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00: 11: 17: 00 Well, what characterizes agriculture and not just in the US, but in Europe and elsewhere, is the fact that it's a very very scientific intensive activity. A tremendous amount of scientific activity has been poured into agriculture, ever since the 1850's. In the US this has been, not only formalized, but institutionalized in government through three pieces of legislation which created the colleges of agriculture, the Land Grant colleges, as we call them in the US. It has done it through the establishment of scientific experiment stations and through the creation of extension activities, which extend the research out into the agricultural population. So we have a tremendous amount of scientific activity which then gets translated into a series of steps in technological development. Let me give you an example, if you want to grow a crop of any kind, how do you want to grow it, how do you want it to be harvested, how will you control water, for example, which is a big question here in California. All of these things involve not only scientific activity, but translating that into a series of steps, so they can actually be put to work on the farm. 00: 12: 48: 18 So what you have then, in countries like the US, is that the federal government and the state governments allocate very substantial amounts of money which gets channelled into the colleges of agriculture, to do research. That research can be very very fundamental like biotechnology research, it can be very very applied like developing a machine to harvest tomatoes, which is one of the cases that I studied. It can involve not only the technology of making a machine, but the technology of growing tomatoes. If you're gonna grow tomatoes in anywhere, and you want to grow them efficiently, then you have to figure out how much water should you deliver to the tomatoes, because rain is not a factor here, except as a storage device. We control water through irrigation, so there's a tremendous technology involved in delivering water to the tomato plants. You want to deliver, deliver them on a certain schedule because you wanna make sure that the tomatoes get to the processing plant where they're put into cans, on a schedule. So, for example, nowadays, if you want to grow tomatoes, one of the things that will happen is, the tomato firm will say to you, you can deliver tomatoes within this two week period and that's all. You then have to plant your tomatoes and grow them so that you're ready to harvest them within a two week period.

And remember you can't harvest all of your tomatoes in one day, so you then have to assemble all of the machinery to harvest those tomatoes within a two week period. Tremendous amount of technology and scientific development exist in that kind of a circumstance. 00: 14: 45: 14 Now maybe what I should do is tell you about the way in which the tomato harvester was developed here in California, as an example of how scientific work is undertaken, is tied together with technological development and then produce a certain social outcome. In California, which produces right now about 85% of processing tomatoes, those are tomatoes that are put into cans and which then turn up in soup and in pizza, and in tomato sauce and a variety of many other kinds of ways.

These tomatoes, these processing tomatoes are grown in California in a scientifically developed system, where the tomato, a special tomato was bred to be harvested by a machine, which did not exist. And a machine had to be developed to harvest the tomato which did not exist. So in effect, you had two forms of research going on at the University of California, in Davis. One to breed a tomato which would

be sufficiently tough, so that you could shake it and have it hit things without getting destroyed, that meant that it had to have a tough skin and you had to develop a machine which would cut the tomato vine and permit the tomato to be shaken off the vine, so that it could then be taken to the processing factory.

00: 16: 24: 10 Now when you do something like that, you have to change the whole characteristics of the tomato line, the way a tomato works is that a tomato vine, it produces some flowers, the flowers start making tomatoes, it keeps on producing more flowers, some tomatoes start to ripen, it is still producing more flowers, some tomatoes are ripe, some are green, some are still flowering, we call that an indeterminate variety. What it is ia a variety which produces tomatoes on a stretched out schedule, that stands in contrast of let's say, fruits, cherries. All the cherries get ripe at the same time, grapes, all the grapes get ripe at the same time. Tomatoes don't naturally do that, so, if you want to harvest tomatoes mechanically, one of the things you have to do is redesign the vine. So that you will get a lot of tomatoes being produced at the same time, once you cut the vine, then in effect no more tomatoes will grow. So you want all of your tomatoes to, in effect, flower, ripen at the same time, so you come in with a machine and harvest them. Now you not only have to change the characteristics of the vine in terms of all the flowers coming at the same time, you have to change the characteristics of the vine so that it will support all these tomatoes. You don't want to have to go through a big field and prop up a tomato, stake it, and tie it, because that involves a lot of labor. So you want to redesign the vine itself, so that it will hold a lot of tomatoes and keep them off the ground, and also carry a lot of water up from the ground and minerals and nutrients to make the tomatoes. You have to redesign the vine; that's a plant breeding problem, it's essentially a problem and sometimes it can be basic research, sometimes applied research. 00: 18: 29: 15 So you redesign the vine, at the same time you have an agriculture engineer who is busy making a machine and this is not a, once a machine is made, everybody says, well that's simple, but as a matter of fact, when the idea of having a machine which would harvest tomatoes was first suggested, most people said that's crazy. Because you have to get the tomatoes off the vine, you have to make sure they don't bounce against each other and get bruised, and that involves a process of breeding, as I said, the tomato, on the one hand, but then in effect creating a machine which will shake the tomatoes off the vine in a way which doesn't bruise them. And both of those research projects were conducted at the University of California. Now when you do something like that, it has social consequences. And the social consequences in this case were, one of the things that happened was that the number of workers involved in harvesting the tomatoes dropped considerably. Instead of needing workers to pick the tomatoes one by one, off the plant, you needed a few workers, relatively few workers on the machine, who would pick out the green tomatoes or the broken tomatoes, or because the machine would pick up rocks in the field, pick out the rocks. So you needed workers to pick out the bad things, and the tomatoes would flow on a conveyer belt on to a gondola, as it's called, a large unit to carry tomatoes, afterwards it could be pulled right out of the field onto the highway to the processing plant. So you needed much fewer workers. We went in California from 50, 000 workers, first, to 18, 000 workers, and then to 12, 000 workers. Right at now, we have about 12, 000 workers, working in tomato harvest.

00: 20: 25: 01 At the same time, the amount of space involved in growing tomatoes more than doubled, so the hectarage more than doubled in this

process, that's because California was able to produce tomatoes very very cheaply and it had a market for those tomatoes. The other consequence, however, was to reduce the number of tomato growers, the number of people growing tomatoes in California, from 4000 to 600. And the reason that happened was, in order to get into this tomato system, you had to plant a minimum of 75 acres, that's about 30 hectares, in order to justify the cost of the machine. The machine cost 25, 000 dollars, originally. So if you're going to spend 25, 000 dollars to grow tomatoes, you're going to plant the amount that that machine can harvest, that meant that all the small units of production, that were only producing let's say, 20 hectares, stopped producing tomatoes. And what has happened over the years, has been that the cost of the machine has gone up, tomato harvesting machine now cost about 135, 000 dollars, it can harvest about 350 acres, which is about, oh about 150 hectars of land, so that if you want to get into tomato production you had to have more than a hundred and thirty five thousand dollars in order to even begin to be a tomato producer.

00: 22: 12: 04 So this produces this process known as economic concentration, where you have more being produced by a smaller number of producers, and the consequence of that is, is that it changes the whole character of the agricultural system. In US agriculture today, about less than three percent of the employed population is working in agriculture. And increasingly we have a small number of firms which dominate agricultural production, and science is one of the key elements which keeps on encouraging this process because most scientific developments call for more capital investment in the process.

--- FRIEDLAND 99A Antonello: Why is agricultural research always focused on the needs of the agricultural corporations?

00: 24: 28: 16 Yeah, we can , we can develop a different kind of way of doing science, but it requires the establishment of different thought patterns, you have to think in a very different kind of way. I mean, take the tomato example that I just mentioned, the tomato vine is indeterminate in its natural state, it produces a lot of tomatoes over a long period of time. You can create a research problem which you say, well, if we have a harvest period for tomatoes naturally, which lasts six weeks or two months, could we develop a tomato vine which would begin to produce tomatoes very early in the year and continue to produce them all the way through a growing season. So that in effect instead of growing, harvesting tomatoes two months, you could harvest them for six months. Could you breed a vine like that? Now I don't know whether or not you can breed a vine like that, but I would argue that if you can breed a vine in which you're producing all the tomatoes pretty much at the same time, you should be able to take the natural characteristics of the vine and breed it to extend, rather than to contract.
In order to do that, though, you have to think of that as a research problem.

00: 25: 58: 05 And the way in which scientific research is conducted largely here in the US, is on the basis of how do you save labor. Labor is considered to be the big cost of production, and if you save labor, you generally replace it with capital. So that most research is oriented to labor saving activity. How can you get the nuts off a tree, how can you get the fruit off a tree? One of the ways in which you can get the nuts off a tree, is to get a machine which shakes the tree and then after the nuts fall to the ground, you could have workers come through and pick up the nuts by hand. Instead what we do is set systems, we

have a shaker which shakes the tree and around the tree we have another piece of equipment which cost very...which cost a lot of money, which makes a canopy around the tree, so when the nuts fall out of the tree, they fall into the canopy. We use two workers where before we might have used twenty five workers, now it's true that the labor involved is easier, that is true. But the number of workers involved is disappearing. And one of the things that I've discovered in my discussions with workers, if you say to them, wouldn't you rather work on this easier machine, they look at me as if I'm crazy and say, "sure I'd like to work on it, but if we adopt this machine, I won't be working on it. This person might or that person might, but I won't be working on it." So that in effect, one of the things that contributes to is this process of continual redevelopment of the agricultural labor cycle.

00: 27: 56: 06 I mean, most agricultural workers don't work in a single crop, thay work in a series of crops, so that if for example, they have a two month period in which they're harvesting tomatoes, and now you take that period away, for most of them, there'd be a small number left, but most of them you take that period away, either they are not working in that two month period or they have to go find themselves some other kind of work. So they may, as I discovered in research in New York, they may say to themselves, well, if I go and harvest apples in New York, I can earn so much, but I can only do it if I also harvest potatoes. If you take out the harvest of the potatoes, it's not worth it for me to go to New York, so then that creates a labor shortage. For people in New York growing....

00: 28: 46: 12 .so each time you introduce a new element of technology, it changes the configuration of the labor process for the workers involved, so that technology is continually affecting workers. And if I have an established, if I'm a worker and I have an established pattern of work, and suddenly, there's a bunch of workers that have been working in another crop, and that crop has been mechanized and they're now looking for work, they're coming over and looking for my job, you see. So there's now competition for the work that I've been doing in my piece of the labor cycle, and at that stage then, a grower might say to me, well, I don't need you because I can get somebody else to work at fifty cents less an hour.

--- FRIEDLAND 99A Antonello: According to your studies would you say technology is replacing workers?

00: 29: 56: 17 ...it's certainly there's no question about the fact that it displaces workers, technology just moves workers around all the time, all over the place. It is not uniform, however, on the issue of deskilling. For some workers it is a deskilling process, for a few workers it can be an enskilling process.
Let me give you an example: When you harvest grapes by machine, it's relatively unskilled work. When you bring in a new machine that replaces workers that harvest grapes, you need a worker who will drive the machine and that machine is very expensive, and the grapevines that are planted are very expensive, you need a worker who's going to be reliable and be sober, and know how to deal with machinery, etc.. You're going to need also some workers that know how to repair the machine because these machines are always breaking down, they take a lot of activity and they break down. So you're going to create some jobs for a small number of workers, the workers that work on the machines where you increase the skill levels. For the workers who aren't working on the machines,

either you will just get rid of them or in some cases, you will deskill them.

00: 31: 20: 08 On the tomato harvester, for example, what happened was, there's not much skill in harvesting tomatoes, but the worker has to judge how to work individually. So there's a certain amount of skill involved; if you're going to be an effective tomato harvester....tomato harvest worker, you got to be able to move fast, pick, see what's going on in the vine, and there's a... there's not a lot of skill but there's some skill. If you work on a tomato harvesting machine, nowadays, about the only thing you do is, you look for a rock and you pull out a rock. Or if a vine gets caught up on the conveyer, you pull the vine out. Because nowadays, they have a machine that looks at the tomatoes and sees whether or not they have the right color red, and if they don't have the right color red, the machine kicks the tomato off the machine, this device. So in effect, that skill was taken away, so that the workers who do work in tomato harvesting, have less skill in that particular case. And I think that's generally what happens with technological development, some workers do get increased skills, most workers either have their skills decreased or are eliminated.

--- FRIEDLAND TAPE 100A

00: 00: 31: 18 You asked about the relationship between science and technology. In agriculture, the relationship is very very close and it's very hard to make a distinction between science and agriculture. Within the agricultural science network, for example, there are always arguements about doing basic research as against applied research, and this is the science vs. technology arguement. Agriculure consists of a process and there are a number of basic biological processes involved, and in that sense you need all kinds of scientists who will be doing what we call basic research. It might be research in genetics or it might be reseasrch in how water flows, and how water flows can be applied to irrigation technology, it can be applied to a whole series of problems. it can be applied to flood control, so, people will be doing all kinds of research which is fundamental in character, fundamental or basic. At the same time, the research is being done in order to improve agriculture, now what that means, improve, what improve means, is that what it has come to mean in the US historically, is to increase the output of agriculture. It's beginning to change a little bit now, but historically, that has been the central meaning of improving agriculture, increasing output. Now in order to do that, what you do is you take sciencific, basic scientific discoveries and you proceed to apply them to a variety of ways.

00: 02: 21: 23 So that for example, if you want to have a tomato vine, which makes a lot of tomatoes all at the same time, so you can harvest them mechanically, one of the things you have to figure out, is how much water should you deliver to a tomato plant to irrigation. That's a technological problem; if you have to harvest the tomatoes on a schedule, which you do, then a question might be, how frequently should you water the tomato plant and when should you stop watering it. If you water the tomato plant every day, will you get more production than if you water it let's say, once a week, with so many liters of water? Those are technological questions, they're not really basic scientific questions. So these are the kinds of activities that scientists and technologists have to engage in, in order to obtain maximum output. And you can't separate the two, they just operate continuously. There is a kind of, what shall I say, hierarchy, what's

considered good in science. So basic research is considered better than applied research. But in agriculture, at least historically, there's been a recognition, that for the basic scientist you have to have a number of applied scientist, so that you can take the new developments, let's say, in biology and translate them into a series of steps that will then be moved out into the fields.

00: 04: 02: 17 So biotechnology is a good example, you have basic, basic developments in technol..in genetics which now are being applied, they're not being applied very much yet, because we're still in the developmental stage, so a lot of fundamental science is still going on. But the attempt is for example, to create devices which will improve production, so one of the scientists at the University of California has developed a bacteria which, according to the theory, if you spray on strawberries, will protect the strawberries from frost, if the temperature dips to a certain level, if it dips beyond that, the strawberries will freeze. But within the freezing point to this level below the freezing point, if you spray this bacteria on the strawberries, the strawberries won't freeze and they'll be protected. Part of this is still at the real juncture of science and technology, finding out what really happens is on the one hand, a technological problem, but the application of the bacteria, as a theory behind that, is essentially fundamental, they're just linked together. Very very difficult to seperate them.

--- FRIEDLAND 100A Antonello: What about the relationship between technology, science and nature?

00: 05: 43: 21 Well, the answer most people will give, most agricultural scientists will give you to a question like that, is when the first human being looked at two wild plants and saw that one wild plant had more seeds on it than another wild plant, and gathered those wild seeds and saved them and planted them, that nature began to be modified. And there's a certain element of truth in that, you can't eat a carrot nowadays, or a tomato or any kind of food that has not been modified very very extensively, in that sense, there is continual intervention with the character of nature. It's hard to find a truely natural thing in agriculture in most of the industrialized countries of the world. You have to go out in the middle of the Amazon jungle, in order to find something which is natural. The real problem here is, how much do you intervene in the process, and what sorts of outcomes do you get through the intervention. Now I mentioned some outcomes which are socially destructive, so for example, if you can produce more tomatoes with fewer tomato growers, is that a good thing? If you can produce way more tomatoes with many fewer workers, is that a good thing? That's one way of posing the question of intervention.

00: 07: 20: 10 Another way of posing the question of intervention, is if you intervene in a particular kind of way, what does it cost to society? So for example, in California, we have a very very efficient agricultural system, but it's efficient because there has been extensive intervention with the way in which water functions in the world. So for example, we have enormous irrigation systems in California, that's an intervention. Is it a good one? Well, one of the consequences of setting up this irrigation, is the amount of water that flows into the Pacific Ocean, at certain seasons of the year drops, so that salmon no longer swim up the river to drop their eggs, so that you will get new salmon. So many rivers in California no longer have salmon in them, this then effects fishermen. Is that a good thing? On the one hand,

you've traded odff increased agricultural output to an intervention in nature, and you effected the lives of the, economic life of fishermen, and there are fewer fishermen as a result. Is that a good thing? Well, it all depends of course, on where your, where you stand. If you're a fisherman, you're very very unhappy about that. If you're growing tomatoes in the San Joaquin Valley, and you can now increase your acreage and produce more tomatoes, and increase your wealth, you're very very happy about that kind of intervention. And that's a second kind of way of trying to access outcome. 00: 09: 08: 14 A third kind of way, has to do of course, with the extensive utilization of petroleum, not only to drive the machinery, but to be converted into pesticides and herbacides which then have all kinds of consequences on the ecology. So for example, in the San Joaquin Valley, nowadays, which is the big central part of California, the most, one of the richest agricultural locations in the world. Nowadays, there is so much air pollution, that it begins to effect the productivity of crops, well, there are two possibilities, that you can deal with under those circumstances. One is, you can ask the question, how do we get rid of the pollution? The other is, how can we breed a plant which will like pollution? And that's one of the tasks which some scientists have set for themselves. Now I happen to think that's a perverted way of thinking about nature. That you resolve the problem, not by getting rid of the root cause of the problem, but by breeding something which will adapt to a nasty environmental situation. I mean, the logic of this is, people, we should breed people that will enjoy smog. Smog is a fact of life, and, in effect, those people that believe this would follow this kind of logic would say, well, smog is a fact of life, what are you going to do about it? Instead of saying, how do we get rid of smog, how do we reduce the amount of petroleum consumption that creates the smog, and that creates the environmental degradation.

--- FRIEDLAND 100A Antonello: Is that the dominant way of thinking?

00: 11: 00: 18 Well, unfortunately, in the US, at the moment, I think it still represents the dominant way of thinking with most of the agricultural sciences, they're a small number that I think have become more enlightened, but they are relatively small in number and it's not the, it certainly not what drives research. But there are some changes which are in process, for example, in the US ten years ago, if you talked about buying organic vegetables, people would think you were crazy. Now they just think you're a little bit odd, unusual, and more and more people are concerned about the character of food. Now it's possible that this is only a kind of a fad and will pass from the scene, but over the period of the last ten fifteen years, the increase in concern with the quality of food has been quite remarkable. And in the agricultural industries, they are now taking it seriously, so that for example, ten years ago, all the people were growing fruit and vegetables organically, were a tiny little units of production, tiny ones. There are people that believed in organic foods ideologically. Now there are people that believe in organic foods for market reasons, that is to say, they know there's a market and they're converting to an organic production. So that for example, there's one firm which is one of the largest table grape producing firms in California, which is now shifting over to organic production, not because they believe in organic production but they know, they know there's a market and so there is in effect over a period of time, a shift which is beginning to take place.

00: 13: 04: 14 Now that shift, it seems to me, is taking place more with growers than with agricultural scientists. The agricultural

scientists haven't really made the shift yet, they still, they still tend to stay concerned of how do you get more production rather than how do you reduce the amount of petroleum inputs in agriculture. But even there, I mean, there are changes taking place, you now talk about intergrated pest management which is a way of reducing the amount of petroleum that's used in agriculture. But it's very very slow, very gradual, it's very painful.

--- FRIEDLAND 100A Antonello: Can you talk about internatioanl, transnational agriculture?

00: 14: 00: 18 Well, increasingly, what happens in the agriculture and food system, is that it becomes transnationalized, it cuts more and more across national boundaries. National boundaries become less and less significant in the whole process.
In the US for example, we ship a tremendous amount of soybeans, I believe they call it soya in Europe, to Europe.
Where it is a major input in animal fodder, so a lot of your chicken production and beef production may depend upon soybean products, so we are intergrated with you, in this respect. We intergrated with you because Europe ships wine to the US, particularly France and Italy. That wine comes in, it competes with California wine. The California wine producers are unhappy because of the Italian and French wine exporters, and they say, well, it's unfair competition because wine is supported by government supports, and therefore, the US government should establish a tariff barrier against French and Italian wine. The US government can't do that because if it did do that, then the European community would establish a tariff barrier against our soybeans. So in this sense we are linked, increasingly linked. We are linked in all kinds of other ways. When Greece entered the European community, it affected raisin production in California, because raisins which are produced only in California, and shipped not only all over the US, but shipped to Japan, all over the world, were also being shipped to Europe until Greece became a member of the European community. At that stage Greek raisins displaced American raisins, that then affected the price of American raisins. Now since raisins are produced from a grape called the Thompson seedless grape, when the price of raisins collapsed, people that were growing Thompson seedless grapes and originally putting them into raisins, shifted them over and sent them to the winery. So it affected the price of wine grapes in the US., so Greece's entering into the common market affected raisins, affected wine grapes. And the price of wine then dropped, so naturally, the wine producers here were angry about what was happening

00: 16: 55: 09 but the point is, that we're getting this increasing articulation between production, distribution and marketing. One of the crops that I've been looking at a little bit, is oranges. We now take oranges, not very much here in California, but in Florida, we take oranges, we squeeze the ornages, take the juice, draw the water out and make a concentrate, it's called frozen concentrated orange juice. Florida was the, is the major place within the US that makes frozen concentrated oranges. In 1962, I beleive it was, there was a freeze in Florida, and the crop was lost, Brazil decided to move into producing oranges for the frozen concentrated orange juice market. Brazil is now the worlds largest export of frozen concentrated oranges. Where does it go? It goes to the US and it goes to Europe. It's a high priced food, so it can only go to populations that have relatively high incomes, in Germany, Switzerland, Italy, France, etc., so now we have a Brazilian system which links together with the US system, with

transnational corporations like Coca Cola, which owns one of the major firms that produces frozen concentrated orange juice, Minute Maid, and they are in international production and international distribution. That's why the word transnationalization is the kind of term we use, because increasingly national borders don't have very much significance to the way in which food is being produced and distributed.

--- FRIEDLAND 100A Antonello: What are the social implications?

00: 18: 48: 07 Well, the social implications are fairly clear, and that is that a relatively small number of international corporations are beginning to dominate the world food system. In wheat, for example, in grains generally, wheat, corn, soy, soybeans, aproximately seven firms dominate the entire world distribution of these grains. Now there are many many producers, but the actual handling of the product is in a relatively small number of firms, and increasingly we're going to see that. We're going to see firms that move into global distribution of commodities. For example, I don't whether or not, there are McDonalds where you are, McDonald's hamburgers, but increasingly McDonalds is spreading throughout the world. And when McDonalds produces a hamburger in Paris, or in Rome, or in Bern, in one of the things that it does, is it has to bring together the factors of production in a standardized way. One of the things they may be doing is buying their lettuce in California. And I know from the research that I've done, that McDonalds, not McDonalds, ... American lettuce firm, delivers lettuce to Frankfurt, Germany to be put onto hamburgers, which are being assembled to sell in Frankfurt. So in effect you have McDonalds now becoming a larger transnational corporation buying its lettuce and beef from other transnational corporations and you get this increasing linkage so that the food system tends to be dominated increasingly by a smaller number of transnational firms. And the capacity to control these firms is increasingly reduced as far as the nation state is concerned. 00: 20: 56: 19 So, for example, if McDonalds is distributing hamburgers throughout the world, they need beef, where will they get their beef? Well they'll get their beef where ever thay can get it cheapest. As long as it fits certain kinds of quality standard, and if in our country we say, we have to protect the workers that work with beef, McDonalds may come along and say, well, that's very nice but we can now get our beef in Australia, cheaper. And they move to Australia, the beef production, so the nation state in effect, loses a significant amount of control as part of this process of transnationalization.

That's one of the, that's another one of the consequences.

--- FRIEDLAND 100A Antonello: What about the idea of progress?

00: 21: 51: 23 The word progress is always one of those slippery terms that has a great many meanings. What do you mean by progress? Now progress has come to mean, in some people's minds, growth. So for example, here in my own town if I go to various people downtown and they start talking about progress, I know what they're talking about, they're talking about getting more people to come to Santa Cruz, and for there to be more businesses, more industry, more employment, and that's progress. For some people progress is more machinery. I deal with growers who when we talk about a piece of machinery and how many workers it's displacing, they will say, well, yeah that's true but, it's progress. So that's another form of progress. Now you might very well ask me what my form of prgress, my form of progress is, that kind of scientific and technological development that creates the greatest

good for the greatest number. And by that, I mean, that you don't get, let's say, to take one way of measuring greater good, you don't get income distribution which is characterized by the people at the bottom barely existing, and the people at the top having fifty houses and fifty boats and fifty airplanes. And you can put it in these kinds of terms, what's the ratio of income of people at the bottom to people at the top. Is it that people at the top have ten times or fifty times. For me, progress is a society in which in effect, you reduce the ratio, so that in effect you're bringing the bottom closer to the top and you're, in general, moving all people upwards. I would consider that to be progress, that's one definition of progress for me.

00: 24: 19: 06 Another definition of progress for me is, has to do with the factors of everyday life, like environmental factors. If I wake up in the morning and I'm sneezing, and I know I have an allergy and I have the scientific apparatus and I see that there is garbage in the air which is giving me this allergy, which will then give me emphesema, which will then reduce my life span, so instead of living for 75 years, I only live to 62 years. I think that reducing the amount of garbage in the air, so that I could live longer, is progress. For me, that's self evident, and if i have to sacrifice something else in order to clean the air, I'm prepared to make that kind of sacrifice. Maybe, my income will go down somewhat, because it will cost something to clean up the air, I'd rather have my income go down to a certain degree in order to clean up the air rather than have my income go up and die sooner, that's progress to me. And I think I could, if you, I can elaborate more and more elements of progress, but the point is progress to me at least, is not concerned with making more businesses, making greater economy, necessarily having having a contiually increase in the standard of living. We have a fairly good standard of living in the US and most European countries have a relatively good standard of living, maybe what we need to do is produce a form of progress in which our standard of living stops growing so much and the standard of living in the third world begins to grow, so that the kinds of famines and hunger that we know about in Africa will stop. That would be progress to me.

--- FRIEDLAND 100A Antonello: Do you believe we are moving in this direction?

00: 26: 20: 19 No I don't really believe that we're moving in this direction. I get very very cynical at times, because it seems to me that the prevailing notion that exist not just in the US, but in western Europe, is that economies can grow endlessly and the standard of living can grow endlessly, I don't believe that that can happen. And I certainly don't believe that you can do it without having it cost third world countries in a variety of different kinds of ways. If we're going to lift the standard of living of the third world, then we're going to have to develop much more systematic operations to see that there's a transfer of technology and science to them, rather than doing it here.

And we're going to have to develop a science and technology, in agriculture for example, which is appropriate for them and which does not particularly increase the amount of petroleum consumption, to use only one variable that's crucial to agricultural production. Now there are ways of doing that, but we would have to take massive resources, transfer to places like Africa and Asia, and put it to work developing appropriate technology, technology which is low input and where in effect the benefits will not come back to us. Now we could do that, but in order to do that, it's necessary for us to change the whole way in which our politics operate. Now there are some places in Scandinavia for

example, where there is much more enlightenment about this, but those are relatively smal countries with relatively small resources, what they are doing is good, but it doesn't even begin to come to grips with the seriousness of the problem.