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"Participation and Alienation in Large Democracies"

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MICHAEL ARBIB: …and I will try to say something totally unmemorable while the tapes are being… well, this morning, we talked about the ways in which we might use computers in planning and in getting access to information, and we were concerned, mainly, I think, with rather large-scale problems. How do we model the world? How do we look at ecology and environment? We're also concerned, though, with the less mathematical aspects of having a database which in some sense was intelligent and responsive. And how could we structure information within the computer so that when we had a question, *we* didn't have to know where to look, but rather the computer program would help us find what we needed.

So we're imagining a society, and I think our consensus was that it's a society that's well on its way in which more and more about planning tasks are carried out with the help of computers, so that we have computer planning of many governmental activities and computer involvement in many expert decisions. And what we're really gonna talk about this afternoon is: what's it going to be like to be a *citizen* in this new computerized society.

Okay, can we adjust the lights again, please? So that we just have lights out there for you people who want to stay awake… and let's look at the first slide. Okay, the first slide for this afternoon is the 30th slide on the carousel. Can we turn that on? Thanks.

Okay... I'm going to take it that—and some of you may wish to argue with me as we go on—but I'm going to take it that we believe in democracy. The only thing is we're not quite sure what democracy means; and so let's just start *here* by looking at two different definitions of democracy. The first of which is the one that we're familiar with, the second of which is the one which people in Cuba and Russia, for example, are familiar with. Multi-party democracy is the form of representation in which there are rather few political parties, each of which is meant to express a widely-held view of the relationship between the citizen and the state. And citizens choose candidates of one of these parties. And, as we'll discuss more as we go along, this is not altogether satisfactory; that a couple of code words like Labour versus Conservative, or Republican versus Democrat, or nationalist versus internationalist, or whatever, fails to adequately capture the full range of our concerns as citizens in a modern society.

And there're also other particular advantages with this sort of electoral procedure; that very often we fear that the politicians, rather than really getting down to solving complex problems, find it easier to spout rhetoric which will win them votes, and avoiding the really tough problems that might require some adequate measures. Some of you may have read in the newspapers or the news magazines the attack of Solzhenitsyn on America, and the feeling that this society is too soft; and what Solzhenitsyn would like, I think, is the sort of thing that the Russians claim to have, but which of course Solzhenitsyn knows they don't have: that's single-party democracy. The idea that a group of people, because of their superior intelligence and judgment—and it's usually they who decide that they have the superior intelligence and judgment—[*laughter*] know better than the average person what the citizens need, and so they constitute themselves as a vanguard party to take the responsibility of governing in the true interests of the people. So they're saying, "Well, the trouble with multi-party stuff is that, you know, you get involved in these pseudo-issues and you don't get down to really tough things. So we do know what has to be done, we will represent the people!" 'Course, the trouble with this is that they get cut off from debate with an opposition, and then lose sight of alternative approaches. They'll get solidified in their own view of the way things are, and even if they are honorable men and women, they may well have too doctrinaire an approach and will not understand the full range of options available, and debate the ways to choose between them.

We live in a time in which we're not very happy with either of these alternatives; and let me just mention two expressions of this unease that we see around us. One is probably summed up in the phrase "Proposition 13": the feeling that the government has become a self-perpetuating machine, not particularly sensitive to the results of elections, but concerned more with giving more and more politicians and bureaucrats fancy expense accounts, and that people do not have sufficient control over how their money is spent. That's one type of alienation that's coming out of the current structure of democracies. The other, which we see most dramatically

at the moment perhaps in western Europe, is the alienation of people who believe that *they* know how the society should be run, and who are prepared to go to great extremes of terrorism to try to bring down what they view as reactionary governments who are not properly responding to the needs of the people. In other words, they see that the parties, to their mind, do not represent *any* of the appropriate alternatives.

It seems to me, that what we're concerned with here is trying to understand ways in which the public—you and me—can have more confidence that the politicians, the bureaucrats, are responding to our needs; and what we're going to try and do as our time this afternoon goes on is explore a number of ways in which computers might or might not enter into this opening-up of the political process.

And I think it should be very clear to you that as we proceed through this discussion, relatively little of what I say has anything to do with computer technology *per se*, although this will be mentioned many times; and a lot more has to do with an attempt to just articulate what one thinks or wants democracy to be. And on the latter topic, my opinions are probably somewhat left of center and probably rather personal opinions, and therefore should not be taken as answers, but rather should be taken as helping you ask questions. In other words, listen to much of what I say this afternoon not as, "Gee, yes! That's the way democracy should be," but rather, "I don't think he's right, but I'm not quite sure why he's wrong; let me figure it out and see if I can articulate a better answer."

All right, so, let's just look at some of the paradoxes involved. I think we agree that we do have to have some form of government, and I think we also agree that very often the public is not sufficiently well-informed about important issues; and so there is a real problem in ensuring that the general public is educated enough so that in a democracy such as ours with many parties, there really is discussion of the key issues rather than just, you know, good old platitudes, and that even in a one-party state, open debate is allowed. And as we may mention again later, though, there's a real paradox in this. Now, suppose that you have been elected or have appointed yourself as the government, and that you are a sincere and concerned political leader; then what you will do is try to make sure that the people learn the facts they need to make the right decisions. And then, of course, the question is where does education stop and propaganda begin? And this is always a problem; and one of the points we will be making as we look into the future is seeing ways in which the computer can add to the power of the press in providing open forums in which a variety of ideas can be expressed. So that in a sense, the job of a government at any time when it involves itself in public education is not to have the monopoly of that education, but at least get issues up to a certain level; but the society must be

open enough that other pathways are available through which opposing viewpoints can be discussed.

I'm not quite sure whether what is happening now is platitudes or key issues, but you will have to judge that as we continue. And then the other thing, as we've said, is that in a situation where all we have to do is either choose between one or two parties, or congratulate the vanguard party on the fine job it's doing every three years, it's easy for people to be alienated and left out, and so we want to know about ways in which we can open up the political process. And, again, we'll be asking questions of the kind related to our discussion this morning, as to what extent the design of new computer techniques for rational planning and exploration of options can also be used as ways of getting information to the public about just what the options are and why the decisions are being made. A little bit along the grounds of the features that we mentioned for that […], that consultation system that we discussed, where it's important that if decisions were made, there'd be the wherewithal for us to ask why they were made and what factors were weighed in making that decision.

That was only the first half of the paragraph but I went on so long I've forgotten the second half. All right, now I've already mentioned that there is this paradox, in a way, between a government which responds to the interests of the people and a government which accepts the responsibility of educating the people to better understand national and international priorities and long-term goals. And I think Proposition 13 is very interesting, in a sense, because I hope and believe that it's initiated a rather intense re-examination of costs and priorities. I had some guests last weekend from Los Angeles who informed me that had Proposition 13 not gone through, their property taxes would have gone from 2,800 to 5,600 dollars, and when faced with data like that, you can't clearly do anything except vote for Proposition 13. But unfortunately, what Proposition 13 did—unfortunately for California—is that their property taxes go down to 800 [dollars], and that's not enough to provide for essential services once the current year has mopped up the surplus.

So how *can* we encourage that level of debate, in which people can understand what are the necessary levels of taxation and so on, and help set the priorities that people can finally live with the right level; and how is it that the bureaucrats can see enough of what's going on that they won't be so insensitive as to carry out insane moves like this doubling of the property tax levels? Now, as I've said, in a closed society, education can become propaganda. We've been through periods, wartime periods, in which even the best of governments have engaged in propaganda, and what we're going to see is ways in which we can come up with new channels of information to help the society stay open.

Now, let's just take a little excursion into the technology of databases, because one of the things we'll be exploring as we go along is the ways in which databases and computer networks can be used to provide information to the government and information to the citizens. And a lot of our concern will be with the proper style of information flow and the proper checks and balances, and I keep saying I do want you to be *thinking* a lot as we go through this talk, in terms of trying to make yourself aware of what I've left out, or where my opinions are showing a little too strongly.

All right, you all know about data banks. It's a place where you store data, and data are just pieces of information. The idea is that what goes into a system, then, is that we decide we're going to set up a data bank for some particular purpose. It may be to keep track of census records. It may be to keep track of your accounts in a money bank; that's what we call a bank data bank. It may be for the draft. It may be police records. It could be for any one of these things, and so there are now thousands of data banks going all the way from what a particular individual has stored in their own home computer or in their share of the files of a time-shared computer system, to massive federal data banks, such as that held by the Internal Revenue Service, that has all your tax returns for the last *n* years. And what goes into a database is not only just the data itself, but also the programs that allow us to use the database; and I just want to give you a feel for things by noticing that there are two different people who can interact with a database. There's *you*, the user, and for you the user, the database is there. It's not something you can change, except in the following way: you can ask questions about what's in the database, and you can add new information. So there's going to be some simple language, some simple set of code, which allows you to query and update the database, and I think the example that's most familiar to many of us is that of an airline reservations database, where we can ask for information about the schedules, we can ask for information about a particular flight, and we can ask for information about our bookings, and we can change our bookings, in this case, with the help of a clerk, or *clark*, as we say.

But for us to be able to do this, somebody else must have set up a database management system, and so expert programmers are required to, in the first place, set the thing up. In other words, in an airline database reservation system, somebody has to decide, "What is the format that's going to be stored? Are we going to have one level for schedules, another level for individual flights, a third level for records on individual passengers? What are gonna be the links from one level to another? What entries can be stored in each file?" and so on. The system programmer sets that up; and so in thinking about data banks, we'll be thinking some of the time about this: what sort of features do we want to be visible to the individual user? And other times we'll be thinking up here: what are the policy decisions that should be made in setting up databases so that they function as well as possible?

This slide just confirms the sort of thing that's been implicit in our discussion so far, is that usually when we think of a database, we think as in the case of the airline reservation network, of a central database with multiple access; so that, for example, American Airlines may well have—I don't know where they have it, but—might well have one computer in Chicago, but through telephone lines, airline reservation clerks throughout the nation—but not in Alaska apparently—can send in their queries and requests, and get their answers and confirmations out of it.

So databases are clearly a good thing, as the airline reservation example makes clear; that in a complex society there's a lot of information, and if we put it on scraps of paper and have to send the scraps of paper through the mail, it would just take too long. The airline reservation system is really rather amazing that you can check at any time whether seats are available on a flight, get your reservation made, and immediately you've done that! Nobody else can get that seat… well, not very often. So databases sound like a great thing. However, let's just look at this. The U.S. Senate judiciary subcommittee looking into federal data banks a few years ago found that there were already, in the federal agencies, 858 data banks. These were just federal agencies. They found that 29 of these contain derogatory information on citizens, 457 of them have been set off without any explicit statutory authority, and that in most cases, people didn't know that there were records on them, or if they knew, didn't have any access to them.

We have, again, this sort of paradox. If we want to get services, whether it's services like getting a seat confirmed on an airplane or getting appropriate medical treatment, it's very good to have information on file. It's good that your bank has a data bank and can keep track of transactions, that if you find that a check hasn't been paid in, you can check out why not. Check check. But when you look at these statistics, you begin to wonder, and of course, we recall the information that was being got by U.S. Army surveillance teams at civil rights meetings and anti-Vietnam [war] protests. We remember the use that Nixon was putting the Internal Revenue Services to, in trying to follow through on his enemies list. We begin to wonder whether letting there be this many data banks with so much information which has not been authorized, explicitly, that people don't know about, whether this is really a good thing. And so, on the slide that was missing next… I told you about… actually, there are a couple of very good slides that we've just missed. For those of you who weren't here this morning, it was an interesting experience to arrive and find that I had the slides not only in random order but about one in ten missing, and fortunately I brought along my originals.

So, what happened was that the Congress started investigating these data banks, and they were concerned about the way in which false information could creep into files, and the ways in which information could be moved from one file to another, and they finally set up the Privacy

Act of 1974 to try and stem abuses, and restructure U.S. federal data banks to provide safeguards. The idea was that they were aware that the individual's access to employment, insurance, credit, and due process could all be endangered by misuse of information systems, and the Act aims to curb the government's abuses of its power. So the idea is, suppose that you lose your job, and you believe that information in a federal data bank was to blame; then you can get the information from the data bank, and you can examine it, and if it's false, then you can have it corrected. Another provision of this Privacy Act of 1974 is that when information is placed in a data bank about you, unless it is something like an FBI investigation leading to criminal charges… I mean, it's not required that the FBI phone up Mafia people and tell them the data they're storing on 'em. Actually, perhaps, if you think about that, you can see the sort of ambiguities in this sort of situation, because if you really believe your government is out to get you, then FBI files are probably the ones you're going to worry about most; and if you believe your government is out to help you, then you certainly see that it's important that files on criminals be kept secret from the criminals. So you already see the complexities of trying to make a free society which nonetheless have safeguards to protect it from its enemies, whether they're the internal enemies: criminals, or the external enemies: other nations.

Anyway, one of the provisions, though, was to say that, people… when you gather data for a federal data bank, you must tell people where it was being stored, what it was being used for, and, most importantly, where it would go. In other words, it could not be transferred into other data banks unless that was an explicitly authorized transfer of information. So, in other words, if you fill in a questionnaire to get a job in one department of government, then it would not be proper, the reasoning goes, for that information to be available to anybody who can hook into any federal data bank. And so, it is illegal for it to be placed elsewhere. However, while it seems that limiting the transfer of information between federal data banks is a very fine thing to do, I am not sure that the provisions of the Act are altogether reassuring, because if you look at your instructions for your federal income tax return, you will notice that it has, in fact, a special paragraph. I don't know… how many of you actually read the fine print about the Privacy Act of 1974 on your last income tax return instructions? Two of you claim to have done so; what it said was that you are punishable by law if you didn't answer all the questions, and that the information contained in this could be transferred to any federal agency. That it could be transferred to any foreign government with which you had economic dealings, and so on and so on, so that… I think that although the Privacy Act is in the right direction, there's a long way to go.

Let me tell you one story about myself, which indicates another dimension of concern about data banks: the concern that what is in the data bank may be true, but because it sits there and you don't know about it, it could do you some harm. Now, there's a piece of information about

me that I'll tell you… which I believe—and, perhaps, because I've used this anecdote in talks before, it may now be sitting in a federal data bank lousing up my career, I don't know. Anyway, the piece of information is this: that in the year 1956, on a platform of Copenhagen railway station, I received money from the Red Chinese consul. Now, we're living in a period in which diplomatic relations are being opened up between the U.S. and Red China—or China, as it is now being called—and probably this information is becoming less damaging, but I think you'll agree that about 10 years ago, had I been trying to get a security clearance, that information in my file, sitting there, would probably have cost me the security clearance and perhaps cost me some important government job, had that been what I was after at the time. And if I hadn't known about that information, and had access to the fact that that information was what had cost me the job, there would be nothing I could do about it. I would just know that I hadn't got the clearance.

But if I had known about it, and known that that was the information that counted against me, I would then have been able to point out that the reason I was given money by the consul from Red China was simply that one of the people in the compartment of the train I had been traveling on was a man on the last segment of his train ride from Peking to take up his position at the mission in Copenhagen, and didn't have enough money for dinner that night on the train, and I'd lent him the cost of his dinner. And hopefully, having explained the data in that way, I would have got my security clearance after all. Perhaps not; perhaps even that would have been too soft on Communism… [*chuckles from the audience*] but I think the point is well made that there may be information that is perfectly accurate, at one level, but if you don't know about it and are unable to put it in context, it may do you a great deal of harm. That's the sort of thing we're concerned about.

The other thing we're concerned about is the fact that if the government or private people are able to take information from many different data banks, they can make patterns that are quite damaging to you. Suppose, for example, that the man you sat next to on the plane last month was associated with the Mafia, and suppose that six months ago the person who cashed a check just before you at the bank was also associated with the Mafia, and suppose that, in fact, the supermarket you go to receives its canned tomatoes from the Mafia. Now, those facts could be in three different data banks and if they were put together, you could be in bad trouble. So, what we're saying is that the computer and the computer data bank, and the ability to put lots and lots of pieces of data together can be used on the one hand in a very positive way, to get information needed to provide vital services, but it could also be used in a way that can be very dangerous.

Let's get away from some of these fantasy stories and just look at a very specific example. A friend of mine was unable to get a credit card. Why couldn't he get the credit card? They wouldn't tell him. In fact, they still don't have to tell him because… actually, they may have to tell him, but the Privacy Act only affects federal data banks. There may be separate legislation now that affects credit card companies, but I don't know. Anyway, he was denied, and he had to go to court to find out why he had been denied the credit card. And it turned out that a company existed whose job it is to go around and collect court records, and then sell these court records to companies that provide credit ratings, and it turned out that a man with the same name as him had had a bad car crash, and hadn't paid his debts associated with it. So he had to go to court to get the information, which then put him in the position to prove that it was another man of the same name whose data had been put into *his* file, and then he finally was able to get it corrected. The only trouble, of course, was that there were no records anywhere about what other credit companies had received the same misinformation and stored it on him. So he still doesn't know when he will be denied some other facilities because of this false information mis-stored.

So, the conclusion that people are coming to is that in building data banks in a free society, it's very important to stipulate very precisely what the data may be used for, to limit—very strongly—transfer between data banks, and to keep records of transfers so that you can follow the thread back if, in fact, you find that you have been adversely affected by what is going on in those data banks. And what I stress, again, is that these protections and provisions I'm talking about are ones that are not guaranteed by the computer; they're ones that you can either program the computer to provide, or program the computer not to provide. If you have an aroused public, aware of the issue and concerned to go to court when they need to, to make it uncomfortable for the bureaucrats not to program the computers properly this way, then, in fact, we will have the safeguards programmed in. If we have a society in which the government wishes to repress its citizens, then we won't.

Okay, so altogether, the implications and developments we will get from the Privacy Act will presumably be some reduction in the amount of stuff that's stored, because there will be tighter authorization required; a reduction in the flow between data banks, although my reminder of the statement on the information on the tax return gives us some pause for concern. There will be more time checking out data before acting on it, and there'll probably be a lot of wasted time, because there are certain people who will enjoy feeling important by finding out what information federal data banks have on them, and spend a lot of time insisting that the spelling of their grandmother's name in the IRS return be updated, and so on. What we need, I think, amongst other things, are… it's not a very good system if, in fact, we have to keep going to court to fight the data that's stored on us, so there have got to be new mechanisms to

make it easy for us to check accuracy and relevance; much tighter restriction on investigative files because, as I've said, there's that paradoxical situation, again, where we want to be able to root out criminals and so on, so we would like to keep investigative files secret, and yet… how do we protect ourselves from having that as a hiding place for political files that have no business existing.

Also, some interesting ideas, though, turning from the concerns to the positive side. How can we make better use of the data banks to follow through on some legislation? For example, we introduce a new type of welfare formula, or we change the provisions for Medicaid. How can we use the data banks to actually follow through and get the data we need as easily and cheaply as possible, to discern the patterns and the trends and find out whether, in fact, the new legislation was cost-effective and humanly effective as well?

Okay. I want to just mention a few concepts to do with the design of large programs that have relevance for us in thinking about this particular problem of massive amounts of information of a possibly sensitive nature in a free society. What is the question of program validation? It's going to be very important to have mechanisms to check that a program does what it is designed to do. In other words, suppose that we do come through with legislation that says you may not transfer data from here to here, and you must carry out certain checks from there to there, and so on and so on and so on. And now you want to check that this, in fact, is the case, and somebody comes up to you and provide you with a listing of a hundred thousand instructions in some programming language and says, "We've done it! Here." What do you think happens then? Well, you either take his word for it or you don't. So, what is happening now is that there's more and more concern amongst programmers of not simply: how is it that we learn how to program the computer to do something, but how come we write the program in such a way that… we keep track, not only of the detailed instructions for the computer, but also our specifications of what we want the computer to do, and check that the two things really fit together.

There's also the question of maintenance. Even if we work as hard as we can to try and make sure the program does things right, there are going to be bugs in it. I mean, a bug is a mistake, an error, and you know that even with the best of maintenance, a car is still going to go wrong, and the same as going to be true if you have a really complex program, there're going to be things you've forgotten about, things you didn't take care of. So there's going to be this problem of keeping track of how well the system is doing, and finding out where, in fact, you forgot about something important, and then updating the program keep track of that.

So, I think we've already talked about the basic ideas here, that if we want to have legislation to make sure that computers are being properly used, we're going to have to not simply say, "Well, your program must do this job." We've got to have a design of program that allows us to actually send in people to check, and presumably therefore, there is going to be an increasing need for… what should we call them? District computer attorneys… people who combine a law degree with a master's degree in systems programming, who can go in and analyze the *legal* status of the specifications of a program and the software status to see whether those legal specifications are being met. In fact, we were talking earlier at lunch about the problem of employment, and whether computers were going to take away all the jobs, but as we keep proceeding, we keep seeing the need for new specialists; so there'll be lots of jobs as long as you've learned how to program.

Okay, now, once we've got a system going, we're going to have to—as I've suggested—rewrite it. Not just update, because we've found errors that we have to correct, but also because we want to update the system to handle new needs. So another idea is when you're designing a system, a computer program that is very large, it really is a system that requires, perhaps… well, what was it? I was visiting IBM earlier this year and they just built a new operating system. The operating system is the programs that sit between you and the naked machine. In other words, they're the ones that make it easy for you to get information in and out of the computer, and easy for you to use some high-level programming language to write your programs in, and so on. And they'd just finished the operating system, and I think it was something like 200 man-years (where "man" means male or female) of programming effort. And so, clearly, you would like to protect that sort of investment; I mean, that's pretty considerable if we're talking about 200 years or 20,000 per person. That's a lot of money; you can each get out your calculators and figure it out.

But let's just think of an example: suppose a credit card company goes international. Now, most of the stuff involved is the same, isn't it? The only thing is that firstly, you want to be able to handle different currencies for people within different countries, and secondly, you want to be able to bill people for expenditures made elsewhere, so you want to be able to convert from one currency to another. And so, the idea is to write the program in such a way that it's pretty easy to see where to add the extra bit that handles conversion from one currency to another. Then it's easy to put in a program that just checks, "Is this currency the home currency of the person involved? If so, fine. If not, consult the latest conversion table and replace the amount in the particular currency that is their home currency." So a good design will continually be thinking about how programs can be modified in the future.

Now, I want to stress, though, that like any system, whether it's a system of legislation or a computer program or a highway system, or railroads, or just a contraption in the kitchen that you finally can't repair anymore and have to throw out, there are going to be cases where, no matter what you do, you can't rearrange things. For example, let's take welfare. I sort of use the program in the two senses, that there's the idea of the welfare program as enacted in legislation, and then, presumably, there is increasingly the welfare program, as run on the computers that keep track of how much income people are having and how many dependents they have and what the eligibility is for different types of aid, and recomputes it. And, for a long time, you may get by with particular ways of fudging that program, and saying, "As an incentive we'll allow people to keep 50% of income they make over $5,000 before it starts eating into their welfare allowances," and so on. But eventually, the time may come when we have to just redesign the program in both senses, and of course, one of the things being discussed now is the idea of a minimum income to replace the idea of a means test for welfare.

All right, now, at this stage, I want to start making a transition from these concerns for computer systems to thinking a little bit more about the interaction between the citizen and the planning process. Now, already we've talked about data banks at some length, and seeing that they can be used, I think, both by government bureaucrats in making decisions. It also can be available to people who need information. We've seen that certain safeguards are required. We've seen that certain steps should be taken, in terms of program design, to make the structures as useful as possible. Now, I want to think about communication from forecasting activities to societal groups. The idea is this: here we have the professionals who are doing planning for us. They're looking at economic planning, ecological planning, they're building nuclear... they're building designs for nuclear plants, reformulating the welfare program, changing the tax base, and so on. We have the politicians who are not concerned with all the fine technical details of the sort of causal system stuff that we talked about this morning, but are concerned in trying to think about how general settings of this professional analysis interfaces with the needs of the public. And then here we have the public, seeing, experiencing the effects of current policies, current governmental systems; expressing their concerns, and so we want to try and get this loop to flow in as constructive a way as possible.

Now. I want to suggest to you, as we think about this interaction, where we came in this afternoon... [*lowering voice, talking to someone directly*] ...Do you find it distracting, as I do, this continual waltz around this... [*trails off*] [*audience chuckles*] [*ARBIB resumes lecture*] There's an English scientist named Gordon Pask, and he does so much of this, that it's im... I don't remember a single thing he's ever said in the lecture, I'm always just waiting until he tripped. [*laughter*] Anyway, where we came in on this, is we said our concern was to ensure that government was truly responsive to the people, and that we would be discussing many just

general political questions, but also we would be trying to think about the impact of computers on this issue of making government responsive. And now, I want to present to you two extremes about how computers might affect the democratic process. One is what we might call "push-button democracy." This says, "Oh! Computers are really great because, you see, with computers, everybody can have a little computer attached to their TV set and tied into this great network, and what will happen is that every evening at 6:30, Walter Cronkite will come on and he will tell us what the important issues of the day are, and then at the end, we can press the buttons, you see, saying what our opinions are on the issue, and then the computer will immediately tabulate this, and then at the end of the program Walter Cronkite can tell us which 10 new laws have been passed by the American people, and which will henceforth affect our lives."

Well, it can be ruled out on *many* grounds—one ground, I would say, is, just let's summarize it as information overload—that, frankly, we don't know enough to vote on most of those issues, and so that if we had to respond that quickly on so many things, all we could give would be a gut reaction which would be ill-informed. So if we tried to get enough information to make the right decision, we would never see our family, never go to work, probably have to live a 56-hour day, and so on. So that seems to be one caricature extreme; using information technology to somehow get everybody involved in every issue. That isn't going to work.

The other extreme is to say, "Well, look! Gosh, I mean, you don't really need people anymore. I mean, you've got these planners working with these marvelous computer simulations and with these great databases. Surely, they can just make all the right decisions for us, and so we don't have to think about things." And I think you can all come up with your objections, but I think basically the idea is—and my discussion with you of birth control as an example this morning I think was a very good point—that is, that planners can work towards publicly defined goals, but cannot set them. That there are always political dimensions… all right, *within* those political constraints we can try to plan what is the best or most efficient way to achieve them, but we still gotta find out what is important to us?

Over the energy crisis, we can decide to have a policy that really works on minimizing our use of fuels, or we can have a policy which is aimed at an international balance of power which gives us maximum use of what available fuels there are; and these are very different decisions. Once having made them, one can begin to explore the ways of achieving them. So what we're suggesting is, we want to see a situation in which, perhaps, we can use the computer to get people to take some part in decision-making in a way they can't do so far, and we want to make sure that computers are used to help plan in the most rational way possible within the politically determined constraints. So we want to find the right balance between these two.

Now, for those of you who are taking the course, one of the articles I had reproduced for you to read is one by Sheldon Wolin, which appeared in the *New York Review of Books* quite recently, in fact. So, for those of you who don't have a copy, you might want to look at it: the June first issue of the *New York Review of Books* had an article by Sheldon Wolin, W-O-L-I-N, called "Carter and the New Constitution." Essentially, this article was an attack on the systems approach to government. And I think he felt that the use of computers was taking us to a sort of *Star Wars*-type world, and that we were heading towards a situation in which… well, let me just read you the last paragraph, and then we can think about it a bit more.

"A system stands for an organization of control made possible by a tightly-integrated set of functions whose performance assures the survival and adaptation of the whole. Integration requires a transmission network that will reliably and rapidly communicate messages and decisions. The identity of the system—what it is—is derived from the conception of rationality embodied in its structure. It is, in that sense, a construct which is radically ahistorical, independent of time and place," and so on and so on. "The last vision is of a constitution without citizens, a construct which commands neither loyalty nor affection. It is fit only for abandonment." Okay so, so much for me. The image I think he has is that if we start using all this systems analysis and using computers, we're going to give ourselves up to a system in which all our sense of what makes America distinctive, or England distinctive, or Zambia distinctive, is lost, and instead everything is done by just calculating what is the most efficient way to do things. That no longer do we worry about individual human beings, we talk about maximizing the per capita income, and lose sight of the fact that when we maximize the per capita income, there may be some people making unnecessary millions while others are still starving. And that in doing this we were reduce ourselves to all following standard formulas, which loses all the sense of history on sense of identity and sense of place.

Now, I think what I've been trying to say to you today is that it really doesn't have to work that way. In a sense, if you want to abdicate your decision-making, it can. If you're going to go off and buy canned programs made in America no matter what nation you're in and without any concern for your local conditions, then you can foul things up; and we've seen that a lot of damage has been done in the Third World by attempts to use… let's say, excessive reliance on private cars where are the economic infrastructure cannot support it. Another example of using the American formula when it's not appropriate and… I mean the word literally. Some of you may have read about this as the campaigns by American companies in underdeveloped nations to sell formula milk and to discourage breastfeeding. The trouble with this is that in a lot of the villages of underdeveloped nations, the water is impure, and so that mixing the formula with water rather than getting milk has come through the mother's breast means that the baby is far more likely to assimilate germs and bacteria. Also, because we're talking about poor countries,

mothers will often think that as long as they put some of this white stuff and stir it up so the fluid looks white, the child is being fed, and so often the child is becoming badly malnourished, because it is not getting the nourishment it would have got from mother's milk. And so, in fact, there's a realization that at the current time, the use of formula milk is inappropriate in the developing nations, and I think there has now been an agreement made with a lot of the companies that were most active in marketing baby formula that they will no longer advertise. They'll still try to sell as much as they can, but without advertising.

I think those of you who have been listening and thinking will see that there's nothing somehow about the systems approach that says, "Thou shall feed everybody with the same formula." You look at the local conditions and now you say, "The local conditions include the history, the available resources, and people's preferences." And within those, then you can start using your system theory, start using your careful analysis. All right, given what we know, given what people want, how can we do this with the least expenditure of tax dollars? If we have to make decisions about per capita income, let's at least know what they are and be able to read them and consider them and debate them. When it comes right down to it, it's no good turning your back on the computer and refusing to look at the data. I mean, there have been underprivileged people who have been exploited and killed and ruined for centuries, long before the were any computers and systems analysis. It somehow doesn't make it better that it wasn't… you know, the guy who was up there living in his mansion while people were dying in his mines didn't make any difference. I mean, he knew what was going on and his vision of the social order was that it was fine. Society existed for him to be rich, and devil take the others. The point of what I'm saying is that I think that the danger in a democracy, or in any society, is the danger of accepting formulas.

But what I'm talking about, the proper use of computers, the proper use of rationality, is not that we use a formula unthinkingly, but that we say, "*What* do we know? What we know about what we want? What do we know about what we are? What do we know about where we come from? What do we know about where we want to go?" And combining that with our causal knowledge about biological systems, physical systems, economic systems: put that together to make the best judgements we can about where to go. And, as we've seen, our world is so complicated we can't do that without the computer.

Okay, and so, what we're saying is we want to use… "What we're saying." I keep emphasizing: what *I* am saying, and what you must decide whether you believe or not—what I'm saying, then, is that I think that the future is going to hold more and more computer planning, more and more use of systems analysis. And our concern, then, is how do we make that systems analysis and that computer planning open to the public so people understand what's going on,

and responsive to the public so people can help ensure that these plans are responsive to their needs.

And again, if you'd like a little slogan, one of the virtues of the computer is that it can let us mass-produce individuality. Now, what does that mean? Well, let's take a simple example. Suppose you're building an assembly line to produce cars. Now, if that assembly line has sufficient computers in it, you can actually have every car that comes off the assembly line be different. You can take orders about, you know, what color you want the seats and what sort of trim you want, and how big the engine should be, so that within whatever the parameters are of what you can put together, you can have people say the car they want, and by golly, the next car that comes off the assembly line will be exactly the one they want, I mean, given the range of available choices.

So in the same way, if, in fact, you can build up information on people which has enough about their needs, then, using the computer, it becomes just as easy for a bureaucrat to give you something tailored to your individual needs as it does to give you something perfectly standard, the same as everybody else. So that a lot of programs can become much more tailor-made than they have been in the past, because of the availability of this extra information. So that I think that in a sense… what is it about computer programs that's important about computer programs? It's the fact that the computer can look at lots of different pieces of information, and make decisions based on that information, consider lots of alternatives to try and find a solution that is tailored to the particularities of the situation: "Try this out. If it works, fine, go on to the next part of the program. If it doesn't, go back and look at this. If that works, fine, go on and resume the control, otherwise go and look at this alternative," and so on. And the more we know, the more complicated we can make that program. Right, we have to be careful every now and again to check that the thing's still manageable, but nonetheless, we can make that program more complex, make it explore more individual alternatives, and so better retail it to what people need.

So that a lot of the legislation in the future, I think, is going to become—you know, the whereases and therefores and whereats—are going to be branches in a computer program. And there's going to be much more of an attempt to not come up with a simple rule that will apply to everybody, but rather a complicated program that will meet lots of different needs. So that often when we find that things aren't going right, it's not that we have to scrap the whole legislation, it's just that we can change certain provisions. All right.

Anyway, coming back to this then, at any stage, we're going to have the situation that the technocrats, the people who are actually sitting there writing the complicated programs that

are being used in town planning and government planning and so forth and so on. At any stage, what they've done may or may not, to some extent, conform to the public will, and… what the hell is the public will? It's short for the public William, of course, but that doesn't help us very much. What I've tried to suggest when I… the point I was making with respect to the sentence when I started this little digression with the slogan, "Computers can mass-produce individuality," was the statement that, perhaps, we will be able to more and more understand that we don't have to do the same thing for everybody. That really, an exciting country and an exciting world is one which encourages diversity. And so often, what we'll be doing is saying, "Well, how can we keep everybody happy who's already happy, and yet develop new facilities for a special interest group that says things aren't going too well for them?" But anyway, back to this.

So whether it's the public will and some sort of general expression of dissatisfaction with rising property taxes, or whether it's public dissatisfaction with, let's say, the handicapped who see too many buildings don't provide proper entrance ways for them, we can go on from there. What is it? The models used are inaccurate; the planning has been based on making projections when, in fact, the projections aren't accurate enough—we don't know enough to be able to project that far ahead, and so what looked like the best thing to do five years ago, turns out to be really silly, because we looked at these trends. We said there were going to be a lot more people using electricity in the region at a much higher level and, in fact, because of more consciousness about energy, the consumption of electricity is dropped off; that sort of thing. The high-level goals are badly stated.

Now, here's my standard examples: You went to the elections and you voted for something. There was some action plan that you thought was terrific and you voted for it, in your numbers, but it turned out what you voted for wasn't what you wanted, and you didn't… it took a few years of living with the technocrats doing their genuine best to give you what you wanted, to find out that you didn't get it right. Now, here's my sort of ultimate example. Consider what, at first sight, seems to be a really great idea. Let us wish that mankind should never have another day of unhappiness. So the all-knowing uncaring computers get the message and immediately they send off the nuclear warfare and by nightfall, not a single human remains on the planet. [*laughter*] Your wish was granted. [*laughter*] All right, well, that's a little extreme, but I think it makes the point quite clearly that often we, as the public, *think* we want something—and at a general level we do—but when it's spelled out, we find that wasn't quite what we wanted. I mean, a lot of fairy tales and legends are based on this, the Three Wishes bit, I mean, is, of course, spelling this out in detail, that you keep issuing your three wishes and finding them crumble to bitter ashes in your mouth or wherever wishes crumble.

Another problem is just the difficulty of balancing goals. [*cough from the audience*] [*ARBIB chuckles*] Would've been nice if they'd misprinted that. The… you want several things but can't have them all. I was talking to one Californian about Proposition 13 and I said, "Well, the trouble, of course, is that while people want to slash property taxes, nobody wants to give up benefits," and he said, "Oh yes, they do. They want to give up everybody else's." [*laughter*] And so, this is of course always the problem we have, that in a real world, there are always limited resources, and each of us is very reasonable about it. We only want 10% more of the resources for ourselves… but unfortunately, if everybody gets 10% more of what they want, you're way over the line, again.

And, of course, there are other things, and that is that even people who can program computers can be either incompetent or nasty people, and so you got to keep an eye on even us computer scientists from time to time. So, my suggestion, then, is that the balance in the society is that, in some sense, the politician—and you remember that loop we looked at a little while ago—the politician's job is sort of the interface between this. He's trying to look at what people are doing, and trying to help get that turned into more specific policies which can then be implemented by the technocrat, and then to keep in touch with the public, to see how happy they are with that implementation, and so keep the process going round and round and round.

Now, my final comments are a little bit more about this question of: how do we keep informed? And what we've suggested again and again is that a computer program or a piece of legislation or a government operation can either be structured in a way that makes it alien and inhospitable, or it can be constructed in a way that makes it responsive to people. Now, we can forget about computers and just think about you go into some government office with a problem—and this is in the days when no computer is anywhere within miles—and, as we've said before, what often happens is that the person behind the desk doesn't give a damn. Perhaps, in fact, ruining your day is one of their secret pleasures, [*laughter*] and they take great pleasure in telling you that they can't help you, and with a big grin they say, "Well, it's in the rules, you see?" Now, you want a bureaucracy like that to be redesigned, so that the people in it are concerned to help you, that their motivation is to help you, and that therefore, when the rules don't solve your problem, their job is to find out how to make up new rules or change the rules so the problem is solved. Now, it may be that they can't do it at their level of authority, so in that case, they will refer you to somebody upstairs, not as a way of getting rid of you, but as a way of helping you.

So in the same way, what we would like is to have a situation—and we discussed it in some detail this morning—where the programs that are used by the planners in making decisions can

also be used by people who want more information. So, for example, suppose you read in the newspaper about some new plan that's been implemented, then you should be able to get on your terminal and start finding out more about how that plan works, perhaps even using part of it yourself to find out how it processes data. Now, of course, most of us won't care to do that, but it will be reassuring to know that somebody who cares, can. I think that what we're going to see, then, is that there are going to be more and more ways in which people who care to, can get more information about the planning process, more information about what's going on, ways of getting access to people, ways of getting access to data.

I think what we're going to see, for example, are what I'd like to call "dynamic libraries" using CAI techniques: Computer Assisted Instruction. The idea that… all right, now, you go into a library and you search through the catalog until you find the name of a book that looks halfway promising, and then you trudge up to the stacks and get the book out and leaf through it and see if there's anything that looks right. Then you put the book back and you go back downstairs and find the title of… and so on. Instead, how 'bout having a dynamic library where you have a computer program that can start getting into a dialogue with you about what you need to know, and helping you find the information you need. And the answer is, we can, but it takes time and money and programming. There's no way you can't just pick up a box of library cards and throw them at the computer and say, "Here… eat that." [*chuckle*] It's going to require people to say, "Well, what are the important things that people use a lot, which are worth the investment of hundreds, perhaps, of people's effort in getting into a good interactive form on the computer." And then what are some other questions people ask so that, in fact, we can ask them? How do we get them sort of branched in a comfortable way down to where they can get the information they need?

Now, you've all been through the situation where you look up something in the encyclopedia, and it's not there, and then you go off and then the next day you say, "Well, maybe it's under something else," and you go back and you find it filed in the most strange place. I mean, you want to look up zebras and turns out it's filed under stripes, for example. This has absolutely nothing to do with this lecture, but I must tell you an anecdote. There was a mathematician in England called Alan Turing, and he was making a mathematical model of the way in which the body grows, and he set up various equations which would show how cells could interact so that they would slowly build up complicated patterns. And so, somebody asked him, "Oh, well, that's a very interesting theory. Can you use it to explain the stripes of the zebra?" And his answer was, "Oh, the stripes are easy. It's the horse part that I have trouble with!" [*laughter*] Anyway… so, I just wanted to make the point though, that it requires a great deal of thought to write the programs in such a way that you'll have a reasonable chance of steering people to the information they need, by setting it up that the dialogue you get into will, in fact, be responsive

to your question. If every time… in other words, what would come up on the screen of your computer will be a menu of choices. All right, do you want to know about politics, art, religion, or other? Now, if you always choose *other*, I think it's fairly clear it's going to be very hard to get any information you need. You'll find that you just sit there as millions of entries pour over the screen, rolling over the screen until you see one that looks appropriate. So, it's going to require a big investment, and what will happen is I think we'll start with, you know, librarians just analyzing what common questions are, and slowly putting those highest needs on the computer, and then as time goes by, this will be incremented until more and more of the information we need can be quickly accessed through computer interaction.

We're gonna get back up to the daily news, right? So you read the paper… well, we can talk about the paper at two levels. Firstly, I think we'll probably see a paper which will not be a paper, of course, or maybe it will. Perhaps we'll still wanna feel the crinkle of newsprint, but it'll be printed in your home, or you'll just read it on the screen. I rather like this—sort of everybody sitting there munching their cereal and gazing at the screen as their personal newspaper rolls up in front of them—but the idea is that you will order the newspaper of your choice. In other words, that you like this columnist in this paper so you'll have that column, and you like the treatment of this country in that paper, and you come from a small town so you want the gossip section from that hometown newspaper, and so on. And so, each morning, that newspaper is unrolled before your eyes. But there'll also be the situation of whatever level you decide you have, because I think most of us will not just want this sort of information retrieval mode, but will want this sort of mixture of news and entertainment where a certain package that you want to read is served up to you and you read that as a matter of course. There'll also be this thing where suddenly something catches your attention and you want to follow it up. Well, the computer will help you follow that up. Time and again you read a news story which is actually infuriating because they never tell you who Senator so-and-so is, and why he is in the story. Or you read a story, then about six days later you wonder what happened. Maybe it's something trivial like: did that person who was in critical condition—well, that's not trivial to them, but trivial in terms of world news—die or… What would happen, I mean, for example, there was a story in the newspaper yesterday about the assassination of the president of North Yemen. Apparently a diplomat from South Yemen camed into his office, opened the briefcase, and they were both blown up. Now, I think I can guarantee that none of us will ever read a news story that will tell us whether or not it is now believed that the diplomat from South Yemen knew what was happening. Presumably somebody will find out in due course, and the information will be somewhere, but there's no way that any of us could follow that down. Well, it might be important to follow that up for those of you who are thinking of setting up a Yemeni branch for your business or something.

All right, *very* important, and the one that, of course, is closest to our discussion here, is updates on planning network activity. The chance to use, perhaps, some of the management and simulation and learning techniques of the planning networks. Let's say that you want to… you're looking at some policy. Suddenly, it occurs to you, "Well, did they think about this?" You as a citizen are concerned to know whether the latest plan really took something into account, so you wanna be able to get in there and find out. You wanna be able to express your opinions; things like, "Well, look, I tried this run and I got the following ridiculous results. I think you should update that plan," and then… not, perhaps, being asked to vote on every possible issue, but at least the chance to look at some programs—TV programs—and express opinions, not in a binding way, but in a way of taking part of a national debate about priorities.

And this final slide is just continuing with this idea that we can expect—for those of us who want it—the computer to help give us new sources of information, and, as I've mentioned, I think that the home computer is going to be part of at least the developed world in the next few years for an increasing proportion of the populace. And, in thinking about the way in which the computer is going to be used in the context of access to information, I think the interesting thing is the question: the cost is not going to be the computer, but communication. In other words, if you want some information and it's stored in a computer in Washington D.C., then if you have to get on the phone and pay for a long distance phone call to have your computer print out the information stored in that data bank, it's going to be prohibitively expensive and you won't want to do it.

Now, in fact, there are cost factors in here. There's now a way of communication called… something or other… Packet Message Switching, or Message Packet Switching, or Switching Packet Messages, or something, anyway, that… those three words in some order. The idea is this: if you're using your computer to simply share words, then the rate at which you type and the rate at which you read is very slow. So that although it looks like you're communicating continuously, in fact, it wouldn't do any harm if the computer waited a second—storing up what you typed or even waited a few seconds storing up what you typed—and then just used the phone line for a fraction of a second, to just send that in a burst over the line. And similarly, the computer at the other end just sent a burst which was then stored in the computer, and then printed out on your screen. And so, in this way, in fact, if what communication you want is communication in typed text, by using packet switching, you can communicate continuously over this sort of network for virtually no cost at all. But if what you want is voice communication or even more, TV picture-type communication, soon the cost is going to be overwhelming. So I think what might well happen is that people will quite often indulge in lengthy print interactions with distant computers, but when they want more in-depth material, they'll probably get to the stage where they'll either decide to go down to the library and take

out a book, or get an audio… you know, a TV cassette, a video cassette or whatever, for further information, and actually use physical transport rather than communication lines to get access to that. And, of course, all these things can be used educationally, too.

So, to summarize, what we've said is that the computer is very powerful. A lot can be done in the way of planning. A lot can be done in the way of gathering and using information. It's pretty clear, I think, that if we want to build a repressive society, we can do it a lot more efficiently with computers. If we want to *ignore* the needs of people, we can ignore them in fractions of a second with computers. But if we want to build a society which in some sense builds on the best of what we know in this part of the world; in other words, a society in which we expect and demand the highest standard of living, a high level of individuality, a reasonable responsiveness of the government to our needs; then computers are going to be a must for that, too. What we've seen today are some of the ways we can start building that responsiveness *into* the computer networks, into the planning process, into the databases, so that we can have a society which is democratic and technologically advanced. Thank you very much.

[*applause*]

HOST: Thank you, Michael. The pattern again is that questions and discussion will come later at 3 o'clock. I think they're literally trying to freeze us outta here, and it doesn't seem as though much can be done. If I can make arrangements to have our taping done in the cafeteria where we start, we'll have it there tomorrow morning and leave notes around where people'll know that we've moved. Since almost everyone attending is also in the class, then we will probably start at 9 in the morning and in the cafeteria in Science 2, and then we'll take a break there and continue for the discussion. [*to audience member*] Yes.

AUDIENCE [*in background, partly inaudible*]: [...] arrange a microphone [...]

HOST: Yes. Then we would also work toward the microphone. Those are the things I'll try to do this afternoon and we can…surely… I'm sure we can work those things out. And that room is satisfactory. It's better to be warm, I think, than in comfortable seats. So we'll see you over there at 3. You can group up to develop questions, again.

[*static for about 30 seconds; program ends*]