's one correction I want to make in something that I said. Remember, there was a question asked about is it really-- is it an end that you feel for somebody else? Or is the end really that you're feeling for yourself? And I had said, Schopenhauer gave this example of how a person cannot-- sometimes does not separate oneself from someone else.

And that has-- there is a slight amendment that I would like to make to that. And it's very slight. And that is that Schopenhauer set down the theory. But it was Joseph Campbell that gave the experience. [LAUGHS]

And Schopenhauer did it-- hold on just a second here. I'll tell you what-- yes. Schopenhauer's book called *The World As Will and Idea* is full of this kind of discussion. Here we go again, the will again. Did you take note of that? Told you in German authors, you're going to find a lot of this issue about the will.

The book is a symphony of rapture dealing with this matter. He uses an image that I like to bring up in relation to this and his foundations of morality. He asks quote, "How is it that a human being can so participate in the danger and peril of another, that forgetting his own self-protection, he moves spontaneously to that person's rescue," end quote.

"How is it that what we take to be the first law of nature, preserving this separate entity, this ego, is suddenly dissolved? And as though one were at where that other--" I'll repeat that. "As though one were that other, one acts spontaneously in the interests of that other. Even at the risk of one's own life, one acts spontaneously to save a child that's about to be run over."

Schopenhauer answers by saying, "This is a metaphysical realization that has broken through which is usually not there," end quote. It's the realization of the universal consciousness of which we are all manifestations. Now, notice that, universal consciousness. This business of there being a oneness to the universe is going to come up. Yes. It's going to come up--

GUEST It's basically the [? mystical ?] condition that where abundance plays such a big role. And it's very German.

SPEAKER:

TAFT BROOME: Very German.

GUEST I mean, nowadays, it's much more popular. It's also very defined.

SPEAKER:

TAFT BROOME: Yes, it's also very defined. I just bought a book on oneness. It's-- I'll get it in the mail at some point. I'll bring it to class. It's a relatively new book. And the person who wrote it is a physicist. I was out at the AAAS meeting last weekend. And they had a book sale, the display. And I bought it there. Seemed to be going quite popularly. So I'll bring that to class.

But it's a physicist point of view that there's a leap you can make, even in physics, that I think what he's really saying is, that some of the great physicists have already made that leap. They really think that there's something out there that's a oneness of the whole universe.

And there is this discussion that I don't understand very well, and I hope you do. And if you don't, it'll be in this book. And we'll discuss it. There is this discussion out there that there are forces between every two particles in the universe. But those forces, the magnitude of those forces is independent of the distance between the particles. That's very hard to accept. [INAUDIBLE] has something to do with that. [LAUGHS]

But nevertheless, so the correction is that the actual experience of the bridge-- of the person falling over the bridge-- was Joseph Campbell's experience when he was a young man. But he puts it in the context of Schopenhauer's works and justifies it there.

Anything else? Doctor Ng had an issue that I don't think that I responded to thoroughly. And I would like to make it a class responsibility to respond to it thoroughly. You want to put that question again?

AUDIENCE: We talked about Kant and how in his philosophy, there were these things that were considered to be always-- that held all the time. I forgot what they're called.

TAFT BROOME: The imperatives, the categories and imperatives.

AUDIENCE: So if you have an imperative, then you operate by means of the imperative all the time. And I think the example we talked about had to do with, if the imperative is I will always steal, then we'll reach a point where there's no more to steal. And then, therefore, the imperative-- that cannot be an imperative because destiny can't fulfill it.

But then my question was, can you have an imperative, basically, I will always steal, and yet not be able to fulfill it? So is that consistent? As opposed to saying that because you can't fulfill it, you can't have the imperative? Maybe can you have the imperative, just there's no opportunity to enforce the imperative or to carry it out?

TAFT BROOME: Maybe would it be fair to say that you were saying that it's logic-- it still remains logically possible, but physically, it doesn't remain possible. Is that what-- elaborate. Elaborate. Let's get some response. Anybody. Jump in.

AUDIENCE: I feel--

TAFT BROOME: Excuse me. Excuse me. Excuse me. Remember, class participation is part of your grade. [LAUGHS] Get in.

AUDIENCE: So my reaction to what you're saying is that the way Professor Broome presented a categorical imperative was that by definition it can always be able to be done. So the question you're posing has already been answered by defining an imperative as something that physically can be done.

But now if we bring in the differentiation between logical and-- logically being able to be done and physically being able to be done, then maybe my response doesn't hold. But if the definition is that a categorical imperative can always physically be done, then it seems like we can't have a categorical imperative that you just want to do but can't at that moment.

TAFT BROOME: Let's keep on-- let's keep with this a little bit

GUEST Actually, I happen to like Kant. He's viewed by many as the greatest philosopher in the last 400 years. Let me
SPEAKER: give you another view of Kant.

TAFT BROOME: Right.

GUEST It's in the modern era that we have a field called cognitive science--
SPEAKER:

TAFT BROOME: Yeah.

GUEST --trying to figure out something about how people behave. If you were to restate categorical imperatives in the
SPEAKER: following way, that people are genetically predisposed to do certain things, different people are predisposed to do different things than other people, rather than make it axiomatic in the logical sense, then Kant is really the first one to actually say that. Anything like that.

Of course, then genetics didn't exist in those days. It wasn't in Darwin, et cetera, et cetera, just so to say that people are predisposed-- this is not what he said, but what I [INAUDIBLE]-- to do certain things is a real significant discovery. That's my point.

The other point I wanted to make is that if you look at the title of his famous book, which was *Critique of Pure Reason*, where he's criticizing Hume. So it's how do you say that this guy is a logician when the title of this major book is a *Critique of Pure Reason*? [LAUGHS] All right, I'll just leave that one open.

TAFT BROOME: That was-- OK. Yeah. Was he remaining-- as I say, was he remaining faithful to his discipline when he wrote that? Being a logician, anyway? I don't know. I tell you what I get-- what I really think now-- listen to me carefully. I'm saying what I really think, when I get my own opinions.

What I really think that Kant was after was a set of Ten Commandments for ethics. Not everything, not a long list of imperatives, but a short list, from which you could reason out your ethical choices. I really think he was looking for a short list of very snap-- short snappy statements. Do this, don't do that.

When I was in army, that's the way it was. Believe it or not, there were 10 rules-- not 11, not nine, there were 10 rules of how to survive in combat. One was-- I only remember one of them-- never let the enemy encircle you. Well, you see, the enemy might encircle you no matter what you do. It goes back to what Dr. Ng was saying.

Nevertheless, there is this compulsion, there's something that really works for us when you can just lay out that magic number, 10 do's and don'ts. Everybody can remember them. And they try to live by them. Now, let me make a few comments on that.

I was reading someplace where even Kant said that you want to set up a life pattern using these categories. And that guide you when you're walking down the street, if a kid jumps across the street, you know automatically what to do.

But a lot of your problems are going to be the ones that you're going to have to sit down and look at as particular cases, particular physical cases. So he did give that away, that both of-- there's a place for both of them in a person's life. So I think that a good life is one that can find a way to use both of them.

Let's see. There was something else I was going to say. But when I get the spirit, I'll just say it. [LAUGHS] It'll come later. How about we get back into some of these cases? Let's make a few remarks to end up. And then you all want to give me some-- a homework, don't you? How do you want to give it to me? Your hard copy? OK.

AUDIENCE: [INAUDIBLE]

TAFT BROOME: Yeah. Let me have them. And I'll work on these. Let's see. Since we don't have class Thursday, I can probably send comments back over the weekend on email. And let me see if we can't make a few comments on this while we're at it. One is that how did you treat the point that if you use a utilitarian approach on A7D, the fact remains that nobody actually got hurt.

How do you treat the issue that if I am Kermit Vandivier, and my boss tells me to falsify this data, and I say, but that's telling a lie. And then, he comes back and says, well, no matter what, the military rules are, nobody's going to get hurt in this.

Comes close enough. Nobody's going to get hurt. How do you react to that? How did you react to it and how do you-- and how would you recommend that the rest of us act to that? Does utilitarianism fail us here?

AUDIENCE: I-- never having done ethical analysis before, I didn't know what to do with the fact that we already knew the results.

TAFT BROOME: Yes.

AUDIENCE: And we knew insider information that the main character in the case didn't know.

TAFT BROOME: Right.

AUDIENCE: So what I decided to do was to narrow the scope and just do the ethical analysis as if Lawson or Vandivier were making that decision. And so they didn't have knowledge-- at that point in time, they didn't know that the brakes wouldn't be installed or that they wouldn't [INAUDIBLE]. So that's how I chose to do it.

TAFT BROOME: Fine.

AUDIENCE: But then, that was one of the problems because after the fact, we do know that no one was hurt. So the greatest utility--

AUDIENCE: Yeah, I actually did the same thing personally.

AUDIENCE: Really?

AUDIENCE: I assumed that we didn't know the outcome. And it was just more about that one decision they had to make. And I really felt like utilitarianism kind of failed in that sense. I mean, I think for probably many engineering cases, it's probably not the best approach to take, I felt, number one, because there are so many uncertainties to the outcomes. I mean, so there are probably not too many engineering projects when you can say, these are the costs, these are the benefits. This is what will happen. There's so many things that you don't really know.

And in retrospect, it was nice. We can say, OK, it didn't turn out that bad. But if they're making that decision then had a problem, we don't really know what could happen, what could happen to these brakes. They could skid off the runway, people could be killed. We don't really know.

AUDIENCE: Right. There's costs and benefits. But each of those costs are met by a sense of probability--

AUDIENCE: Exactly.

AUDIENCE: --whether or not it actually happens.

TAFT BROOME: So therefore, it seems that utilitarianism is going to be a way of looking at the world where you can resort to probabilities. Where as the categorical imperative is either A or B.

AUDIENCE: Right. That's why the categorical-- the [INAUDIBLE] approach or the principle-based approach for me in this analysis seemed less shaky in terms of coming to a conclusion because I could just say--

TAFT BROOME: Don't lie.

AUDIENCE: Yeah. Don't lie. Or in my case, yeah, don't endanger-- don't infringe on the right of someone to their life.

TAFT BROOME: There is an-- have we satisfied or satisfactory treated your question, Dr. Ng, because I'm jumping around here a little bit? I want to play one more game with the A7D case.

And let's play-- and this is a game that comes up a lot with utilitarianism in engineering. You don't find it so much in science. And that is that the person who's making the decision is making the decision in a very large, powerful, hierarchical environment, where he or she is somewhere down in the middle towards the end bottom.

And so the question then becomes, is the decision-maker and I'm going to put this question to you-- is the decision-maker one of the affected parties to his or her decision? I will tell you how that gets to be a big issue. This is what they call whistle blowing case.

In engineering ethics, I think we will not find any category of problems that is as great of an issue in terms of hostility that engineers can have for one another than whistle blowing. This business of loyalty to the corporation, or to your employer, or to your client, it's a big deal.

So the question then-- the issue comes up called blackballing. That's a formal term and it's one word, blackball. What that means is that this invisible power structure in engineering practice that runs from this employer, to that client, to that employer, is one in which it can punish a whistleblower by saying, you'll never get another job after you've blown the whistle.

There is some structure to that. And it's called the resume. That when you go from one job to another, you have to send your resume. And you have to have some persons from your other job to make some-- have to give some references. So they called back to that person. That person says, oh, she blew the whistle on us.

And they say, well, we looked at your application. It looks very good, but we decided on someone else. And then, after a while, you'll see a pattern in your life. And that turns out to be a very stressful pattern. So is it fair? Is it right for the decision-maker if that person wants to use utilitarianism to consider him or herself as an affected party? Is that a legitimate thing to do in utilitarianism?

AUDIENCE: My understanding of utilitarianism is that it includes the person making the decision, that when you talk about the greatest utility from affected parties, nothing in that seems to me that it rules out yourself as being [INAUDIBLE]. And maybe the problem is utilitarianism is supposed to just focus on this general audience. It's just that most people place more value on themselves--

[LAUGHTER]

--than probably the other people in the audience. So maybe think about it the same way.

TAFT BROOME: Yeah. Well, let me ask you to do something. Let's see. How can we do this? Suppose I am Vandivier. And suppose one of the pilots out there is your son. And I say that, well, if I make-- if I don't tell this lie, I will get blackballed. How do you feel about that? Do you think that I have a claim?

AUDIENCE: I think if it's my child, I don't think you have a claim.

TAFT BROOME: Right.

AUDIENCE: And maybe that's the problem because everybody has certain biases. And everyone has a way of saying general overall good because if my son dies, the overall good in the world has dropped. And then for you, you still have your job. Maybe you experience some kind of financial gain. So maybe our perception--

TAFT BROOME: What I'm going to do at this point is tell you that this is where John Stuart Mill fits in and why he-- and my judgment is why he gets more credit for utilitarianism than Bentham. And even all the way back to Plato, why it is. And that is John Stuart Mill goes into that kind of question. What really counts as the maximum good? Is good really a matter of feeling good or is there something that's different?

Is there something about worth feeling that you've done something of worth that doesn't necessarily make you feel happy, but what does it make you feel? So try to pick up something that John Stuart Mill has written or that somebody comments on John Stuart Mill and go into some detail about the happiness principle because he takes into account all of these kinds of ramifications.

How about-- let's look at another case. Want to do the Challenger? Let's do the Challenger. Let's see. Give us a recapitulation of the case, someone, some two persons. What-- give us the time of the day, what happened in that case. Act as though the rest of us really don't know.

AUDIENCE: [INAUDIBLE]

TAFT BROOME: Go ahead.

AUDIENCE: So my-- what I recall is that an employee for the company Morton Thiokol maybe--

TAFT BROOME: Thiokol. Thiokol.

AUDIENCE: --Thiokol that manufactured the O-rings, that seal in between the fuel sections, knew that they did not have any evidence to prove that the O-rings were safe at low temperatures. And the launch was to take place very early in the morning in January in Florida. And it was unseasonably cold, like in the 20s. And he knew that there was a chance that the rings would fail.

And so he urged his managers to prevent NASA from launching-- from doing the launch. But NASA really wanted the success of the launch. So they needed it to go ahead on time. And the managers wanted to continue their relationship with NASA and the lab for that success to happen. And also, they overruled this engineer. And the launch happened, the O-ring failed, and the explosion occurred.

TAFT BROOME: Yeah. Miss Ratliff, do you want to add something to that, or correct-- or not correct, but change your view on something there?

AUDIENCE: No, I think Krista stated it very well. But I think there's a well-known quote. I'm going to get it wrong. But I think the management tells the engineer to put on his management hat.

TAFT BROOME: There.

[LAUGHTER]

GUEST Ah, the famous line.

SPEAKER:

TAFT BROOME: Yeah.

AUDIENCE: And so it really kind of--

TAFT BROOME: Go into some detail on that, please.

AUDIENCE: Right, because he goes in saying, don't launch. We don't need to do this. We don't have sufficient data. And then he--

TAFT BROOME: Excuse me. We're talking about the vice president for engineering. And he's sitting at a table with some of the other vice presidents and the president. And he gives his opinion that says, don't fly. And keep going.

AUDIENCE: And I guess these various reasons. And then, that's their response. Put on your management hat. If you are a manager, see it from our point of view.

TAFT BROOME: Right.

AUDIENCE: We have to do this. And eventually, he says, OK.

TAFT BROOME: All right.

AUDIENCE: [INAUDIBLE]

TAFT BROOME: Now, remember when we talked about story terms, I said, the causative sequence, the point, the point of view? You see? And we talked a little bit about Moby Dick and how it starts-- the first words establish the point of view. Call me Ishmael. Now you know the whole story unfolds through that person's eyes.

I can't think of a better case where a point of view can really change how you look at something that just change-- put on your mind management, take off your management, put on the other hat. There's a point of view in it.

So now, the question then-- another question comes up about this is, that before we get into it, and I want you to address this, is whether or not a practicing engineer should obey a different moral code from the manager. Better stated, of the engineering manager. Is there something different about their ethical responsibilities or do they have the same responsibilities?

Let's see. Let's put some flesh around those bones. Let me see. Do you all remember that day? What were you all doing that day? Some of us old people can remember that day just like it was yesterday.

AUDIENCE: I remember coming home from school.

TAFT BROOME: Coming home from school?

AUDIENCE: [LAUGHS] Yeah. I just remember the scene on the TV.

TAFT BROOME: Now, that's another thing that you all can-- they played it on television again.

AUDIENCE: Yeah.

TAFT BROOME: Again, and again, and again. Did it numb your senses at all to see it over, and over, and over? Or did it do something else? How do you feel about it? Do you remember this?

AUDIENCE: No, I was just five years old, so I didn't have that--

TAFT BROOME: Five years old. Yeah. Well, I remember that day very well. When it happened, I was in the library.

[KNOCKING]

Is there somebody over there at the door? OK. Oh, yeah, come in. When it happened, I was at the Library of Congress. And I was sitting in the reading room in the technology building, the Jefferson Building. Not exactly a large reading room as the Library of Congress goes, but maybe the second or third largest.

And I'm just sitting there reading. And librarians in the Library of Congress tried to be as unhelpful to a reader as they can be. [LAUGHS] Can be very-- unless you've come there to use-- unless you're going there to use a rare book division, or unless you were there from a Congress person, just sitting on the floor.

But this day, this librarian yells out in front of everybody, and says, Dr. Broome. I don't know how they knew my name. They said-- I think I know. They described me. They said, they want you on television. And I'm thinking-- well, Howard has a TV station.

So I run down there. And they're putting on the microphones. And it was a live show. And I said, well, what am I-- they said, the Dean had given them my name because I had a NASA grant. I said, OK, what's going on? They said, we'll show you. I saw the-- I saw the film two minutes before I was supposed to comment on it and take phone calls. [LAUGHS] And I sat there. And they played it one more time for me.

What I got fixated on when they showed it was the pictures of the people in the audience, the parents, as they saw the thing explode because they showed it twice. They showed it once where the focus was all on the shuttle. And then the second time, they showed it where the focus was all on the people in the crowd.

And you just had to know what was going on with the shuttle when they-- and if you'll remember, I remember distinctly, there was very little immediate shaking response. It was like they couldn't believe that it happened. I mean, it was like, it was still going up. And the realization that their sons and daughters had died had just not settled in.

GUEST Well, it wasn't clear initially that the people died. That was-- that took some while--

SPEAKER:

TAFT BROOME: Some time.

GUEST --some time to establish.

SPEAKER:

TAFT BROOME: OK. But it exploded way up there in the sky.

GUEST Something happened on it.

SPEAKER:

TAFT BROOME: Yeah.

AUDIENCE: Maybe the shuttle itself, but--

GUEST Well, I mean, if something fell into the water. And--

SPEAKER:

TAFT BROOME: Oh, it could have been [INAUDIBLE].

GUEST --yeah, maybe they could have survived.

SPEAKER:

AUDIENCE: Yeah. OK.

TAFT BROOME: Yeah. You hope.

GUEST Yeah.

SPEAKER:

AUDIENCE: Right.

TAFT BROOME: You hope. Now, there were some other things-- issues surrounding the whole case that bear on it. One was that President Reagan had just made a speech. And he made some statements in the speech that could be interpreted more than one way.

But one way that many NASA people took it was that the success of this flight had a lot to do with their funding, NASA's funding, because there were a lot of questions out there about whether or not exploring space was a good place to put a lot of money. And so a lot of engineers actually said in testimony later that they felt pressured to have this flight.

Then there was another issue that was very emotional for everybody. And that this was the first flight where you had somebody on the shuttle who was not a trained astronaut. You had the schoolteacher.

And that was very significant because what they really wanted to demonstrate beginning at that time, that flight of that sort is one that anybody who could get in an airplane and fly across country could get in a shuttle and go up in space.

They really wanted to do all of that. And this was a case to prove that you didn't have to have all of this training, you didn't have to have super physical abilities, that you just get on and fly. And when she went down, there was a whole lot of terrible feelings in the United States.

There was one other one that was emotionally stressful for MIT people. Remember who it was?

AUDIENCE: MIT astronaut? An MIT alum?

TAFT BROOME: Keep talking, maybe.

AUDIENCE: Yeah. McNair.

TAFT BROOME: Yeah. As a matter of fact, when I met Dr. Ng, I gave a lecture into his class in the McNair Building. Wasn't it McNair?

GUEST Building 37.

SPEAKER:

TAFT BROOME: Mm-hmm.

AUDIENCE: No, wasn't it building 34?

TAFT BROOME: 34? McNair was somewhere around in there.

AUDIENCE: [INAUDIBLE]

TAFT BROOME: --that passed by it? Because I remember seeing--

GUEST Three buildings behind it.

SPEAKER:

TAFT BROOME: Three buildings behind? OK. So Ron McNair was an MIT person. And he was on the flight and died. So there was-- so this particular issue was one that was unique in many ways, probably one of the-- let's say, probably the most important unique way is that virtually the whole world participated in the thing, if by no other way than just looking at it and having something to say about it afterwards.

I wrote an article on it. Not on it, per se, but I included it. And at some point, I'll be able to get this up and go. Come on. [INAUDIBLE] And while I'm looking this up, tell me what you think in terms of an ethical analysis of the whistleblower. Remember his name? Beaujolais? At least, that's the way he pronounces his name.

Do you think he did the right thing? Do you think that the people who didn't pay attention to him did the wrong thing? Who's the judgment [INAUDIBLE]? He said, we shouldn't fly, and he went and told us about it.

AUDIENCE: So I don't-- no, I don't think that can be the wrong thing.

TAFT BROOME: Which theory are you using? Utilitarianism, categorical imperative, or some other theory?

AUDIENCE: Right. In all of them, he did the right thing.

TAFT BROOME: For all of them?

AUDIENCE: Yeah.

TAFT BROOME: Make your case.

AUDIENCE: All right. For utilitarianism, if they listened to him, people wouldn't have died that day. He also-- if he didn't say it after they died, he would have felt like, wow, I was a traitor to the dead, because I didn't say it. So it helps him, and it could have helped if they listened to him from the utilitarian point of view.

And then, from the impact on the categorical imperative point of view, he said what was right regardless of the consequence. I mean, the consequence had nothing to do with-- he just said what was right. So his job was at risk. And he could have thought, I should save myself. So from that point of view, he did the right thing took not thinking of the consequence.

TAFT BROOME: So not thinking-- not necessarily using Kant's theory about the categorical imperative, but just not thinking about the consequences. That's a principle at work here that says, well, you should tell people when things are not safe. And yeah. That was a cold morning. And it went below specifications. But some of the engineers said, ah, but it won't hurt anybody.

But now, there are some other points of view on this. But before I get to what people have said who've had plenty of time to think about it, I want to hear more about your initial-- your views about it. What do you think about this thing?

AUDIENCE: I'm trying to think about utilitarianism approach to his decision to tell managers that he didn't think it was safe. And I guess, if he himself had the power to cancel the launch, then maybe utilitarianism would be more problematic because canceling the launch if the O-ring was safe would produce a lot of pain for many parties involved, for NASA, for the money that had been spent on all the launch preparations. But he, in giving the recommendation that the launch shouldn't happen, didn't have the power to actually cancel the launch. So he was giving someone else the opportunity to make the decision. I don't really know where I'm going with this.

TAFT BROOME: Keep going. Just keep talking. OK.

AUDIENCE: Do you have to take into account the actual power that the person has to make the course of action-- follow through with the course of action? So all that Beaujolais could do was give someone else a big decision to make with actual facts.

So certainly, from that categorical imperative point of view, he wasn't infringing on anyone's rights. He was treating his managers as people who had the ability to reason. Which seems to be what that approach to ethics would say is the right thing to do.

AUDIENCE: Well, again, I have a problem with it, because I-- with applying the utilitarian approach, because I just feel like there's so many uncertainties. And it's so hard. Retrospect is a wonderful thing. We could sit around and look at it and say, this is what would have happened, this is what could have happened.

But from his point of view, it's really hard to implement that kind of approach, because he had no clue the ramifications of his actions. Either he would present this data and say you shouldn't, or he would say nothing.

But I don't think he was truly aware of what it really meant, or maybe he didn't think about it, or he didn't sit down and weigh all options that people actually die, or what does this mean for NASA if I say this, and we don't launch, will all the funding get cut? I don't know if he weighed all the options or was even clear what they were at the time.

TAFT BROOME: Let's talk about complexity a little bit. Let's make it more complex. And see if there's a way to think through something that really is complex. We have to have the optimism that even when it comes to engineering that we do every day, all of the things that can happen to our designs, somehow or another, we get these models and we get through it. Can we do the same thing with an ethical problem? All of these complexities, I'm going to add another complexity to it.

There's a man by the name of Hans Mark. You know him?

AUDIENCE: Is he at Texas?

TAFT BROOME: He's--

GUEST He is now.

SPEAKER:

AUDIENCE: He's--

TAFT BROOME: He's still, yeah, chancellor at the University of Texas.

AUDIENCE: Yeah, I just remember hearing his name.

TAFT BROOME: Oh, you-- and you remember that name?

GUEST He was at NASA.

SPEAKER:

AUDIENCE: Because it's a distinctive name. Yeah.

TAFT BROOME: Yeah. He was at NASA. He for several years was the number two man at NASA. He was the one that gave the final say so, yes or no for shuttle flights. And I don't recall if he gave the yes or no for the Challenger. But I think he did.

That's a good thing for you to look up. I knew him. Hans Mark was what I would call a basically decent person. Basically decent person. He sent-- he-- I wrote this article. And I'm going to give you two complexities in this thing. What I said in it-- and I think I told you all that-- I think I had to restart this thing to get it up on here.

What I said in this article was that lethality was a part of engineering. So we can draw lines and say that some things are too risky. We can draw lines and say if some things are unlawful. There's certain risk factors that you have to observe. And I said, but we cannot, nor is there ever any intention, to get engineering down to zero risk.

We're always going beyond what science can tell us is truthful. And in some instance-- and an instance I made the argument that we're going beyond what most ethicists if not all ethicists have tried to tell us in terms of reasoning things out. And that is to say, we engineers get into situations where you have to make a decision right away. You don't have time to think it out.

Not only that, it's a novel situation, so you couldn't practice for it. So how do you get through-- and there are systematic ways to get through this. We're not just left at the elements. But that we have to take all of that into account. Hans Mark-- didn't I tell you the story about this news article? I had to meet with these people who told me I had done this horrible thing to engineering?

AUDIENCE: You never sent us the article.

TAFT BROOME: I looked yesterday for this thing. I can't find it. I know there's a copy at home. I'll get my wife to fax it to me when we get back. I'll give you the reference for it now anyway. So maybe you can find it.

AUDIENCE: [INAUDIBLE]

TAFT BROOME: Yeah. And Hans Mark read that article. And he write it on the plane going from Washington to California. And he wrote me a letter on the plane. And when he got back, he had his secretary put a paper that he had written together and sent the whole thing to me. And he said, he just couldn't stop thinking about the article.

What he had said in his paper-- and until I get the paper-- I know where the paper is. It's in my office back at Howard. I'll bring it back when I come back up here. But so I have-- so I want to read to you what he said. But I'll tell you know what I recall what he said. And I carried it with me all of these years. What he said was that every time he gave the order to fly, there was a group of engineers saying that the flight was going to explode.

And somewhere in their arguments, if you look further enough down into it, the A, B, C, D, as to why it was going to explode, the O-rings were in there. And he said, that either this country has a commitment to go, or it doesn't.

Now, can you justify that? The important thing is that that is a hard reality. It's a hard reality. So every time-- let me see. I'll get it right now. Let's see. We've used these. You've seen enough of these. That's it right there. Let me get the lights just for a second. Thank you.

AUDIENCE: Yeah.

TAFT BROOME: This is *The Washington Post*. It's in the outpost section of *The Post*. That is me. The title is, *The Slippery Ethics of Engineering*. And this is December 26, 1986, day after Christmas, Sunday morning. And there is a picture of the shuttle-- I'm sorry, the Challenger. *The Post* got these from stock photos.

You all remember-- you all ever heard of the Bhopal case? We're going to cover that one. That was a case where the issue was whether or not the safety standards you use in the United States should be the same or higher any place else.

And this US company had a division in India. And they had lower standards over there. And there was a chemical problem. And a lot of people got killed, including little babies. So they put that in those papers. And the whole world exploded. [LAUGHS] Yes.

AUDIENCE: The image that they included with your editorial made such a difference in their response.

TAFT BROOME: Well, they said that I-- everybody said that I was saying that engineers kill people. And my response to that-- I had two responses to that. First was that, well, we don't want to do this. We don't like this. But there's somewhere in here where lethality is part of what we do. That's what Hans Mark was really saying. Now, how can you justify that, or can you justify that? I want to go into that today.

And so you can't get that lethality part of it out of engineering. For me, the question was-- I had two questions. Are we going to do engineering or are we going to change engineering to something else? Engineering as it does not have to be this. I'm not so sure it's escapable from this.

This Three Mile Island, yeah, you are all pretty young for that one too. You ever heard of it? The Three Mile Island case? You ever heard of the Three Mile Island Case? Ales, we're going to do that one too. I think that's listed here someplace.

I have a personal experience with that. I went to work with the Nuclear Regulatory Commission two months after Three Mile Island. [LAUGHS] Yes. We're going to discuss this too.

But we got some issues on the floor. I mean, how do you deal with this case that if you want to be really good and safe, that you cannot always do engineering? And tell me if you believe that's true or not. The important thing is, if it is true, what do we do about it? Can we justify it? Can we not justify it? Do we have to change what engineering basically is as a matter of discipline?

See if you can't get a hold of this. And if you can't, even if you can, I'll bring back my Xerox copy from home, but it'll be a couple of weeks.

AUDIENCE: And then we can get it [INAUDIBLE].

TAFT BROOME: And if you do get it, please tell me how you got it. *The Washington Post* seems to be reluctant to want to give back issues that go back more than six months. I tried to log on and get it-- become a member of what they call it. I forgot it what it is. But I had some difficulty, and I just gave up. Maybe you can be more successful. Maybe there are some copies of old issues in the library.

AUDIENCE: Yeah. That's where I was thinking.

TAFT BROOME: Yeah, because they have these big books, so big. And they keep all issues. And you just go back and just pull one out. And if you do that, then I'll reimburse you, whoever gets it, if you make Xerox copies for the rest of us. That's good to get you to the library. That leaves some questions out there.

GUEST What does that have to do with academic tenure?

SPEAKER:

TAFT BROOME: Oh. [LAUGHS] When this issue came out, I was invited-- I was chair of the Ethics Committee of the AAES, the American Association of Engineering Societies. I tell you what. Let me go back through this story. We got time. Let me go back through this story. Hope you don't get bored with it. But I won't make it long. The engineers were complaining that they did not have as much influence in Congress as the physicians did and as the scientists did.

And somebody told them that the physicians had *The New England Journal of Medicine* and the scientists had the AAAS, where you could get one voice for the whole of them. And that was more powerful than the engineers coming in there from the American Society of Civil Engineers, the IEEE, the AIChE, and all of those.

So they formed one group in imitation of the AAAS, and they called it the AAES. And the members were not individuals, they were the societies. And their representatives were the presidents of those societies. And they formed the board. And that board, when this article came out had a special meeting and asked me to come to the meeting. They the word ask is very polite. I had to go. [LAUGHS]

So I went to this meeting. And I walked into the room. And there's this long board table. And all of them were sitting on one side of the table. And they had this one little lone chair on the other side. And I was invited to sit there. And all of them had copies in front of them of *The Washington Post*.

Now, let me give you a little background on that. It wasn't just an article in *The Washington Post*. This thing was syndicated by the *Los Angeles Times* news service. It was reprinted in the [INAUDIBLE], the *Times*, all sorts of places. They said it was going to go out to 400 or 500 newspapers and that 100 million people were going to read it at minimum.

So the engineers really felt bad that this thing has gotten out all over the world. So when I went in there, the first person to speak was the immediate past president of the American Society of Mechanical Engineers. And he leaned across the table. And he pointed his finger at me.

And he said, Taft Broome, what you have just done has caused more damage to the engineering profession than any other single act in history. Now, that's a direct quote. Yeah, I remember that. [LAUGHS] And I stayed in there with them 2 and 1/2 hours. We went through every line.

And at the end, they went down the table. And each person had their say. And each person said what had just been-- except for the first one-- said what the previous person had said. They said that everything in here was true, but that I should not have told it. That's that loyalty thing again. It's very strong all the way to the top.

And then when it got around to me, what I told them was that how can the AAES ever presume say, to have an important say so in Congress if you don't have the power of life and death? Then I asked them, I said, how many of you all will me out for a drink? Three of them did. [LAUGHS]

When I finished the drink, got back to Howard, literally, the dean was standing in the hallway waiting for me to come back. And he said, the president of the university wants to talk to me. And I hadn't made full professor at the time. [LAUGHS] I had tenure, but I had not made full professor.

So I went to my office. I called the president's office. President got on the phone. And he said, well, I want to let you know-- and these were his words exactly, quote, "The captains of industry want your head." End of quote. I said, "I think I know what you mean by that." Howard had just gotten a chemical engineering wing gift from one of the oil companies.

And they were threatening the president with all of these things that they were no longer going to give to Howard if he did not fire me. And so I said, "Well, Mr. President"-- that's the way we talked to our president. I said, "Well, Mr. President, what did you tell them?" And he said, "Well, I told them that I would like to fire you but that you have tenure."

Now, the lesson that I learned from that was not so much that academic tenure was powerful, that the holding of academic tenure was powerful. What I learned from that was that the president was so glad that I had academic tenure-- [LAUGHS] --because look what kind of life he would have to lead if every powerful person out there could intimidate him with money.

Not only that, but 75-- sorry. 2/3 of Howard's operating budget comes as an act of Congress. And they have power over the committee that provides that funding. They were threatening to cut that off.

Now, what kind of life would a president of a university lead if he or she had to bend to the will of these powerful people every time some faculty member said something? [LAUGHS] Tenure was the greatest thing for him. No, sorry, my tenure was the greatest thing for him. That's the argument that I made.

So the point that I'm making here is that we're not dealing with some trivial theoretical-- not that I have anything-- any problems with theory. But we're not dealing with anything trivial here. This thing hit the world with a sledgehammer.

GUEST

Can you repeat, what is it that you actually said in the article?

SPEAKER:

TAFT BROOME: What I said was that-- this wasn't my original name for it.

GUEST

Of course.

SPEAKER:

TAFT BROOME: They changed that name. My original name for it was Cicero is dead. Period. Long live technology. And Cicero had said that the safe, quote, the safety of the public shall be the highest law.

And I was saying that engineering, the safety of the public is not the highest law. That was my thesis. Don't get it out here that the highest law that we try to deal with is no harm. That is not what engineering is all about. And so I went through and made that case.

AUDIENCE: So you're saying, as engineering is the highest law, it's not, do no harm. But perhaps, engineering-- but do you hold out that perhaps engineering should have that as the highest law?

TAFT BROOME: That's a good question. Now, I'm here to finish this book on philosophy of engineering.

AUDIENCE: Right.

TAFT BROOME: And one of my-- probably the biggest point I have in there is what is the highest law. [LAUGHS] I'll give you a hint as to what it is. And before the class is out, I think I'll be able to give you some of what I call the high points of that book. But what I say is that I break all learned disciplines in three categories. You can guess what they are-- regal, priestly, and popular.

And those are the points of social order. And I say, that engineering is a regal discipline. The King wants to build a road. That's why we have what they call imperative signature. Where do the imperatives come from? Not out of the sky. But from a regal point of view that says, we want to hold society in tact. And we want to do it. Ah, come on, give it a chance.

AUDIENCE: Yeah. [INAUDIBLE]

GUEST Yeah, now, see, Plato, I wouldn't call him regal, but he's the upper class, the aristocracy.

SPEAKER:

AUDIENCE: [INAUDIBLE]

GUEST It's an aristocratic position--

SPEAKER:

TAFT BROOME: Yes.

GUEST --that we're looking for, whereas the middle class may be referred to as--

SPEAKER:

TAFT BROOME: The popular.

GUEST --the popular is probably closer to the middle class, which is what [INAUDIBLE].

SPEAKER:

TAFT BROOME: And I'm trying to say what engineering is.

AUDIENCE: Yeah.

TAFT BROOME: Only in my last chapter do I start talking about what I think engineering should be. And that's out of 14. 13 chapters are laying down what I think it is and has been since day one. What it should be is a different story.

Well, this step-- we got time to just say this last point, that engineering-- I'm talking about engineering as a learned discipline. I'm talking about engineering when it got into university courses of study. I'm not talking about the pyramids. I'm not talking about the Great Wall of China. I'm talking about when those artisans met calculus and physics.

And that is the beginning of what I call engineering as a learned discipline. Why did-- on what account did people say we want these artisans to come together with physics and math? Because the military wanted calculus to do calculations on trajectories for cannonballs and other things.

So in the military, the mission is more important than the soldier. Basically, that's why soldiers get killed. So we come into engineering with a higher principle. That is-- and I call that regal. Dr. Moses would say that that's platonic.

GUEST Or aristocratic.

SPEAKER:

TAFT BROOME: Or aristocratic. It's coming in, it's saying the same thing, different angles. That when you come in from the military, you do have a higher principle than the safety of the men. It's the mission. So I-S is what I am about with this engineering should be, but maybe you all can write a paper on that.

[LAUGHTER]

I can probably tell you where you can publish it too.

AUDIENCE: Yeah. I'm just thinking about all the-- another kind of engineering that happens when members of a society or members of the town, especially in developing communities, come together and do engineering in order to make their town or society work better-- so the creation of what doesn't already exist in order to improve their lives, which it comes from the bottom up instead of from the top down. But that's not professional engineering as you're talking about it.

TAFT BROOME: What is? There are two things about that that's already come up. Two things. One is I'm going to give you a name, Richard Sclove, S-C-L-O-V-E. [INAUDIBLE] MIT PhD. He started something-- he wrote a book.

And his book tries to apply what goes-- there's something that goes on in Denmark to the United States. In Denmark, they have this concept of-- trying to think of what the exact name of it is. But it's where you have-- wait, actually, you buy engineering advice pretty much like you go to the store.

And Sclove has not written a whole lot of books. So if you look him up, you'll find, I think, maybe two or three books. And the one that I'm talking about will be obvious by the name.

AUDIENCE: OK.

TAFT BROOME: And it has a name-- it's a very pedestrian name that he has for that-- that they have for this concept. But it seems to work over there. The second thing is that I went to a conference once.

And a woman-- I gave a talk, and a woman came to talk to me afterwards. And she identified herself as the sister of-- he ran for president in the last election. He is-- what's his name. I'm having what they call a senior moment.

[LAUGHTER]

I know this guy, he ran for president.

AUDIENCE: For Democrats or Republican? No, obviously not.

TAFT BROOME: He ran as an Independent. And he has-- he's known for-- he sued one of the automobile companies.

GUEST Oh.

SPEAKER:

AUDIENCE: Nader?

GUEST What's his name.

SPEAKER:

TAFT BROOME: Nader, Ralph Nader.

GUEST Nader, Ralph Nader.

SPEAKER:

TAFT BROOME: She identified herself as the sister of Ralph Nader. And she said that in-- up here in New England someplace, there is a town. And they have the city engineer and the mayor. But the citizens have their own engineer [LAUGHS] as a second opinion for all of this stuff. And they call that community engineering, which is not out of the realm of what you're talking about is not out of the realm of what this Sclove is talking about.

So there are ideas out here about a new kind of engineering. None of them, I think, have yet surfaced as university courses of study. And to fit into what I'm talking about, that's what it has to do. It has to fit into a university course of study. Then I can talk about a new kind of engineering. But yeah, there's new kinds of engineering out there.

And some of them coming down the pipe, and some of them may hit courses of study. All you have to do is have a professor say, he or she is going to do it, or a grad student [LAUGHS] to say they want to take a course in it. So yeah, there's something coming down.

Not only that, but we have not even explored it. All I'm talking about-- notice-- all I'm talking about is the United States.

AUDIENCE: Yeah.

TAFT BROOME: There's a whole other world out there. We need to get all of us-- everybody involved. Who knows what's going on [INAUDIBLE]? Denmark is the only time I went outside United States.

So we got all of this-- all of these complexities with this Challenger case. Let's see what we can do with some of the analysis points. With some of the math analysis points. I would think that the principle that Hans Mark was making is a principle that it's a contract.

I think that Hans Mark is going to be able to point to someplace where the American public has given NASA a mission to do these things and has said, do them, and not necessarily be constrained by all of the principles of science to do them. And they certainly would not say, don't be constrained by all of the principles of ethics they're doing.

But I think that that's the way he interpreted it. That the people at NASA have a contract with the American people. And most of that contract, but not all of it, is formally made through the representation of, quote unquote, the people, to NASA.

So he's going to use a-- now, there's a term here that is going to be tricky. It would seem like a good term for this kind of contract would be what you would want to-- would be social contract.

Well, there's already the term social contract in philosophy and in political science that means something else. So let's not use that term. Let's reserve it for something else. I'll get into that at some point in time. I'll definitely get into it.

But it's a contract that he would say is what he has with the American people. And as long as this affected nobody else other than American people, then if Hans Mark was sitting here, he would say, if you don't want us to do it anymore, make some new laws. Or give NASA a new mission.

I have to apologize, but I forgot, but I had a newspaper article. And I can tell you right where it is right now. It's on my dining room table in my apartment. And I forgot to bring it. I apologize. But it's common knowledge. And I was hoping to get Sheila Widnall over here. I invited her. She hasn't gotten back to me.

But NASA, the conclusion made about this and about the Columbia from the standpoint of investigating committees out of Congress was that NASA got into these problems because it had a certain cultural problem of get things done, make the deadlines. It was a kind of a culture that pervaded over everybody. And in a sense, that is not too polite. It makes it sound like people say, well, the culture made me do it.

Well, I use that term, because I know that having used it, you won't forget it. Now that I've used it, let me say that there's some justification for that. I'm not saying entirely justified. But what happens is is that people just get in a mode of doing things every day.

I worked for NASA. I held grants from NASA for 12 years. I feel like an insider with NASA. I have an emotional attachment to NASA. But I don't think that justifies what they do. But I think it explains it.

AUDIENCE: Does it [INAUDIBLE]?

TAFT BROOME: Now, the report never said that, except for the whistleblowers, as I recall it, that there are other people who disagree with that. They just said that this whole NASA culture is-- now, saying that, if I get Dr. Widnall who's here at MIT-- I don't know if you know her.

AUDIENCE: [INAUDIBLE]

TAFT BROOME: I don't know if she'll really want to come. But I invited her. She said she'd think about it. And I invited her to talk about the ethics and the facts. But if she does not want to talk about the ethics and just talk about the facts, that's good enough.

GUEST What the culture that they are concerned about is what they call the safety culture.

SPEAKER:

TAFT BROOME: The safety culture.

GUEST And after the Challenger, there was a lot of attention paid to safety. And that eroded over time. And as you point out, the issue of time, and budget, et cetera, took over. And the safety issues became less and less important to the people.

SPEAKER:

And so we got the Columbia situation. And so there's a lot of attention now being paid to the safety issues, and how they're going to embed that into NASA, et cetera. We have another faculty member. Maybe you can get her to come. But she's only available on Friday. Her name is Nancy Levinson--

TAFT BROOME: Yes.

GUEST --who is the safety person that NASA has hired. And that's why she's only here one day a week. She's spending all her time dealing with NASA issues on how to embed this safety culture into the organization.

SPEAKER:

TAFT BROOME: Well, Nancy Levinson is going to get an invitation to either come or interact or something.

GUEST It will probably have to be in another time.

SPEAKER:

TAFT BROOME: Well, that might be an occasion where we can have our special class. Just have it on a Friday when she can come and have her lead the discussion. I worked with her once. It was with-- we've got to get ready to go. But anyway, that's where we are. I think we've covered all the housekeeping issues. Am I right?

AUDIENCE: Should we be prepared to do another case on Tuesday?

TAFT BROOME: Yes. You should be prepared to finish the Challenger case and to do the Ford Pinto case.

AUDIENCE: OK.

TAFT BROOME: OK? Good. All right.