GUEST SPEAKER: OK, Well, hello, Dr. Broome. [LAUGHS] Today I'll provide you with an overview of the work I've done for my term project on the ethics of engineering for international development. I should note that engineering for international development is not a term of art, as you suggested. But these are just the four words that most concisely describe the use of engineering to meet social, health, and economic needs in developing communities outside of the United States.

To understand my title, it might help you if I tell you that an alternative description for my talk could have been the ethics of humanitarian engineering in less developed. countries. Humanitarian engineering is the term that some engineers are using for pro bono engineering service projects in developing communities, usually in Africa, Latin America, and Southern and Eastern Asia. This term is being used officially at the Colorado School of Mines, where they now offer an undergraduate minor in humanitarian engineering. But whichever words I use today, I'm trying to describe the application of engineering to the design and dissemination of technology that meets the most basic human needs of people in developing countries, in resource-poor countries.

So I'll continue today with a discussion of the motivation for my project. What problem am I trying to solve? Then I'll bring us up to speed on some vocabulary. I'll introduce three motivating cases of engineering for international development. And these cases will serve as a springboard for a discussion of the main ethical issues that face engineers that are intervening in developing communities. Then we'll look at some possible answers to those ethical questions from various sources in the literature. And then I'll synthesize those answers-- excuse me-- and try to propose an ethical analysis that real engineers can use in the field. And then I'll test out that method on a recent case from my own experience.

So what does engineering have to do with international development? And why do we need extra study of ethics for this type of engineering? So let's start with an authoritative body, the United Nations. In September of 2000, all of the member countries of the UN signed the Millennium Declaration, which set forth eight goals for alleviating much human suffering by 2015. And these eight targets are called the Millennium Development Goals, or MDGs. They involve cutting the hunger rate in half, providing universal education, and combating preventable diseases like HIV/AIDS and malaria.

This chart on this slide is from the 2005 report on the MDGs. So every year, the United Nations issues a report on how they're doing. And this just shows you that in Sub-Saharan Africa, 33% of the people, and in Asia, 10% to 20% of the people don't have access to enough calories every day. So this is just one example of the real problems that exist in the developing world. To combat extreme hunger and other problems, the UN set the MDGs.

So now, to solve these eight problems listed in MDGs, the international community will absolutely need technologies. So engineers who create technologies are essential to the accomplishment of the MDGs. And many engineers are starting to realize this, are starting to realize that they can help the world achieve the MDGs. And they're trying to get involved. So every year, there are new pro bono engineering service projects and new faculty and student humanitarian engineering projects.

However, both the professional and the student engineers often venture off to developing countries without any ethical training, as you know, and certainly without any training in the unique ethical dilemmas that face engineers who are practicing cross-country engineering. So let's look at an example. Let's look at Engineers Without Borders USA, which is a new non-profit organization, a humanitarian organization founded in the year 2000 by Dr. Bernard Amadei, who is faculty at UC Colorado Boulder.

So the stated mission of Engineers Without Borders is to improve the quality of life in developing countries and help meet the MDGs. And their stated vision is a world where all people have access to the knowledge and resources with which to meet their basic human needs, very lofty goals. And they state that they're going to need to follow six requirements to meet that vision. And ethics, as we were talking about the other day, is one of the requirements they think they think they have to follow.

Now let's look at how they define ethics-- so the promotion of honesty, communication, and forthright disclosure, human dignity, value, and diversity, social responsibility, and appropriate action, fairness and equitable distribution of time, effort, and resources, sharing skills and resources, and promotion of the ideal that people should not be exploited in any form whatsoever.

Now these are great values. But what happens when, for instance, the promotion of the equitable distribution of time conflicts with respecting someone's human dignity? Sometimes to respect one person's dignity, you have to give them more time and more resources than other people. So there's a lot of potential conflicts here. And how are Engineers Without Borders members prepared to deal with those conflicts?

So I think this example shows us that Engineers Without Borders has indeed considered the ethics of their intervention in developing communities. And they have good intentions, but they lack pragmatism. And they lack justification. So we must ask, what are the ethical traditions? What is the justification for this code of ethics? And how is Engineers Without Borders providing its members tools to actually carry out these ambitious so-called ethics?

So this example of Engineers Without Borders unsupported ethical intentions is just one piece of the large amount of evidence that we need to do work, scholarship, to help engineers who are developing and disseminating technologies in developing communities. First, we need to do some descriptive ethics, as you helped me realize. What ethical issues are faced by those who practice engineering in developing communities? And then second, we need to do normative ethics. What should engineers do when they actually face these issues?

So before I tackle those two questions, let me pause for some definitions. So when I say international development today, I mean positive changes in the quality of life of a society and its members in both the social and economic sense, implying the right for people to access the resources of their society and the right to choose between alternative resources. When I say paternalism today, I'm referring to the attitude that one group has when it believes it can decide what's best for another group that it perceives to be less capable. And assistance is the word that is often used to describe the responsibility of more affluent countries to provide tax finance aid to poor countries. Humanitarian engineering would fall under the category of technical assistance.

So what organizations are doing these things, are using these words? We have the United States Agency for International Development, which I know you know about. And then the World Bank is owned by 184 member countries. And it provides interest-free credit, low interest loans, and grants to developing countries for education and infrastructure health. You know about the United Nations. And the World Health Organization is their specialized health agency. And then we have some non-profit humanitarian engineering organizations.

So how is ethics involved in these humanitarian engineering projects? Let's do some descriptive ethics. So here's our first case of humanitarian engineering gone wrong. As we talked about, when people from the United States learn that in developing communities some people go out into the fields to get rid of their waste, the engineers from the United States decide this is a problem, something that needs to be fixed.

And in a paternalistic fashion, they often decide that the communities need to build latrines. But they kill two birds with one stone. They suggest composting latrines. So there's a safe place for humans to get rid of their waste. And we can use that waste to fertilize the fields for farming. It sounds like a good idea, as you suggested also an old idea. Even though humanitarian engineering is a trendy term, the technologies themselves are old.

So it sounds like a good idea. But if the local people don't internalize all of the messages associated with composting latrines, all the messages about sealing and proper ventilation, the latrines turn into a disease factory, a breeding ground for flies, mosquitoes, bacteria, parasites. So the situation actually becomes much more dangerous to public health than when people were just going out to the fields to get rid of their waste. So are the engineers who install these composting latrines morally culpable?

Here's another case of a technology failing because the entire set of messages wasn't conveyed. It's what I call the 3/4 ring beam. Ring beams are continuous beams-- you probably know about this-- which sit on top of external walls to tie a whole building together to help support it during an earthquake to prevent it from collapse during an earthquake.

In one community in Yemen, engineers went in and taught the people about ring beams. But they missed the message, the essential message, that the beam has to be continuous around the whole house. And many houses were built with the beam on only three of the four walls. So now this doesn't provide any extra strength. All it provides is a false sense of security that the family will be protected during an earthquake. So again, are the engineers morally culpable?

And we looked at these pictures the other day, more evidence of humanitarian engineers failing to consider the ethical dimensions of their work. So this is from an automated flood warning system project in Honduras. And in the left photo, we talked about the fact that there's a Honduran metal worker on top of a ladder, which is supported by people in a boat on top of 20 feet of water in a rushing river. And he's drilling in the concrete.

This is not safe. What if he fell? He's installing a sensor that US engineers built and asked him to install. Would those engineers be culpable if anything happened?

In the middle, he's rappelling off a bridge in not very safe conditions. And on the right, we have a mixture of US engineers and local engineers installing a radio tower with simple rock-climbing harnesses and one person on the ground supporting them. This would not pass US safety standards. What would be the result if someone was hurt?

So for me, these three cases illustrate some potentially very bad consequences, consequences that could cause harm or destroy human life. And for me, they lead-- it's OK, just getting to the big ethical questions. So for me, these cases lead to the three categories of questions that humanitarian engineers should be asking.

First, they should ask, given the poverty, hunger and disease in the developing world and given my relative wealth and surplus of engineering skills, technical expertise, am I obligated to lend those surplus skills to international development work? On the other hand, given that I don't understand the local culture and living situations, and given that I could do harm by intervening, is it even morally permissible, acceptable, for me to go?

The second category of questions, once I decide to go, what regulations should I follow? Do international regulations take priority? Or local customs, do they take priority? Then the third category of questions is, how will I know if those actions end up being harmful or paternalistic or protective? How can I prevent the harm and the paternalism?

So now with these cases I've exemplified these questions. And I've summarized them here. Now I want to move into normative ethics and share with you some solutions to these issues suggested by a variety of experts. So first, we'll look at the first question. Is there a moral obligation to lend engineering expertise to suffering people?

Gail, I have a handout for you. There you go. So not surprisingly, philosophers have the most to say about this matter because it's the most abstract high level. In his 1972 article, "Famine, Affluence, and Morality," Peter Singer argued that humans have a universal moral obligation to contribute any surplus-- and he was talking financial surplus-- that they have toward alleviating global poverty.

Later, reflecting on Singer's position, O'Neill claims that individuals and states might not be capable of combating global poverty. Individuals and states are actually quite weak in some cases. But there might be certain professions that do have the special skills to combat global poverty. And I suggest that engineering might be one of those professions with those special skills.

Another philosopher, Pogge, supporting O'Neill, argues that the redistribution of wealth is not enough to make poor countries richer, to cause international development to happen. People in foreign affluent countries have to also change their behavior and their policies. So that might mean going there more often.

Besides academic philosophers, I think that the United Nations also has something to say about whether engineers are obligated to share their skills if they're able. One look at the Millennium Development Goals and their indicators, which are partly shown here on the slide, and one look at them tells you that technologies and engineers are essential to the success of the MDGs. So simply by signing on to the MDGs, I think that the more developed countries in the United Nations are saying that the engineers in their countries are obligated to help out. The countries have signed on. Then the people in their countries have also signed on to the MDGs.

Onto the next category of questions for the humanitarian engineer, if I'm a humanitarian engineer, what regulations, what standards, what customs am I supposed to follow? What takes priority? Well, I want to suggest that one source of knowledge for these types of questions is international law. So here is a list of international legal principles that could guide engineers who are working in cross-country situations.

A more precise document is the International Bill of Rights, which actually consists of three documents, all adopted by the United Nations General Assembly in various years. And since these were signed on to by all of the member countries in the UN, I think the articles in this Universal Declaration of Human Rights can override local customs. All the countries signed on to it.

Now onto the third category of ethical issues for intervening engineers, am I doing harm? Or am I engaging in arrogant paternalism? Or am I actually providing for the protection of well-being in humans?

So here's where academics from various disciplines have written the most. Schumacher exhorts us to acknowledge that development does not start with goods, does not start with the technologies. But rather, it starts with people and their education, organization, and disciplines. Tavis, a business scholar at Notre Dame, insists that when a person engages in a multinational venture, he or she is responsible for learning more about the local quality of life. The multinational professional must know about the circumstances of the poor in order to be developmentally responsive, says Tavis.

Finally, Harris, an engineering ethics scholar that we have read, suggests that to be ethical, the engineer needs to realize that the public is those people who are vulnerable to the effects of technology through the lack of political or financial power, the lack of information, lack of technical training, or lack of time for deliberation. And the engineer needs to be aware of all those potential lacks.

Now while these ivory tower academic arguments are helpful, I have more confidence in the suggestions from organizations that are dedicated to international development. So we could choose to follow the United States Agency for International Development, USAID's nine principles of development and reconstruction assistance. Or we could follow the World Bank's advice to rely heavily on community participation when we define technology requirements in developing communities.

Finally, we could take a cue from the Village Earth consortium or other non-profit engineering organizations. Their guiding philosophy states that technologies for developing communities should always start with a need defined by the local village. They should always rely on local supplies and know-how. The hard technologies should always be accompanied by the appropriate soft technologies like civic structure, motivational techniques, things like that. And there should always be a plan for monitoring and evaluating that technology.

These organizational guidelines are great. But I put the most stock in the words of the individual engineers that are actually making a living by working in developing communities. I trust them.

Most of these experts insist on the development of appropriate technologies. And that actually is a term of art. Appropriate technology is defined as any object, process, practice, or idea that satisfies human needs, is compatible with local, cultural, and economic conditions, utilizes locally-available materials and energy resources, and uses tools and processes that are maintained locally by the people there.

One development engineer, Fritz, gives us five criteria to test whether or not a technology is an appropriate technology. We should ask, are the characteristics of the technology close to traditional practices? Does the technology require little cash outlay? Does it have a low degree of risk? Is it comprehensible to use? And does it not endanger a subsistence lifestyle? So we have to answer yes to all these questions to have an appropriate technology.

The picture on this slide is a diagram of a screenless hammer mill which is an appropriate technology designed by Amy Smith here at MIT to create flour from grain. And the fact that it's screenless means she's taken out the screen, which is the part that breaks and needs to be replaced and is not an appropriate technology because it can't be found locally.

Eric Dudley, another professional development worker, has written an extremely helpful volume on how to do development engineering from the point of view of the critical villager, so the critique of the local villager. He tells us that in developing communities, the reason that technologies often fail is because even if they seem simple, they're based on a complex set of interrelated principles for their use. And the local people often lack some critical piece of knowledge that would allow them to grasp that whole set of principles.

So to avoid this course of events, the engineer must pass every technology through the big ideas test, the 3 R test. Could a critical villager say yes, this is reasonable, yes, this is a recognizable technology? I know it by name. I know its limits. And would the critical villager say, this is a respectable thing for me and my family to us? After passing the technology through the 3 R big idea test, then the engineer needs to look at the associated messages that are essential to the technology's success.

I've just shared a lot of information with you, a lot of advice from a lot of different sources. First, I went over ideas from philosophers and from the United Nations about the possibility that engineers might be morally obligated to provide technical assistance to developing countries if they can. Second, I talked about resources from international law that might help us set priorities for which regulation standards and customs to follow. And third, I gave advice from academia, development organizations, and individual development professionals about how to design and disseminate technologies that bring about the most good and avoid the most harm.

Now from all of these sources, can we synthesize the arguments and exhortations into one unified systematic method that humanitarian engineers can actually use to do ethical moral decision-making in the field? To guide this synthesis, I want to go back to the basics, to the great thinkers, as you were talking about, Professor Broome, of Kant and Mill. Let's see if they can help us.

So we remember that Kant's categorical imperative, to act according to a maxim which can be adopted at the same time as a universal bar. This tells us we have moral duties. Another way to state it is to act always so that you treat humanity, whether in your person or in that of another, as an end but never as a means only. This implies that decisions should be based on the freedom of every person to exercise his or her own will. I think this implies that engineering in different countries must involve listening to the local community in order to define what that will of the local person is. How can you respect the freedom of the will if you don't understand what the will of the person is?

What about Mill and consequentialist analysis? Mill's ethics is to act according to the principle of producing the greatest utility for all involved. And utility is defined as the greatest happiness, which is intended pleasure and absence of pain. This principle I think again implies that engineering and developing communities involves listening to the local communities so that we can learn what constitutes pleasure and pain for the local person.

So combining these ideas from Kant and Mill and the other expertise I reviewed today, I want to propose the following method for humanitarian engineers to use to do ethics in the field. So first, we have to start, engineers who have relative wealth have time to take off from work and family and the means to travel should just consider, can their engineering skills be lent to the human needs in developing communities?

If they consider that and decide yes, before initiating a project, humanitarian engineers should consider how their potential project might infringe upon the rights of the local people and of others involved in the project. So that's using Kant's respect for the freedom of the will of other people. Then if they decide that it is indeed morally acceptable to engage in the project, then as the technology is designed and disseminated, they should constantly be checking that technology against the criteria for appropriate technology, the criteria that we went over.

Furthermore, they should periodically pause and reassess all that they've learned about the local community, because that's the audience for their actions. That's the audience. And they should reapply an act utilitarian approach. So this is bringing Mill. What are the consequences of my actions now that I know more about my audience? If the consequences change, the outcome of the act utilitarian analysis change as we learn more, do more listening to the local people.

So to wrap up, let's test this decision-making approach on one more case. Water chlorination in Honduras-- so here's the problem. Villagers get their drinking water from surface streams up in the mountains. They're gravity fed down to community storage tanks. And the surface streams are becoming increasingly contaminated by waste up in the mountains. Humans live there now. There's lots of cattle there. So these surface students are susceptible to pathogens.

There are hypochlorinators on top of the water storage tanks. So this is supposed to be a tank to hold super concentrated chlorine solution to disinfect the water. However, these tanks do not allow for reliable flow of chlorine into the tanks. The community has decided that they don't work and they're not using them.

And so the people are drinking contaminated water. And children are getting sick, especially children from birth to age five, with water-borne diseases, diarrhea. So potential solution that US engineers could help with is to first analyze exactly what the contamination level of the water is so that the villagers know how much chlorine they need exactly, and then to install an adjustment to the hypochlorinator, a flow regulator made out of simple materials, and then to teach the local plumbers better chlorination practices. That's a potential solution.

Let's use this systematic method for doing ethics in this situation. First, should I go? Let's assume I'm the engineer. He's deciding about this. Can my engineering skills help in this developing country? Well, I think that with my knowledge of water treatment engineering, I might be able to prevent some water-borne disease. So I think I'll go.

Well, then the next thing, before initiating the project, I need to consider what rights might be infringed upon by this project, what local rights. So by going and working on water chlorination in this community, I might infringe upon the plumbers' rights not to be defamed. So by going and saying this is a problem, it's not working, I'm telling the community that the plumber is doing something wrong without the plumber having a say in whether or not I say that to the community.

I think I could also infringe upon the villagers' rights not to be deceived. What if we do this bacterial analysis of the water? But we don't have great sanitary conditions. It's hard to keep things really clean in this environment. What if I misdiagnosed the contamination level of the water and then I tell the villagers a wrong contamination level? So they're being deceived about how safe or unsafe their water is.

I think I might also infringe upon the villagers' rights not to suffer from broken promises. So we might come in and help them learn about this technology and install it. But what if it stops working because of lack of maintenance after we leave? The villagers have been promised clean water. They're now drinking their water. What if it becomes not clean, not safe anymore? Promises have been broken.

So those are some of the rights this project might infringe upon. But I also have to consider what rights are being infringed upon now without any intervention. So I would say that the villagers' right to bodily integrity, to health, is being infringed upon. Because they're told their drinking water is OK, but it's really severely contaminated.

The villagers' right to informed consent is being infringed upon. They don't know. They're not informed of the health risks of drinking water. And the villagers' right not to be deceived or cheated, I think, is being infringed upon. Because they're paying for chlorine. They're paying a water tax. And they're receiving water that is making their children sick.

So I decide that the rights infringed upon by not intervening are more severe, more severe rights infringements than the rights infringements that would occur by intervening. So I decided to go, to go do this water chlorination work. And my engineering plan, let's say, is to do bacterial analysis and to add this flow regulator to help the local plumbers learn how to build these, learn how the technology works, and install it in their tanks.

Now I need to constantly check. Is this technology appropriate? So let me describe this for you. So the problem is this is just a big storage tank with a hole at the bottom that's supposed to allow chlorine to flow into the water tank. Well, the flow rate out of the hole decreases as the amount of solution in the tank decreases. As the pressure had dropped, the flow rate drops. So we don't have a constant flow of chlorine.

This is just a plastic tank, an upside-down gasoline tank, with a toilet valve coming from the big tank. So chlorine flows into this tank through a toilet valve. The bulb, the floater bulb on the toilet valve, when that floater bulb changes level, more chlorine solution is added to the small holding tank. So this allows a regular flow of chlorine into the water.

So that's what we would call the technology. Is it appropriate? Well, let's apply those five criteria. So are its characteristics close to traditional practices? Well, if you consider the traditional practice of adding chlorine solution to the big tank, then all we're doing is adding another step in the middle. So you could say it's close. On the other hand, this is a totally new step. Maybe it's not so close to traditional practices.

Does it require little cash outlay? Yes. The answer to that is yes. All these materials together cost only $10. And you just need them once. They're already buying chlorine.

Does it have a low degree of risk? Well, we're not introducing any new risk into the water system. Is it comprehensible to use? Well, I think that depends on the training that we give to the plumbers and the local people. So that's a question we need to keep coming back to.

Does it not endanger a subsistence way of life? I don't think so. It's not really associated with that. So those are the criteria for appropriate technologies.

And then as we learn about the community work there with them, we need to pause every once in a while and consider the consequences of this engineering action, so do an act utilitarian analysis. One example is that we might learn that the plumbers, when they clean out the storage tank with chlorine, are not wearing protective gloves or masks. So we learn that they're in this tank. And they're not protecting themselves from this super concentrated chlorine plume that's around them that's corrosive.

So that might tell us that our decision not to do training sessions on the maintenance and cleaning for this chlorine solution but just to focus on this system, that might tell us that that decision is unethical. Because we're telling the plumbers to use chlorine but we're not passing along the messages of safe use of that chlorine.

So that's just a sampling of how I might use the possibly systematic method of doing ethics in the humanitarian engineering environment. There's certainly more work to do to perfect this method. First, I would suggest that we survey all the humanitarian engineering organizations in the US, those like Engineers Without Borders, et cetera, and collect what their ethical guidelines and considerations are, so understand what people are assuming is the standard and find out if people have the tools that they need.

Then I suggest we collect more case studies of humanitarian engineering projects that have caused harm and then apply my suggested systematic method for doing ethics to those case studies and see whether or not applying that ethical tool would have prevented the harm that these projects have done. And if we find that this ethical tool, decision-making tool, wouldn't have prevented the harm, wouldn't have pointed out the harmful consequences, then improve upon this method, add new techniques for doing moral decision-making.

So to conclude, let me just summarize what I've talked about today. I explained why the ethics of engineering for international development is an increasingly important issue, that engineers are getting more and more involved in this. The international community has said it's important but we're not providing training.

Then I presented three cases where ethical dimensions had been neglected by engineers. Based on these cases and the literature, I identified three main categories of ethical questions that face engineers who go into developing communities to try to help. Then I reviewed potential answers to these questions from philosophers, development organizations, and individuals. And then I combined these ideas with the ideas of Kant and Mill to propose a systematic moral decision-making tool for real engineers, college students, professors, professionals on vacation time, to use in the field. And that is the end. Yep. Thanks.

TAFT BROOME: [INAUDIBLE]

GUEST SPEAKER: Oh, yeah, of course, if we have time, I'd love to. In your slides, there's my references and then the Universal Declaration of Human Rights which I talked about. I wanted you just to have that in case there were any questions about that.

TAFT BROOME: Can you-- on your first sheet--

GUEST SPEAKER: Yeah.

TAFT BROOME: Also known as, a.k.a. At this Colorado School of Mines, there's this course called humanitarian engineering.

GUEST SPEAKER: Right. It's a minor, so it's several courses.

TAFT BROOME: Several courses?

GUEST SPEAKER: Yeah, they started it. There's actually an ASEE paper. There's a couple of papers on their efforts to start this minor in humanitarian engineering. I think it's about three years old. So it's courses, the technical, how to design appropriate technology. And there's the cultural dimensions. What is the history and politics of Honduras, for example? They can choose from a variety of more politics and geography and history classes. So it's a combination of the technical and the humanity.

TAFT BROOME: Does the name Carl Mitcham mean anything to you?

GUEST SPEAKER: I haven't heard that name or seen it on the--

TAFT BROOME: He's at Colorado School of Mines.

GUEST SPEAKER: OK.

TAFT BROOME: He might be the-- well, I think that he is the preeminent scholar in the United States on the philosophy of technology. He's an ethicist. But he does philosophy of technology.

GUEST SPEAKER: OK, I didn't.

TAFT BROOME: He's teaching philosophy. But he mainly does philosophy of technology.

GUEST SPEAKER: Huh. OK.

TAFT BROOME: And I'm wondering if here's anything to do with that.

GUEST SPEAKER: I'll have to look that up.

TAFT BROOME: Actually, I'll be phoning him next week. If you're around MIT in September, he'll be up here.

GUEST SPEAKER: Oh, great. I'll be in Boston still.

TAFT BROOME: [INAUDIBLE]

GUEST SPEAKER: OK. Yeah, in the NSPE, their newsletter, they're September 2005 newsletter, there's an article about the program at Colorado School of Mines actually. So I meant to put that reference somewhere. Again, it'll be in my paper.

TAFT BROOME: On the slide, motivation for the project--

GUEST SPEAKER: Yeah.

TAFT BROOME: --ethics is defined by EWB. Now I don't know what to offer here except an observation.

GUEST SPEAKER: Yes.

TAFT BROOME: And that is that you might have noticed in many of the engineering codes of ethics, there's such a thing called super principle. They will say which of these principles was more important than the other.

GUEST SPEAKER: Right.

TAFT BROOME: And that principle is usually the health and welfare of the public is paramount.

GUEST SPEAKER: The paramountcy clause.

TAFT BROOME: So I don't know what to do with those bullets there. But it would be nice to know if any one of them's is considered by the EWB as more important than the others. That gives you a fallback position in case you've got conflict.

GUEST SPEAKER: Right. That's what I think they need, that's why I put this in the motivation. They have this list. But how are they following it? What takes priority? So they don't have a paramountcy clause listed in their code. They just list these things.

TAFT BROOME: Would you be inclined to make that recommendation in your paper?

GUEST SPEAKER: Yes, that's a good idea. For organizations that are doing humanitarian engineering, they need to consider what values and ethical principles they want to follow. And they also need to provide a paramountcy clause. Yeah, that's a good idea.

TAFT BROOME: Unless they've done it like a philosopher. They deduce principles, to deduce concepts from a single principle. Unless they're going to do that--

GUEST SPEAKER: I mean--

TAFT BROOME: --which is not what they did here.

GUEST SPEAKER: Yeah. They state their vision. But I don't know that you can deduce moral decision-making from the vision that the world should be--

TAFT BROOME: Frankly, I don't think that organization is capable of that. Because people came together with slightly different motivations and mission. And to hold everybody together, you pretty much say, well, let's list down the things that we can agree on as a group.

GUEST SPEAKER: Right.

TAFT BROOME: And those things are not necessarily divisible from a second principle.

GUEST SPEAKER: They don't work like that.

TAFT BROOME: They need a startup principle.

GUEST SPEAKER: Yeah. Right.

TAFT BROOME: OK, so that's fine. But you as an analyst might be able to offer something to them. Because even in the case of engineering codes, which are collectively decided upon, they are able to reach out one of them if they can say, go to this one in case there's a conflict [INAUDIBLE] be others. That's kind of helpful. So that would be a good--

GUEST SPEAKER: It's like a recommendation.

TAFT BROOME: Recommendation for you. Let's see.

AUDIENCE: I'm looking at [INAUDIBLE] trying to see which one the--

GUEST SPEAKER: I know. I mean--

TAFT BROOME: You cut across me.

AUDIENCE: I'm sorry.

TAFT BROOME: I'm getting off here.

GUEST SPEAKER: Did you hear what she said?

TAFT BROOME: No.

GUEST SPEAKER: She said, which one would you pick of these-- if these were the ones they're stuck with and they need to prioritize.

TAFT BROOME: Well, I'll tell you which one. I have no doubt about that-- the second one.

GUEST SPEAKER: Yeah.

AUDIENCE: Yeah

GUEST SPEAKER: But what if there's one human who insists that adding, doing anything to water besides just scooping it up from a stream and drinking it, that doing anything else to it is harm, is which doctoring, whatever? If there's one human that believes that and then there's a child who's drinking this water and getting sick, which of those two human, respecting human dignity?

TAFT BROOME: The notion of--

GUEST SPEAKER: But that involves life, I guess.

TAFT BROOME: Yes. Notice that when I said human dignity, I'm leaving out the other parts. I'm just talking about human dignity.

GUEST SPEAKER: Dignity, which implies, yeah.

TAFT BROOME: The concept is that you should be able to treat everybody with high degrees of human dignity under all situations. There should be no conflict in the ability to treat everybody as a person.

GUEST SPEAKER: What do we do with criminal people?

TAFT BROOME: You should respect them. You respect them as persons. You put them in jail. But then you give them clean facilities.

GUEST SPEAKER: Right. So respect their most basic needs.

TAFT BROOME: Well, I want to [INAUDIBLE]. What is it that causes a person to be a person? That's a rhetorical question. There's some things that cause a person to be a person. And some of those things rise above what you would say causes an animal to be a mammal. So there's something about being a human being.

Now we can go to philosophers. We can go to biologists. We can go to theologians. We can go all over the place. The point is you should be able to come up with a few things that says what a person is, something you can defend. I'm not saying for the paper. I've actually responded [INAUDIBLE] first, not yours.

So you should be able to say and then give everybody equal deference when it comes to those two things, no matter what the circumstances are. And don't rob them of their humanity. OK?

And one way to do that is with Immanuel Kant's notion of do not use a person as a means to an end. I can do that with anybody. I don't care who the person is. You can bring in Idi Amin. You can bring in Adolf Hitler. I can still treat them--

GUEST SPEAKER: As an end in--

TAFT BROOME: --as ends in themselves and not means to my ends. I'll put them in jail. I'll do a whole lot of things with them if I have the power to do so. But I can still say that I am not using you to advance my own self.

AUDIENCE: Do you think that there could maybe be a fine line between robbing someone of their humanity like we discussed and infringing on someone's cultural beliefs?

TAFT BROOME: Yeah.

AUDIENCE: I think there's a fine line. Yeah, because I think you did a great job addressing that and dealing with that. So I think there is a fine line.

TAFT BROOME: There's nothing magic, I think, or morally compelling about culture. I mean, culture is just things that you do and value and have done as a people. And we can think of some cultures that need to change.

GUEST SPEAKER: Right. Right. Now, that's [INAUDIBLE] argument.

TAFT BROOME: Yes. So I think that culture is probably one of the most important terms we could ever use we're talking about collectivities of people, particularly when we're talking about clashes of cultures. But there's nothing sacrosanct in culture in and of itself. But human dignity, I think, is something that can be observed. It's like Kant. I mean, this is a logical thing. You can observe it all the time with everybody.

AUDIENCE: I just had a couple of comments, things that [INAUDIBLE].

GUEST SPEAKER: You didn't get to see all the pictures.

AUDIENCE: I'm so sorry. I was stuck behind a disabled train. And the whole time I'm like, oh, no. I'm going to miss [INAUDIBLE] presentation on the green line. You know the green line is slow anyway.

GUEST SPEAKER: Oh, no. Oh, that must have been so frustrating.

AUDIENCE: It was so frustrating.

GUEST SPEAKER: Well, here. So these are the pictures. You can didn't the latrines, did you? So I was talking about here's more examples of cases that are supposed to be humanitarian engineering interventions but where some ethical dimensions were missed. And there's either potential for harm or harm itself.

So this idea of composting latrines that is a famous, a favorite appropriate technology. US engineers discover that people are having to go out into the fields at night to defecate. They say, you need a latrine. You need to have a safe place to do this. And let's make it a composting latrine so we can use your waste to help your fields as well. But if they don't convey all the messages about ventilation and sealing of the latrines, then it becomes a disease factory right next to the house. So this was one example.

Another one is these ring beams, which are just a continuous beam all the way around a house, all the way around the external walls, to help support it during an earthquake. So it makes all the walls work together. But in Yemen in one community, the local people missed the message that the most important part of the technology is that it's a continuous beam. And so they just built all these houses with beams on just three walls. And so then no extra strength is added. You're just giving them false sense of security that their family is going to be safe. So that was another one.

And then these are from the Honduras project. And this slide is really about the ethics of engineering practices like construction. And so we're installing sensors and radio towers. And in the left, it's blurry. But there's a Honduran metal worker on a ladder. He's drilling into concrete. The ladder is supported by people that are on a boat, which is floating on 20 feet of water in a rushing river.

And then in that one, he's rappelling off a bridge. And in this one, they're like using rock-climbing harnesses to construct a radio tower. So nothing bad happened, but what if something had? He would have been responsible. So those were the pictures you don't see.

TAFT BROOME: Let's see.

AUDIENCE: I like where you presented your analysis of the dynamic process so that you just don't put a technology out there, saying, this is good [INAUDIBLE]. Because things are changing. [INAUDIBLE] developing countries. And so I think that [INAUDIBLE].

GUEST SPEAKER: Yeah. I'm glad you pointed it out. Because that was something I hadn't articulated before I did this project, like the continual checking instead of just a needs assessment up front.

AUDIENCE: [INAUDIBLE]

TAFT BROOME: I have see some minor stylistic things--

GUEST SPEAKER: Sure.

TAFT BROOME: --also. The case for the chlorination, the slide actually, the one that shows the tank.

GUEST SPEAKER: Yeah.

TAFT BROOME: No. It says-- yeah, that one, the community water storage tank. This is stylistic. It would be good to have some sense of the dimensions.

GUEST SPEAKER: OK.

TAFT BROOME: You know, it was like if a person was standing there, you could tell-- how high is that tank, by the way, anyway?

GUEST SPEAKER: So it is-- I can see a person here.

TAFT BROOME: Is there a person there?

GUEST SPEAKER: If I stand next to it, I come up to like-- this is how tall I would be.

TAFT BROOME: OK.

GUEST SPEAKER: So it's [INAUDIBLE].

TAFT BROOME: An easy way--

GUEST SPEAKER: It's like 20 feet tall, 10 meters? This is 1 meter.

TAFT BROOME: OK.

GUEST SPEAKER: That's 1 meter. So that tells you. So it's not 10 meters. It's like 5 meters tall.

TAFT BROOME: OK. Whatever you decide to do with this after you've heard this comment may be the right thing.

GUEST SPEAKER: That's a good comment though.

TAFT BROOME: Yeah, sometimes when I'm watching these documentaries on television and they have a bone on the ground, they don't have a pencil sitting beside the bone.

GUEST SPEAKER: Is it a dinosaur bone? Is it--

AUDIENCE: Chicken bone? What is it?

TAFT BROOME: Chicken bone.

AUDIENCE: Yeah, you don't know. [INAUDIBLE].

GUEST SPEAKER: Yeah, I didn't put captions on any of these pictures. So this is from my trips to Honduras. And if I had more time, I would have talked about this practice. So we're doing a bacterial analysis of water here with a really cool-- another appropriate technology [INAUDIBLE] MIT, a cheap way to test water. And it turned out great for us when we did blanks. So when we put distilled water through the process, we never found bacteria, which is a check on our procedure.

But there's still the potential. I mean, it's not a lab environment. We're just in a meeting room, you can see. It's not the cleanest place to be doing water analysis. But there's lots of issues. Are there stylistic things, Professor?

TAFT BROOME: Well, some more stylistic observations.

GUEST SPEAKER: Yes.

TAFT BROOME: One is that philosophers are hesitant to say, we'll solve the problem. We engineers always say we solve the problem. So it's not a question of being apologetic. It's a question of knowing that whatever response you have to a problem is justifiable. You can justify it. But somebody else may have a different response that's equally justified.

Because in philosophy, there's no hierarchy of decision making. And an engineer, you cannot build a bridge 10 different correct ways. Doesn't matter if your way is correct or not. We have to decide on one way to do it. In philosophy, there's no bridge.

GUEST SPEAKER: Right.

TAFT BROOME: So whatever you decide to do with that word, even if you decide to leave it in--

GUEST SPEAKER: Just the word of solve or solution?

TAFT BROOME: Solve or solution.

GUEST SPEAKER: OK.

TAFT BROOME: Just be aware that there's this academic cultural difference.

GUEST SPEAKER: Is there a term of art that's used? Or is there [INAUDIBLE]? I mean, what would you say I--

TAFT BROOME: You say, well--

GUEST SPEAKER: A suggestion or proposal or something?

TAFT BROOME: I've analyzed the problem. And here's my recommendation, is-- they'll say, here is my conclusion and my justifications for that conclusion. But I'm not suggesting you change your language. You just have to be aware that when you deal with-- well, in a sense, we're talking about cross academic cultures.

GUEST SPEAKER: Yeah.

TAFT BROOME: All right, and depending on who your audience is--

GUEST SPEAKER: You think about how they perceive the words.

TAFT BROOME: Yeah, these words, I used to get in a lot of trouble with that all the time. As a matter of fact, I had a paper rejected once. Oh, I get a lot of papers rejected. But I had a paper rejected. And the reason was that I reference one of my own papers. And I referenced it by using my last name, Broome said.

And they said, Kant said. And they said that Newton said. But Broome doesn't say, like who are you to be saying? You know, what you do is don't reference your own name.

GUEST SPEAKER: You have to reference the paper.

TAFT BROOME: You could reference the paper.

GUEST SPEAKER: But do you use the first person then? Do you say, I said? Or you just--

TAFT BROOME: If you have to say I said, you do. But you try to say, in this paper.

GUEST SPEAKER: And just say-- they rejected it totally?

TAFT BROOME: Well, I turned it. I erased it and sent it right back. And they published it.

GUEST SPEAKER: Oh, OK.

TAFT BROOME: They rejected that. I mean, you can't be going around using your name like Aristotle. Who do you think you are? Well, in engineering, that's what we all do all at the time. I mean, you're writing a paper that's built up from another paper.

AUDIENCE: Well, you cite your own paper. No problem.

TAFT BROOME: And there was another one. Oh, another one-- you used a term of art correctly, but it is problematic. And that's paternalism.

GUEST SPEAKER: OK.

TAFT BROOME: Now, I'll tell you what's problematic about it. You'll never hurt anybody's feelings if you use the word paternalism. You use the word maternalism, and you've got a problem. A lot of people don't like that like that term. Because it's negative.

GUEST SPEAKER: Paternalism isn't always negative?

TAFT BROOME: No. No. It's not taken that way as negative. Maternalism is.

GUEST SPEAKER: I've never heard anyone use maternalism.

AUDIENCE: Neither have I, I have to say.

TAFT BROOME: Well, that's because over the years, we've ironed that out. But that was a long time, about 20 years, when that was a term that could cause some problems. It makes it sound like maternal is bad. Paternal makes it sound like it's bad. But nobody's offended by it. No men are offended.

GUEST SPEAKER: Right, but using maternal in a negative light is like putting down someone's mother or something like that. So do you suggest I make any changes?

TAFT BROOME: No, I wouldn't suggest you make any changes at all.

GUEST SPEAKER: OK.

TAFT BROOME: But you definitely have to be aware.

GUEST SPEAKER: OK.

TAFT BROOME: Because that's a term of art. But you just have to be aware that if you're going to use paternalism, don't go around later in the same paper and use maternalism negatively.

GUEST SPEAKER: OK.

TAFT BROOME: Because you're going to run into some issues. And I think you are on solid ground.

AUDIENCE: I like how you broke it up into what the philosophers say and the organization.

GUEST SPEAKER: Oh, really?

AUDIENCE: And then the individuals in the field.

GUEST SPEAKER: OK.

AUDIENCE: I think that.

GUEST SPEAKER: Good. I'm glad. That was the hardest part of this because there isn't one body of knowledge on engineering and developing communities. So I pulled from a lot of different kinds of sources. And at first, I was just arranging it all just by philosophy, organizations, like individuals. And I didn't have those three categories of questions. And it was just kind of a mess. It was like I was just telling you what I read without organizing it at all. So then I did, OK, well, let's have categories of questions and categories of potential conclusion, potential solutions.