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Antonello: What about the idea of progress?

00: 00: 42: 14 Well, certainly we can ask about progress in many different dimensions, if we're thinking about progress in terms of knowledge. It certainly looks as though, starting from a certain point, we know more. Our science has given us more knowledge of the natural world than we had, say, in the 17th century. Modern science has expanded our knowledge of the world, at least in a particular way. After certain kinds of questions, then it expanded our knowledge, we know more in some way. So if knowing more, I mean, if more means progress, if bigger is better, then there's been a certain kind of progress. And if we think socially, I think again it depends on what progress means, I think that there.....that certainly, ideal participatory democracy have greater currency today, then they might have had, say in the 17th century. But I think in terms of the realization of those ideals, I'm not sure that we're any further along, we certainly have an illusion in this country of the realization of those ideals. 00: 02: 18: 21 People like George Bush are patting themselves on the back for being responsible, or American ideals being responsible for the current rejection of authority in Central Europe. I think that's nonsense, I think this country has managed quite cleverly to convince all of us that we are participating in an experiment in self-government, when in fact, we're not. Our ideas are manipulated by the media, so we think we're self governing, when we're not. I think that in some ways there's progress, there's progress in the sense that there's greater lip service paid to certain ideals, but when we look at the respect in which those ideals are implemented, I don't think we live in any more of a generally democratic environment, than we did under.....that's exaggerated but, let me put it this way, that the extent to which we've managed to realize ideals of participatory democracy, is not really as broad, or as deep, as widespread as we'd like to think.

Just because people vote in this country, maybe 51 percent of the population votes, this is not democracy. 00: 04: 02: 17 Now another respect in which we might ask about progress, is in terms of the material well being, members of society. And again I think it really depends on where you're looking. The material well being of certain numbers of the society is certainly increased, diversified, but ...and I think some basic aspects of public hygiene are better. I think we understand, we understand the importance of hygiene more than we did earlier, so the necessity for clean water supply, for example, is better understood in this country.

And that's responsible for, I think, in general improvement in quality of health in the population. But this is a country which has terrible extremes of wealth and poverty, in the quality of life for very large segment of people in this country is not very good. We have items that might be coveted in other parts of the world, little bits of plastic, bits of plastic that break, radios for example are widely available. But in terms of peoples' ability to live a meaningful life, that's very true for themselves, again, I don't think we've come very far at all. So I think progress, it really depends on where you're looking and how you're defining it. In some ways you can see progress in other ways, I think there's no progress at all, if you look very carefully, particularly, you look at the differences between social classes. --- LONGINO BETA 104A

Antonello: ...we have more knowlege...? 00: 07: 05: 10 Well, that's a good point, no. Only a small cast, if you will, actually has more knowledge. Antonello: contradiction between knowing more...majority of people? 00: 07: 34: 21 Well, so you're asking about the contradiction between, there being somehow more knowledge in the society in some sense, and that really not effecting the lives of a majority of the people in this country. I think it's interesting to think about this, for example, in connection with the source of things that Jacob Brunowski argued in his book, Science and Human Values. Because one of the things Brunowski said, is that science is, or science has developed in Europe in the context of the scientific revolution, is a force of democratic values and ideas. What we've seen is, in the 20th century, a real flourishing scientific research. But I don't think that it's had the effect on society that Brunowski thought that science as he imagined it would have. And Brunowski thought that in order for science to flourish in a society, that society itself will of necessity become a democratic.

The values of truth will prevail in that society, the values of participation, community, criticism and so forth. 00: 09: 07: 00 But that's really not what's happened. We have, I think, the emergence of a scientific and technological elite, a concentration of knowledge in the hands of a certain number of college educated, actually, graduate school educated individuals. And the vast majority of people in this country are scientifically and technologically illiterate. One of the problems that this produces, I think, is an illusion of the, about the character of knowledge that is produced by those scientific elites. As long as knowledge is concentrated in those hands, it's possible to preserve the illusion that the

procedures of science, the methods of science are dis-interested, impartial, value-neutral ways of discovering the nature of the world, the nature of the universe. Information that we can then use in whatever way that we want. As a few critical voices has come into the sciences, we can see that that's really not the case, that the sciences produce an impressively coherent way of thinking about the world, (??) sciences have produced an impressively coherent way of thinking about the world. But that, it's really not the only way we can think about natural processes or the objects of the world. 00: 11: 08: 03 So this inequality of knowledge, I think, has given a tremendous amount of power to the scientific elites. Because those who might have an interest in challenging power, don't have the information, don't have the tools with which to challenge. The tools are a necessity are going to be some understanding of science itself. And as long as that's limited to a certain cast, thea certain crucial avenue of criticism is going to be closed off in the sciences, that the sciences will easily continue producing knowledge of a certain kind. And expanding, so there will be again a solution of progress, as we were talking about earlier. Expansion of knowledge of a certain kind, and no attention to other kinds of questions that might be asked, you might be asking, no attention to other sorts of overall frameworks within which we might try to place our inquiries, which might give us a very different understanding of natural processes and of our own place as human beings in the natural world. 00: 12: 35: 13 So, I'm not sure what else I want to say.....I think there's a ...we have to go back to what I was saying earlier, there's a terrible contradiction between this illusion of more knowledge on the one hand, which is both more knowledge but it's not more knowledge in the way we think it's more knowledge. I think we think that science has had, in some absolute way, expanded our knowledge of the world. And what we fail to see, is that they've only expanded it within a certain paragon to use a new word..within a certain framework. Asking some particular set of question, some questions are being answered and other questions are not being answered. At the same time, while there is this expansion of knowledge that enhances the power of certain cast or classes in society. There's adiminishment of the, both knowledge and power, many segments of the society in which we live and this happens through, I think, bad schooling or non schooling. And it also happens through the intersection of consumerism and media that distracts people, and provides certain rewards for.. it's like bread & circuses of the Roman period, just keep people occupied and amused, and keep them from seeing the ways in which they're being cut out of very important decision making processes, that will ultimately have very severe impact or have the impact on their lives right now.

It's not until something like a Love Canal; it's not until the toxics start bubbling up in the backyard that ordinary people start questioning science and technology. And by that time it's too late, the damage has already been done. --- LONGINO BETA 104A Antonello: What is the relationship between science and technology? 00: 15: 23: 16 Well, I think that there's much less of a division between science and technology, than there was before, say, and I do think thatas you were saying earlier, the second world war, the Manhattan project, this kind of massive organization of scientific person power, if you want, towards the production of one object-the bomb. It changed the way we think of the sciences, and I think we came to see the sciences as a source of, much more directly as a source of power and as a source of technology with which we might manipulate change, and alter the world. So that the technologies that we have today are much more science dependent, but the technologies are supported are science dependent. And the science that's done is much more oriented to applications, certainly than it was, say, in the 19th century. And in the 19th century you still had the idea of...a masculinist ideal, but they're gentlemen scientist. I mean, somebody just trying to understand the world for the pure pleasure or the pure gratification of knowledge. 00: 17: 08: 05 I think now, we don't give ourselves the luxury of engaging in, inquiry for the pure pleasure of inquiry. Our funding agencies demand certain outcomes of scientific research, you can't get work funded unless you can show that at some point, in the not too distant future, there's going to be a practical outcome of the work. So, we're harnessing scientific inquiry to technology, I think. Now there's another connection here, is worth talking about. That is, that the technologies that gave favor, tend to be...sort of technologies that have been supported in this country, are technologies that are particularly dependent on certain kinds of scientific research. For example, there's a much higher level of financial support for research into nuclear power, than there is dedicated to research into solar or wind power. In thinking in terms of medicine, again, we're starting to think about human health in ways that are technology dependent and dependent on technologies that are themselves the product or outcome of certain kinds of scientific projects. I'm thinking here of that whole complex of activities in the life sciences connected with the genetic engineering; the Genome Project is being sold to the public as the source of technologies, it's a knowledge base for technologies that will prevent certain kinds of disease.

Again, I think there's an interesting connection here between the kinds, the way we're thinking about technology, the way we're thinking about the role of technology in our lives and the kinds of science that are producing those technologies, it's kind of BIG science, industrialized science. As the Genome Project and the atomic bomb project were --- LONGINO BETA 104A Antonello: Why is more money given to nuclear energy research than solar energy? 00: 20: 35: 13 Well, I think that more money goes into nuclear research, than into solar, wind power research because, this may sound like a paranoid theory of decision making, but I think that nuclear power requires a

concentrated, using nuclear energy as a source of power, as a source of electricity power requires the, a single, the concentration of the source of power in a single location. Obviously, you have a number of locations distributed through the country, but contrast that with solar power or wind power, where you could have the sources of power much more widely distributed; so, I think that we, it's not that we have a kind of model of how power operates, but it comes from some center, and it radiates outward. But that...as long as the source...I mean, electricity is crucial to the way we live in this society.

As long as the control of electricity is restricted in the ways that it is in nuclear power, I think that, in general, power is restricted. That it is our ability to do things, do all the kinds of things we need to do with electricity, is dependent on those sources. So we are dependent on those sources. So if we have our own little solar battery, we're not dependent on Pacific Gas and Electric, we're just dependent on the sun. So we're much more self sufficient. I think that, nuclear energy promotes the kind of dependence on central sources of power. And I, quite frankly, I do think that that's one of the attractions of nuclear power to the decision makers. That is, it maintains and promotes a inequality of power, a division of power, a concentration of power in the hands of a certain elite. There are also the obvious connections between nuclear power and the weapons industry. The by products of nuclear power plants are used in the production of nuclear weapons. I don't know what's going to happen to that connection if detente is real, peace is really breaking out, I don't know what's going to happen to the arms race. It's anybody's guess at this point....maybe we'll invent a new enemy ha-ha... Antonello: 00: 24: 54: 09 Yes, I do think that scientist are new priest. As human being, I'm not an anthropologist, nor am I a psychologist, but as I look around me, I think that as human beings we look to impressive figures in our society as sources of value. We look to people who are held up as models of achievement, and in a religious culture it was those who somehow had access to God, somehow had a special access to divinity however that was determined. However was determined that one had that access, we now live in secular cultures in spite of the fundamentalist christians. Who have their foothold in the White House here, but scientist, ...it's scientist now who have access to something. If there isn't a God, well there's at least the universe. There is natural processes, natural relationships, the powers that we see is in thunderstorms, and in the atomic bomb. So scientist do have a kind of power, not from God, but from their knowledge. And so I think we have made them, we have made scientist into priests. I'm not sure of what it is that we worship, with the help of these priest, but we look to scientist and to the sciences as sources of value. And I think that's where we hope to find some, ... Again, because we think of the sciences as impartial producers of knowledge, we look to the sciences as somehow impartial producers, or impartial sources of value. So with the values that are, in some way, encoded in the sciences, are the values that come to have legitimacy in the larger culture. --- LONGINO BETA 104A Antonello: What about the social implications..about learning in this system....? 00: 27: 41: 14 Well, the social implications of this are multiple, and we can talk about them at many different levels. When ...you might say something of a crude level, but the kind of scientific research that I looked at most closely, is research on the biological basis of behavior. And I've been looking, particularly, at research that attempts to show that gender differences in behaviour and incognition, as well as sexual orientation are outcomes of physiological processes that occurred during fetal development. Levels of hormones that program the brain in certain ways. Now, what this research does, and this research as I'm sure you know, gets written up in newspapers all the time. We have headlines on the front page about the latest findings within this research paragon. Whether it's about women in mathematics or whatever it is, what this does because of the status that scientist have, is to simply reinforce the gender differences that exist. Because we think they're biological, we think therefore that they are unchangeable by social processes, and this is how we are, this is how we're supposed to be, so we have no incentive really, to be interested in changing those differences. We don't have any incentive to think about alternate explanations of those differences. So I think that's one way, one example of social implications, but in terms of --- LONGINO BETA 105A Antonello: the social implications...? 00: 00: 53: 22 Well, I think the other level of social implication goes to, the aspect of your question that mentioned learning, I think that if we, as we invest these characters, the scientists or the scientific elite with this princely power, we give up our own right to participate in the production, in the construction of knowledge. But as we leave it to them to tell us what the world is like, and as they develop more and more esoteric languages in which to express ideas, theories about what the world is like, we are less and less able to interact with them. So we become progressively disempowered and disenfranchised because we are not taking part in the construction of knowledge which really is also the construction of our reality. Our reality is being made for us, by others and we have to fit in if we're going to survive into that reality as best we can. Or we're going to be rolled into fitting in through the mechanism of a consumer culture, as I was talking about earlier.

Gratification of certain kinds of desires. 00: 02: 47: 13 So I see the social implications of the direction in which the sciences seem to be going, as from my point of view, quite frightening. As long as the sciences are as embroiled with the sources of political power in the society as they are, I think we're going to greater and greater centralization of decision

making. Less and less genuine democracy, more and more illusion of democracy, and even that illusion is rejected by that large proportion of people who don't even bother to cast a vote. They can see that it's an illusion, there's no real choice for them in the issues on which they're being asked to vote. And because they feel themselves locked out of the, somehow, the procedures of decision making, knowledge construction, I think that their not accepting certainin a small circles trying to challenge that decision making that has cast them out, that has locked them out. I think unless we can do something to change this, then I think what we need to do to change this, is to explode, among other things we need to do, is to explode the illusion that the sciences are an impartial way of discovering the nature of the world. We need to rend the fabric that gives them that kind of priestly authority, that ability to tell the rest of us what the world is like. And perhaps, if we do that, we can at least limit the kind of authority that the sciences have, and by doing that, start to break the intimacy that exist between the sciences and the sources of centralized power, or the centers of power in this country. 00: 05: 35: 23 Maybe, for example, as new voices, or if new voices come into the sciences, you may get new models of natural relationships, for example, new models for natural processes that are at variance with the model of centralized control that seems to be so prevalent in the kind of sciences that are done. Evelyn Fox Keller, for example, talks about this in terms of the ways in which we think about the role of the gene in biological processes. The gene is the master molecule, it's the center of control.

Well, as we, or if we, I shouldn't say...as is my optimistic mode...if the sciences can be forced in some way to make room for alternate voices, we may have new models of relationships which may get another ripple effect, socially.

In that we might come to see that centralized decision making is not necessarily natural. As we might remove one of the implicit forces of support that our sciences give to inequality of power, which is that that's just the way things happen.

It's just natural that there's some element that is in control of whatever processes, social and natural that we're talking about. If we start to have models of interdependence where we see the elements in a process as affecting each other, not one way relations of control but mutual interactions. We might start to think about alternate models of social relations and of political relations, that would distribute power in a more equitable decentralized participatory way. I think I've gotten off the track..... --- LONGINO BETA 105A Antonello: Is technology the force that drives history? 00: 08: 47: 09 No, I don't think technology by itself drives history, I certainly don't think that advances in technology are somehow autonomous in the social context in which they're produced. I think that developments in technology and history are....well, maybe I'll put it this way, I think that technological history and social history are interactive.

Technology doesn't develop autonomously. The kinds of technologies that are developed in certain social context, are dependent on those contexts. As I was saying before, about nuclear power, it's no accident that this country has funded nuclear power as heavily as it has, over against other kinds of power technologies, such as, solar power, wind power, which are much more decentralized, much more distributed. It has to do, I think, with the ways in which political power is centralized, with social power is centralized and concentrated in this country. So, well, and I think that....in a different kind of social context, that other technologies would be developed. We'd be looking and asking questions in different kinds of ways. But in a sort of context, and it's not. 00: 10: 24: 09 ..or speak of this in political rather than economic terms, but as you pointed out earlier, the profit maximization that's involved in the concentration of the source of power in one location, is also operating here. But profit maximization, I think, as a goal, ultimately has the result of producing concentrations of power..a claim that Marx made.....competition results in the elimination of the competitors and the merchants, the concentration of merchants of one source, the merchants have a monopoly. Monopoly of economic resources, a monopoly on power, it doesn't really matter which we're talking about. --- LONGINO BETA 105A Antonello: We have more knowledge all the time but we get it too late. We figure out the system too late? What is wrong with this system...? 00: 13: 14: 18 Well, I think one of the things that that's wrong in this picture, is that because of democracy, it takes such a long time to deal with the toxic it takes another five years and by that time so many more people have been poisoned. I really think that..put in the bluntest terms possible, we need a social revolution, not necessarily a violent revolution. But we need to change the location of power and decision making. How that comes about, is very problematic.

If we did have at the outset, a much more genuinely democratic form of decision making, and if we saw the sciences as subject to that democratic decision making process, I think that we wouldn't have quite the sorts of problems that we have now. We would be able to ask before the plant is introduced, about the effects of by products of the plant. We would, because there would be people with concerns about those by products in at the original decision making, or at least representatives of those people, in at the original decision making, the chance of implementing a technology that would have these harmful effects, is certainly much less. I don't say it's eliminated because we never have certainty about the effects of our actions, I mean, it's just the human condition. But I think that the condition we have now is a condition where only certain kinds of questions are asked about the results of implementing certain technologies. And it's only the questions that are of concern to the people who have the power to implement them. People who are going to be

effected in a negative way, by the by-products of technologies aren't even part of the decision makers. So their questions never even get asked. 00: 16: 09: 07 So, I don't think, I think that what I'm saying is that the sciences are not going to reform themselves.

We are not going to be able to simply, by showing the ways in which social interests interact with and the structure interact with scientific processes and structure of scientific knowledge. We are not going to be able to get the sciences themselves to become more democratic, but the sciences are dependent on social resources, it's our tax money that supports scientific research in this country. And if there were to be some kind of really radical change in the, in who participates in decision making, I think the sciences would of necessity become more responsive to social concerns. But it takes, that's a political change, and it's a political change in the larger context in which science operates. I don't think it's something that...the sciences are not going to change as long as the culture does not change. --- LONGINO BETA 105A Antonello: What is the social responsibility of the scientist? 00: 17: 39: 22 Well, you know, when we're talking about social responsibility, we're talking about ..we're talking about a moral issue and certainly there are individual scientists who do have a sense of social responsibility. They're computer professionals with social responsibilities who are concerned about the ways in which their defense department controls research into artificial intelligence and other applications of computing high speed intergrated circuits and so on.

There are other scientific groups for social responsibility and I think that they are a certain source of challenge to some of the, I suppose, socially noxious aspects of science.

But I think that there are ...well, and I think it's very important that there be socially responsible scientist, scientist who have a sense of social responsibility, partly because it keeps scientific institutions from collapsing into a monolith, that is, that it does preserve a certain kind of diversity in the scientific community. But, there are two problems; one, is that ..with some exceptions, I think many of the people involved in social responsibility groups are still trapped or seduced by the myth of the scientist as or the idea of scientist as priest. And they're going to save the rest of us with their more socially responsible ideas and views. So I think that that's still a problem from an ultimate political point of view. 00: 20: 16: 12 Secondly, I don't think that they're going to have much of an effect in the long run or in really changing what happens, unless there is a social structure that can enable them to implement, or develop their ideas. It's a kind of (? ?) voice that's tolerated, but it won't really have much of an effect in society unless there are..unless the social structure is changed, so that those who are in positions of decision making are actually, actually have an interest in implementing those ideas. So the ideas can be tolerated as long as they don't have to be implemented, and that's not really, that's going to assuage ones individual conscience, but it's not, and it may keep ideas alive until the political situation changes. But I don't think that by itself it's going to produce the sorts of changes that are really necessary to alter the balance of power between the scientific elites and the vast majority of people. Antonello: 00: 21: 56: 09 That I was saying, that's what the older scientist were saying about social responsibility, and their saying, well, they just do their research and then the society makes use of it. But I think that that you can only use that as an excuse if you are operating with the kind of philisophical view about scientific inquiry that supports the illusion that inquiry, methodology and so forth are value free, that scientific inquiry is somehow an impartial method of inquiring about the world. Then you can say, ah yes, well, we just do our science and then the society is what determines what is going to happen. I think that some scientists are themselves in contradiction, internal contradiction, because in order to do the work that they do, they have to accept certain kinds of models of processes as natural or inevitable. Even when maybe politically, they're democrats or leftist, i think that there's an internal contradiction that many scientist don't want to face, because if they were to face it they might think they'd have to leave science. That is, they're attracted by the power they can have as scientist and they may assuage their conscience by being leftist, but they're not really trying to make changes in the science. I think once you recognize the relationship between social values and scientific research, then you can no longer say, oh, I just do my, and then it's up to the society to decide what to do with it.

Because your work, or my work is structured by the values of this society that when we go out and vote, or do our political work, we're trying to change. So there's a contradiction there that I think has to be faced, and that the seduction of power really prevents the individual scientist from facing. So I guess what i want to say is, I don't want to say that scientist are not or should not take social responsibility seriously, but when they do take it seriously, they have to look at the way it ..at the implications of social responsibility for the content of their work as well as for that application that are made of their work. And I think it's that distinction that the older scientist make that has to be rejected, and has to be broken. Or the notion of social responsibility in the sciences to make any sense. --- LONGINO BETA 105A Antonello: Can you give an example? 00: 25: 19: 10 Well, suppose I think that, or suppose I'm a researcher, let's just take the example of work i know best because it will be easier to talk about it, this work on sex differences. It's interesting that there are a lot of women involved in this research. There's women who are involved in research that has as an outcome theories that gender or gender role behaviour is a function of purely biological, physiological events in the organism. And so out of the

control of either society or out of the control of the individual herself or himself. Now, I think that at least some of these women would argue that women ought to do science or ought to be permitted to participate in the activities of the society as much as men should. I mean, they're doing science after all, they're working in the laboratory. On the other hand, they're doing research that is used to support the notion that really just, women just don't have what it takes to do science. So I think that there's a contradiction, a contradiction there, the defense that they can offer, is that, the work that they're doing in the laboratory is an impartial investigation of natural processes. It's the impartial investigation of behaviour, of the relation between physiological processes and behaviour, they're doing pure science and it has nothing to do with their political views. But in fact, the way in which the data are construed in that research program, is very much a function of certain politically based values and assumptions. As long as we hold to the illusion of value free science, there's no incentive or no need, no need, no perceived need to look at what background assumptions, what invisible unstated hidden background assumptions might be structuring the work that takes place in the laboratory or the clinic, or wherever. 00: 28: 32: 18 So I think, some, a scientist who takes the notion of social responsibility seriously, has to take that not just in looking at the applications of work, actually. It's not just condemning the second bomb, but thinking about the way in which the research is structured in the first place, and the kinds of ends it's ultimately serving. That means asking scientists to do a lot more than just be scientists. But if scientific knowledge is at least in part or at least in part constructed by the values of the society in which it takes place. The scientist who really cares about knowing something about what the world is like, has to ask herself or himself about the social values and the functions that are structuring the very research that she's doing or that he's doing. So it does require, I think, a level of social and political sophistication that scientist have in some way invented themselves from.

Treating themselves in some way as children who don't have responsibilities for the ways in which their activities are used or directed. ---

LONGINO BETA 106A Antonello: can you give us another example...? 00: 01: 23: 16 I think that is the bind that scientist are in, is that research is not, you can't fund or support research out of your own pocket these days, it costs too much money. And you have to find sources of funding and people don't just disperse money for, out of the kindness of their hearts, in the kinds of amounts that are needed for the science. People give dollars out of the kindness of their hearts, they don't give millions of dollars. And the scientist, I think, who is, wants to call herself, socially responsible, has to pay attention to the...one of the things that she has to do is to pay attention to the interests that are served by the research that she's doing. I think that's one of the key aspects of social responsibility and another aspect of this, or a necessity to this, is a certain kind of humility, we don't know all the ramifications of our actions. That means we have to look very carefully at all of the dimensions of our activities in order to be as certain as we can, that they're not going to have effects that we would later regret.

00: 03: 21: 18 So with the issue of funding, I think is a very good one, the researcher into say, artificial intelligence may be outside the artificial intelligence lab, a peace activist.

Where does money come from for artificial intelligence research? Most of it comes from the defense department, now it doesn't come from the defense department because the defense department has some abstract interests in machine intelligence. The defense department is interested in machine intelligence for use obviously in warfare. Now the computer scientist may tell herself, oh, this is the only way I can get the money to do the research that interests me right now. If that's only from the defense department that you can get the money, that's a good clue that the research is ultimately going to have some kind of application that she's actually out in the streets demonstrating against today, and that she, if she survives will be out on the streets demonstrating against in ten years when it's actually put into practice. So, I think the scientist really is in a bind and as I was saying, I think it's the seduction of power that science holds out that keeps the scientist from examining all the dimensions of her work or his work, in the ways that are required. The seduction of power simply in being permitted or allowed to go on doing research, playing a role in that priestly community, in that elite that is the source of ideas, values, knowledge and so forth for the rest of society. That's a very seductive, very seductive idea, and I think it overwhelms. It overwhelms the sense of social responsibility that individuals feel. And it blinds us to the ways in which we're in fact counteracting our own goals.

Our own personal goals or political goals in the research that we do.