DeVane Lecture Discussion – March 22, 2001

AK I found myself thinking, toward the end of your talk, about the value of impediments and frictions in democratic life. You made the observation, early on in the lecture, that voting shouldn't be too difficult—you don't want to make it too strenuous for people to exercise their right to vote, but you don't want to make it too easy, either. There is something valuable in the discipline that is required to get yourself out of your home and down the street to the neighborhood school, to the polling place, to cast your vote. It focuses the mind. It reminds you, at least symbolically, that the act you are about to perform is an important one. It causes you to feel, perhaps, a sharpened sense of responsibility. It puts you briefly in contact with a small number of your fellow citizens and reminds you in that way that this is a social obligation, a political obligation that you are fulfilling, and those are useful reminders. They have a chastening influence which is valuable. It does slow things down. If you could, instead of rolling out of bed, just roll over and turn your computer on and scroll down and press the button indicating the candidate of your choice and then put on the snooze alarm and go back to sleep, it wouldn't be quite so difficult but there's a value in the difficulty. And that started me thinking: you know, some people have proposed that the representative form of democracy we now have, in which we vote for men and women who will serve as our representatives in some legislative assembly, in which we are not ourselves actively involved (they'll be our voice and conscience, represent our interests and the like, but we don't vote directly in the assembly to which we elect our representatives) -- some people have suggested that this form is a function of our archaic technologies of preference expression. If we use the computer imaginatively, we can restore, even to a very complicated 21st century America, a form of direct democracy that hasn't been possible technically for centuries. Instead of have five hundred and some Congress-persons voting on our behalf, we'll have daily referenda and everybody in American who's so inclined—every eligible voter gets to cast a vote for or against . . . say, the tax bill. Well, we'll listen to the President and his opponents have their say, and then we'll all vote. We won't leave it to Chris Dodd and Joe Lieberman and our Representatives in Congress to vote for us. We'll do it directly, ourselves. That's a friction we can get rid of—the intermediate voice of the Representative.

DG We hear that a lot.

AK Yes, we hear that a lot. But the thought occurred to me, there's a value in that friction, too, in having someone else, a smaller group of "someones-else," charged with the responsibility of voting for us, a small enough group so that they can talk and chatter and debate and deliberate. And we don't want to get rid of that friction. This is the general point I'm working my way around to: there are lots of sticking points in our political life which, on reflection, may serve a function which is valuable from the standpoint of our ultimate democratic political objectives.

DG And we tend to underestimate those negative functions.

AK Which are the good ones and which are the bad ones? Give me a theory of optimal friction. How do we tell the frictions that we ought to get rid of, can and should get rid of, from the ones that are really serving a useful function and ought to be preserved?

DG It's hard—as are so many questions that have to do not with the correct answer per se, but the correct balance. Coming up with the right balance on the basis of experience and intuition about what works is tremendously difficult. And there's no analytical way to arrive at the solution. When you mention the value of inherent difficulty, it's true that the first thing we hear about, when we talk about computer voting on the Internet is this idea of direct democracy, and the idea that we could run a referendum every time we had a question to decide, which strikes me and so many other people as catastrophic. When you talk about the way the government is set up, it reminds me of the fears that are raised whenever people start talking about a Constitutional Convention to pass amendments to the Constitution and bypass the lengthier procedure of, say, legislative Congressional votes and so forth. People say, once you have such a Convention, Lord knows what it could do. It could wind up tearing the Constitution apart and putting it together in some bizarre way and the fact that it isn't easy to convene such an assembly is

probably good because, once you convene it, you don't know exactly what's going to happen. But it's intriguing to think that the design of our democracy reflects technological limitations. In ancient Athens, it was possible to gather all the citizens on a hill and have them listen to the speakers and vote, and that was no longer possible in 18th century America. It's intriguing to think that we can just get rid of this unfortunate design restriction that was imposed on us by antique technology. But I think it's clear that the Founding Fathers didn't come up with representative democracy as a second choice. We have a romanticized view, in this country, of long standing, of New England town meetings and so forth. I think it's clear that the Founders had in mind government by people who weren't professional statesmen but who made it their business to ponder the issue. Whenever you ask for opinions, you're liable to get—inevitably mixed in with real opinions—phony opinions that are cooked up, just to please the questioner. Somebody comes up and asks you for your opinion on X or Y, maybe you think X, maybe you think Y, maybe you never thought about it and you don't really care. But naturally, there's a tendency to say, "Well, you want to know, it's either X or it's Y," exposing the population at large to constant questions of that sort—do you think we should go this way? Do you think we should go that way?— that fails to respect their right not to care. The great thing about this democracy is that it functions well and often smoothly enough, the state is sufficiently unobtrusive for the most part, we're far enough away from any kind of tyranny, that we can sit back and ignore government to the extent that we want to ignore it. And many of us do want to ignore it. And rather than pushing them to start voting laws up or down, I think maybe we should back off and let people who care vote and let those who don't feel disposed to care, one way or the other, let them alone, let them worry about other things.

AK This last observation prompts the following question: Over the long haul of American history, there have been periods, episodes of tremendous public involvement, activism, engagement on the part of large numbers of citizens, separated by much longer periods of disinterest, disengagement, and the business of government being managed by a few while most folks go about their business and follow their own plans. On the whole, I think that pattern seems very attractive, congenial, to many Americans. I take it that it does to you, and it does to me. I'm comforted by the thought—looking back at the historical record—that at those moments when we've really needed energy and engagement and activism, we found the will or the inclination to be engaged. Is it at all likely, do you think, that computers—the experience of using them, the habits that are born of the experience of using them, will alter that longstanding American habit of not caring most of the time but, really, when you need to care, responding to the call of duty and coming forward with public spiritedness and attention?

DG It's an important point, certainly. The most astonishing thing about American history is the tendency of the enemies of the United States to underestimate our capacity to pay attention when we want to. And the huge reserves of energy that this country can mobilize when it feels called upon to do that are one of the miracles or whatever; certainly, it's worked well when we needed it and it's something that we would be making a big mistake to jeopardize. I don't know that computers are necessarily a threat to our ability to go about our business and nonetheless know when the critical moment has come and when we need to snap to, and read the newspaper or do something.

AK You don't worry that we get narcotized into habits of dependency. . .

DG I think what one worries about with computers is not so much that they will create bad or destructive or self-destructive social patterns so much as they will underline or accentuate trends that we don't like. I think computers are, basically, a spectacularly uncreative force in the country. They don't make things happen, but they can bring out the worst in us or the best in us. They can make it easier to do good or to do bad. And the real question is whether our civic culture, and whether society at large is delivering the goods in terms of active and alert citizens. If we're slipping in that respect, if we're failing to turn out citizens who have some sense of the community and the communal good and the national good, computers will make the error more dangerous because, certainly, they make it easier to tune out the world at large and to live entirely in a world of your own construction. But it's not just computers. Computers are one manifestation of our increasing turning away from common ground and towards specialized forms of information and passing of time. It's been a long gradual decline of national celebrations, of Independence Day parades, of Veterans Day observances, and it's part of the fact that we have 500 TV stations instead of everybody tuned into 3 networks. In general, our attention has been

spread over more and more sources of interesting stuff, which is, in itself, good. But computers just showed up to fit into the pre-existing tendency. And it seems to me that they're a footnote, that the real question is: How do we go about educating our children today? What do our schools delivery? What do our universities deliver? What does our national political life deliver? And computers are an interesting topic, but we don't want to be distracted and start thinking that they have caused what we caused ourselves.

AK But granted for the moment that they're just another expression, or perhaps, better, an instrument of the pursuit of a privatizing inclination, which is already very strongly embedded in the culture, are there ways that computers can be used instrumentally to, if not reverse it, at least help, at the margin, to redirect this current of attention and feeling in a more public spirited direction? Are there ways of using computers to revive our flagging public life?

DG It's a natural question. And it's one I come back to whenever I think about the stream shaped software that I mentioned in the talk. It's not a technical issue, but it's easy to build software whereby a large group of people all share access to a common sequence—like a bulletin board or whatever. It's not too different from a web bulletin board today. And it's natural to notice that, in principle, one could build a stream that every citizen in the country has access to or, for that matter, every resident of the country. And it's easy to believe that, in principle, you could have an ongoing national conversation about anything that would be accessible to anybody and a resident of New Haven could chat with interested people in Colorado or Utah or Hawaii or whatever, just by tuning in this ongoing national clock structure or whatever it is. It's a natural thought, it's an interesting thought. It's just that one has to be skeptical. Of course, it comes to mind and you wonder whether it might not be useful and it might not be interesting to have this ongoing neighborly, over-the-fence type of conversation. And yet, immediately, one pictures it being monopolized by the same loud mouths who always monopolize every conversation and the people you'd really like to hear from would probably never tune it in.

AK What do you think about talk radio?

DG Talk radio . . . I don't know enough about it to pontificate about it. I do know this. It's obviously doing something important in this country. It's obviously performing a service that people thought they needed, people felt the need for, because the outpouring of interest, and this is harder to appreciate at an institution like Yale, but certainly, a huge percent of the population feels intellectually disenfranchised by what they read in the newspapers and what they see on TV. And talk radio—whether you like it or hate it or have no opinion (I really don't have an opinion because I don't listen to it and it doesn't particularly appeal to me) --- nonetheless, we ought to be thinking about it because it's doing something that people feel the need for. I'm not sure what exactly it is, but it's something important.

AK I've been exploiting the moderator's privilege of putting questions to my friend here, but let me share that opportunity now with the rest of you. I'm sure that many of you have questions you'd like to put to David Galernter. I invite you to the microphone.

Q In your lecture, you clearly highlighted the need for people to be aware of how computers work and just the basic structures behind them, but you also seem to dispense some criticism toward things like the Clinton administration's encouragement of putting the Internet in every classroom and just a general over-exposure to these sorts of things. My question is: What are we supposed to do to expose our citizens, and students especially, to enough of this technology so that they can learn how to use it and learn the fundamentals behind it but not so much that they're just inundated with useless information?

DG It's a good question—again, one of these tremendously difficult questions of balance. Generally, we know the right balance not because we've figured it out but because we stumbled on it by accident, and we noticed in retrospect that it was working. There are two separate issues that you raise—one having to do with the nature of what we say about computers to children, to students in the schools, and the university for that matter, and another having to do with what our priorities should be, what a student's priority should be, what a teacher's priority should be. The first issue—one might say, as I've said, people, other things being equal, should know more about computers. On the other hand, we are too

uncritically ready to spend lots of money and, more important, lots of time, on computers and the Internet in schools. There's a very important point about what we do with computers in the schools. First of all, it's hard to say exactly how they're used because so much data about what the schools do and how they operate is systematically suppressed. It's hard to find out how exactly they're operating. But the evidence seems to suggest that, by and large, they're used as tools that it's regarded as desirable that everybody should understand. People should know how to operate a computer, how to work a word processor and how the dashboard works and what a disk is and all those things, which is absolutely true. You cannot function effectively in society today if you don't know those things any more than you can function effectively in society, for the most part, if you can't drive a car. Our schools have long recognized the fact that people need to learn how to drive and the schools have to teach them because, if they don't, they won't necessarily learn, or it will be hit and miss whether they learn or not. But nobody's ever suggested that driver's education should be the center of the curriculum, or that we should introduce it in 2nd grade and keep coming back to it and hitting it again and again and working it into every lesson, building everything around it. We've understood that, on the one hand, driver's education is not trivial, it's important, people have to learn it. On the other hand, it's not terribly substantial intellectually. It's a skill that people should learn but it's not something that we should warp our idea of education around. Learning how to operate a computer, in the sense of just making it work, is similar to learning how to drive a car except that it's much easier. It takes a few months of practice to be a decent driver and you can probably learn how to operate a computer in a few days or a few weeks or whatever. It's easier to do. But aside from that, if we look at it as a skill to be developed, which is the way most schools seem to treat computers, it's too insignificant intellectually to carry the burden of teaching that we're loading on its shoulders. On the other hand, that isn't to say that there isn't something important about computers that we could teach if we wanted to—computer science, the study of what computing is, the study of what it means to compute something, what's computable and what isn't, the study of how a computer works, what software is, a bizarre new kind of substance, unlike anything that's ever existed, how you build software, what software is capable of doing, the mathematical theorems on which computing is based, the engineering principles that go into building software. This is the substance of computer science, a tremendously awkward name for a field that still hasn't really figured out what it's about but knows that it's got intellectual substance and that intellectual substance is not the same as the skill of using a word processor or, for that matter, the skill of writing a program. All these things are useful, but they're very different from the intellectual substance of computer science. So if one were to invest as many hours in computers as we do, evidently, in schools today, one would like it to be at least considered, at least on the agenda, that we should teach children something about the intellectual substance and not just about the skill of driving a car, or driving a computer. There's a lot there that we haven't even touched on in most school curricula. There are remarkably no computer science curricula per se for grade schools. There are not that many for high schools or any schools. But then there's a second question. One could be opposed to much of what the schools are doing with computers today and yet not be opposed to computers being in the schools. They probably belong in the schools. It's just that we could use them in a more serious way. It's a question of intellectual seriousness basically. We could be far more serious about what we do with them and what we teach about them.

But there's another question following that, which is a question of priorities and what's important and what's more important. I think it's easy to believe that it would be desirable in this country if more people knew something about technology. I certainly believe that. So many questions of public policy and community life hinge on computers today and more will hinge on computers in the future that there's no way that it would not be desirable for people to know about what these laws are dealing with and what the federal judges are deciding and what the issues really are on the Internet and privacy, security, the structure of corporations, taxes, all these public issues. It would be tremendously desirable for people to feel that they could have informed opinions about these topics. On the other hand, that doesn't mean that computing is the most important, desirable topic to learn. It's one important topic and if I had my ideal world, everybody would know something about it. But I would much sooner everybody know how to write and know how to read and how to do arithmetic. At this university, I think it would be OK if everybody took a computer science course—I think that would be desirable. On the other hand, I would much sooner have everybody take a physics course and a biology course, a music course. So, I'm arguing that something has been neglected—knowledge of technology --- and that something is desirable—knowledge about computing and software. It doesn't mean, necessarily, that it should shove everything else off of the agenda, and particularly at a time when we are covering the basic curriculum as poorly as

we are today. One wants to say, on the one hand, yeah, computing is tremendously important. Other things being equal, we ought to be teaching it much more seriously than we are today and yet, don't do it to the exclusion of teaching children how to read and write decently, teaching them the history they need to know, teaching them the arithmetic without which they're condemned to a sharply limited view of the world. Those things are more important. There are a lot of more important things.

AK But the problem that you're focusing on now is really that our knowledge or lack of knowledge about computers is just one particular illustration of a general and very widespread problem which is our increasing ignorance of the instruments and technologies that surround us in everyday life and on which we depend to do the various things that we do. And on Tuesday, you spoke about the value of transparency, again with special reference to computers; the value of making computers and their operations relatively transparent to their users—meaning "intelligible" to them, so they're not mysterious functions that you manipulate with no comprehension of how it actually works. But the range of our incomprehension grows apace and that's a consequence of the increasing sophistication of science and the variety of its technological products, and our practical dependence on them. So all of that suggests that, in the name of restoring and maintaining a meaningful degree of transparency, which may itself be a prerequisite for maintaining a meaningful degree of independence, which may in turn be a prerequisite for maintaining a reasonable, meaningful degree of democratic citizenship—for all of those reasons, it is imperative that we take command of our situation knowledge-wise and make sure that we acquire and that our children acquire enough of a basic working knowledge of the underlying science so they're not intimidated and don't condemn themselves to a life of servile ignorance. All of which leads me to put this question to you: it's a problem in the 2nd grade and in the 10th grade, it's a problem at the college level, too. If you were designing the Yale curriculum and imposing requirements or eliminating requirements, given a free brush to paint on a blank canvas and do as you wish, made the autocrat of the Yale curriculum, what would you do to address this problem?

DG That's an interesting question. I made myself something of a traitor to the Computer Science Department when this issue did come up. It was 10-12 years ago when the distribution requirements came up for discussion and we had a committee and I happened to be on it and it seemed to me that we needed something more like a science requirement, but it seemed to me that the essence of the science requirement should be the natural sciences and that one shouldn't be able to satisfy the essence, the core of the science requirement, by taking a programming course or, for that matter, an engineering course. In the world of science and technology, there is a logical hierarchy and we can deny that it exists but, anyway, it's there. Physics is more important than computer science. If you understand physics, then nothing will surprise you about how a computer works nor, ultimately, about what a computer does, what computation does. You can be the world's greatest computer scientist and not necessarily know what happens when you drop a ball on the ground or have any purchase on what the world is like. Lots of thought, over the centuries, has been devoted to this question of what topics are really fundamental and I don't really have anything original to offer. I think the consensus that was agreed upon in this country before it all got swept away in the late '60s and the early '70s and then partially reconstructed since then. I think the consensus before that, if you look at Yale course requirements in the early 1960s, was a reasonable consensus. The consensus was that an educated person needed to have some grasp of natural science. I would say you ought to take a physics course and a biology course. Some people would say, "Take a chemistry course," or whatever . . . There's room for argument there.
But the natural sciences are an indispensable part of what a person knows. Mathematics, to some extent, is. Philosophy and history were part of the Yale course requirements in the early 1960s. Everybody took a philosophy course. Everybody took a history course. I think everybody took a European history course and an American history course. There were some arts requirements. These were courses that were widely ridiculed at the time—art appreciation, music appreciation. And yet, you notice that the generation of people before our generation that are college educated, these people have a general view of what happened in music history and art history and they may ridicule the courses—the superficial courses that romped them through 2000 years of art history in one term—nonetheless, those courses served a purpose. I know many people who are glad to have had them. We have a responsibility, when somebody shows up asking for an education . . . Our responsibility is to teach courses intelligently. But our first responsibility is to stand up and be counted and to say what an education consists of. It's not fair to expect incoming freshmen or incoming anybody at any school, at

any level, to have a view of what is important in the educational scheme of things, and I think we've made it much easier on ourselves . . . It's much easier to be a professor here today than it was in earlier decades when the faculty shouldered the burden of saying, "You're going to take this course and this course and this course." That was a hard thing to do. Nobody wanted to do that. Nobody wanted to each the courses. Teaching those courses was tremendously unpopular. Nobody wanted to stand up and tell students, "Sorry, you're all going to take this philosophy course whether you like it or not." Nobody wants to makes himself unpopular. We made it much easier on ourselves but, nevertheless, I think we're failing in our responsibility to deliver this information that we should be delivering—that if you don't sit down and learn from physics, you're missing something and you will regret it. I don't mean that you'll regret it in a moral sense but you'll regret it intellectually. They're something that we could have delivered to you that, out of laziness, out of making it easy on ourselves, we have decided not to bother with. I think accepting the responsibility of saying what an education is in the first instance is more important than the details—does everybody need physics, or can you have biology instead? It's the logically prior question of accepting responsibility that's really the . . .

AK How did we come to lose that sense? Is it recoverable?

DG It's very hard, once you've made things easy on yourself, to make them harder again. How did we lose this structure of required courses which, if you look at Yale in the early '60s, late '50s, early 1965, that whole period of time, the university had changed enormously from what it was before the war, in the '30s and the early '40s. It had been transformed. It was a liberal institution in a lot of ways. It was very different from the old Yale that we read about. The structure of required courses was not onerous, but it was well defined. How did we lose that structure? I don't think that we lost it because we made a rational decision that it was a bad idea. We lost it in a fit of pique and we got carried away without thinking carefully about what we were doing. We decided that the whole idea of a required course was wrong. We lost confidence in ourselves. The whole nation lost confidence in itself and, certainly, professors lost confidence in what they were doing. They didn't feel any longer able to assert that it was critical for everybody to know American history or for everybody to know something about philosophy. And then the loss of confidence, we took that out on our students. And I think, almost immediately—I'm not an expert on the history of the university but, almost immediately, when I was a student here in the '70s -- the university was backpedaling. Almost immediately, it had the idea that this was a big mistake, that eliminating the whole structure of required courses was merely a way of making things easy on the faculty and that leaving the education to assemble itself, hit or miss, on the part of individual students was an abrogation of responsibility. But it's much easier to demolish a building than to build one. It takes a few demolition experts and an hour to blow something up, but it takes much longer to build it—in the world of human life in general.

Q. I had some related questions about democracy and voting and by voting I'd like to talk about what you talked about in your lecture—that is, voting for candidates in regular elections as distinct from what Dean Kronman is talking about, voting on issues that come before the legislature. Basically, I wanted to run a couple of scenarios by you and ask you whether these scenarios are possible either with present technology or likely to be possible in the next couple of years. Let's say that we could vote in either of two ways by computers. We could all have individual PCs or handsets, or we could all go to the polling place—the fire station or public school—and wait in line and vote in terminals that were common for everyone. Is it possible— let's say we're choosing a governor of Connecticut—for there to be either hand held hand sets or wireless hand sets, or computer voting machines in fire houses and the like where every time somebody voted for the Democratic or the Republican candidate or whoever they did, by flicking a switch, that that total could go into some sort of central scoreboard in Hartford or wherever and, whether we like it or not, people could keep track of the running total from the whole state as people voted. And then, once 8:00 came around, the end of the day, we would know the grand total right away and we would know even more accurately, I guess, than efforts supposedly do with exit polls, how people were really doing during the day. Is that feasible now? If it's not feasible now, is it likely to be feasible in the next few years, broadly defined?

DG That's an interesting question. Two questions. When you say "feasible," there's the issue of social and political feasible and then there's technologically.

Q First, just address the technical piece.

DG It's the kind of proposition that technologists like to dismiss. It's the kind of problem they hate to solve and they would much rather not have to solve—compatibility in general. Computer people would rather just say, "The hell with it. We don't want to worry about that." But, in fact, I think it absolutely is doable. The technical community resists such approaches but as the technical community would say, "This half and half system is difficult to regulate, it's difficult to fit the pieces together" just like it's hard to move files from a Mac to a PC, depending on the software environment in which you're working. It's difficult to take a printer from one machine and plug it into another machine. It's difficult to move from one software environment to another. But all these difficulties are just artifacts of technological laziness and the fact that consumers are so undemanding that they're willing to—when they buy a new computer—say, "Well, I'll buy a new printer, too, and I'll throw out the old one." There's no reason people should accept that lack of compatibility and there's no reason why we couldn't have a system in which you could vote using a computer and you could also vote using a voting machine. It would be hard. It would be complicated. These compatibility things are always hard to engineer. They tend to be hard to engineer. If we wanted it, we could have it.

Q Dean Kronman talked about friction. It occurred to me, just as he was saying that, that when I went to my ATM earlier this week, there was actually sort of a little ritual, and it was a good ritual in terms of accuracy, that I identified myself and I had to type in my password and then I had to choose "Withdrawal" and then I had to type in a number and, if I remember right, it displays the number and said, "Are you sure?" or "Is this the number?" And it seems to me that, with voting for a candidate, one could do something like that and vastly increase the accuracy and, I suppose, to some extent, reduce the impulsiveness of the vote. I mean, the reduction in impulsiveness would be minor but at least it would tend to eliminate the thought that, "Oh, my God, I voted for the candidate I didn't intend to." So I'd be interested in your reaction to that sort of technology in terms of voting, and then in terms of technology, and then whatever social or political spin you'd like to put on it.

DG You could reduce the impulsiveness of voting a lot if you wanted to by banking information available on any net connected computer, so that the voting act wouldn't be something that took 10 seconds or a minute, so that we naturally thought of it as something that was more like reading a magazine. It might take 10 minutes or 15 minutes, or have some information associated with it. We could do that next year. We could do that soon. We could do that right away. And it's interesting to speculate what the effect would be. You mentioned ATMs by the way. One possibility is that we could turn ATMs into voting machines. There are a lot of ATMs and they're already wired up anyway. That's one possible scenario. What you mention is a possible good effect. It probably would arouse, I would think, violent opposition which is the idea that we'd show people a running total of what the vote was. Given an election in which people were tremendously upset about the possible effects on voting of projecting the results of an election before the polls had closed all over the state, and similar things have been issues in elections for a long time. On the one hand, if you showed people the running total, you'd make an election interesting to watch. People would tune it in and they'd see these big numbers running up and you'd have a sense of the election as a dynamic process. It would be fascinating for some people, for many people. But I think grave fears would be aroused that people would be influenced and would try and gain their votes in a way they wouldn't otherwise, and say, "Well, this guy doesn't need the vote, so I'll give this guy the vote," but you may not realize the dynamics of the election and you may be outsmarting yourself. You would thereby give the public the opportunity to outsmart itself. On the other hand, in the final analysis, the public deserves the opportunity to outsmart itself and, once you have computer voting, once you have a slot in some computer somewhere which has a number in it which reflects all the votes that have been cast so far, as in 10:30 or whatever in the morning, it's only a matter of time before everybody can see it. So when we talk about computer voting, whether it's good or bad, I think we're kidding ourselves if we believe that we can insulate ourselves from the consequences of computer voting. And one of the consequences is that you can have all the data at your fingertips. And once the data exists, it will be made available, either by somebody hacking into the system or legitimately. Eventually, it will come out and we ought to be thinking about whether we want that or not.

AK It's very difficult to predict just what the behavioral consequences would be of a running total. It seems, intuitively, that voters whose candidate is slipping behind but still seems to be within close range of catching up will have a stronger incentive to get themselves to the poll to vote and those whose candidates are ahead, a weakened incentive because now their vote is no longer needed. But by 5:00 in the afternoon, if the incentives are both working in those directions, the situation may have reversed itself and those who were ahead now find themselves behind and are scrambling to get there in time. Maybe in a close election, a larger fraction of the registered voters would actually end up voting and, of course, then I suppose it's a question of what's a good thing or a bad thing, but let's assume naively it's a good thing that more registered voters vote than less. In an unclose election where an unbridgeable gap opens up early in the day, and by unbridgeable I mean no amount of mobilization before 5 PM stands a good chance of closing it, then fewer people may end up voting than would otherwise. But maybe it would be the other way around. It's a complete, unpredictable mix of incentives and, perhaps, if we could run a controlled experiment or two—call it Connecticut or Massachusetts—it would be interesting to see what the results are.

Q When the networks started to experiment with exit polling, it was clear that, by reporting California totals at a particular time of day, enough surveys showed that that, in fact, did influence voters negatively. In effect, "My guy's going to win. I'm not going to go out." In effect, "My guy's going to lose. He's losing by big numbers. Forget it." So it has had, wherever there has been scientific study, a negative effect. There are two places in a campaign where people know how the election is going every hour. That's in the Democratic campaign and the Republican campaign. They have enough accurate methods of measuring which voters are coming. And neither party wants that out publicly, for the very reasons I've pointed out. It has an effect that no political candidate can control. And candidates want to control the effect of any election. Just a comment.

DG Certainly, it is the case that people are very worried about the deleterious effect on a candidate who seems to be losing if we announce too early that he seems to be losing—not only on that election, but, maybe more important, on other elections. Other state elections are not going to draw people if the top of the ticket seems to be hopelessly sunk. And, as you say, political campaigns and their tracking polls have constant information that isn't necessarily accurate. They believe it to be accurate. We heard very early in the last election, on election day, that the Bush campaign was clear that it had locked the thing down, and they were wrong. They had tremendous amounts of data, volumes of information. In the long run, however, the data will get more accurate. Our ability to extrapolate voting tendencies will get more accurate and one thing that we are very bad at doing in this country is suppressing information. In the long run, we never succeed in doing it and I agree that, ultimately, the effect is imponderable. I don't know what it will be like when anybody can tune in the election and find out exactly where everybody stands, and also see the time sequence of events. You're going to see clearly where the trends are and you can extrapolate it out however you like. I don't know what the effect will be but I wouldn't bet against that information coming out. I think, sooner than we believe, it will be everywhere.

AK Let me raise another subject. What are often referred to as "communication skills" (not a phrase I'm particularly fond of, but it does descriptive work), communication skills are an important element of democratic life—being able to listen critically and to communicate and to speak and write articulately are important for the conversational give and take of democratic life. If all you have to do is give orders or receive them in autocratic fashion, communication is less important. You just need to know how to obey and that requires some communicating to be sure but of a more reduced form. And so, having a vibrant, communicative culture seems to be an important part of democratic life, maybe even a prerequisite for a healthy democratic life. What's the bearing that computers and their steady use and the habits their steady use form have on all of this? You speculated a bit about writing and computers. And I found myself in agreement, just on personal anecdotal grounds, in agreement with some of what you said and not persuaded by other things. But in general one might take the "it's only another tool" view and say, "Computers help us to read more, to read more quickly, to speak more quickly, to write more quickly, and in greater volume." To that I can attest. The average length of papers I receive from my students must have tripled in the last 10 years easily. They look much more elegantly finished; they look like books, actually, Indeed, they are books, in both length and appearance. What does all this mean for communicating of the kind the democratic life requires?

DG Again, I think you wind up concluding, in many cases, that computers highlight and underline our pre-existing tendencies. They make the louds louder and the softs softer. We ought to be in the middle of a tremendous prose renaissance now. We should be the greatest generation of writers that have ever existed—first because the tools themselves that we use are so perfect for writing and for revising: a word processor and a printer, exactly what a writer needs to polish his prose and make each sentence beautiful, and also because of the Internet . . . I mean, writing is one of the things that could be taught by remote control—not as well as it could be taught face to face but, nonetheless, effectively. I could teach a writing class, in principle, where the students are in San Francisco, and computing provides just the right technology. Students could write paragraphs or pages or whatever and send them to me or send them to somebody and the teachers would mark them up and send them back, and we're seeing some of this to some extent. So not only are computers the right tools to polish the writing, but they're the right tools to teach writing, to make a wider variety of writing teachers available than has ever been the case before. And, for example, many people who are truly good writers, of course, have nothing to do with the universities. They may be editors, they may be reporters, they may be journalists, they may be novelists, or whatever. They aren't available to teach a course full time but they might be available to teach a writing seminar by remote control to Tegucigalpa or something. And we have the technology to support that nowadays.
However, it doesn't seem to be the case. I mean, you pick up the *Times* today, or a news magazine, or a student's paper—certainly, the news outlets that we have today are more sloppily written and edited than they've been for many generations. Anybody who's interested in American history and spends a fair amount of time reading old copies of the *Times* or the *Tribune* or *Time Magazine* or whatever notices it immediately. Students today are often painfully aware of how badly their writing courses have been conducted. I've had a lot of people tell me, "I know writing is important. I want to be able to write. I work on it. I didn't get taught properly." Many students are aware of this. So why is it that we have marvelous tools and instead of having the greatest generation of writers we've ever seen, we have some fine writers… It's not as if writing has disappeared. It's not a lost art. There are fine writers and there are fine student writers, and yet we have the farthest thing from a renaissance of writing or of prose. I think you have to conclude that computers are not that important in the final analysis—certainly to this issue. It depends what our dispositions were. When we want to write, when we want to teach writing, when we hold good writing in high regard, then we produce it. And it doesn't matter if we're using a quill and ink or a typewriter or a fancy word processor. We'll get good writing. And if we don't care, we're not going to get it. And so, the question really becomes, not what computers do for writing, but what we think about writing and what we care about, what we value, what we regard as important, and then computers can help. But if we approach them with the feeling that we don't necessarily have any predispositions or agenda and we'll just do what comes naturally or whatever is easy, then we'll wind up with our least admirable tendencies underlined.

AK This was the general theme of your lecture on Tuesday. You spoke at several points about the chance or the opportunity—sometimes you said, "the excuse" -- computers give us to do what we are otherwise independently inclined to do or perhaps not to do, to avoid doing. But in the view that you expressed on Tuesday and then again in several of your comments here this afternoon, computers don't seem to be generative of much moral, spiritual, personal, intellectual ambition of their own. They're available there for the expression, expansion, extension, maybe even suppression of feelings which exist, and ambitions which exist antecedently, but they're not the nursery beds of these things themselves. They're merely the opportunity, the occasion, the excuse, maybe the megaphone or the muffler but not the place where real ambition of whatever kind begins.

DG I think that's absolutely true and I think what is unusual is that we should even think the contrary. If you look at the history of the typewriter, for example, the typewriter probably represented just as important a methodological improvement on writing with pen as the word processor does over the typewriter. And the typewriter was a very important thing. But nobody, as typewriters began to be widely available and so forth, nobody really pondered deeply on the effect that typewriters would have on American culture or world culture. If you look at the point where the typewriter was introduced, it really had no effect on prose. Great prose was written pre-typewriter and great prose was written post-typewriter. That doesn't surprise us. That is, it doesn't surprise us that typewriters really didn't change

culture very much. Certainly they made it more convenient to go about the business of being a writer. But I don't know if it's fair to expect computers to be any different qualitatively in their effect on culture. They give us an opportunity. They give us an opening. They make it easier to do certain things. If you are predisposed to revise, they make it easier to revise. If you're predisposed not to revise and to rip out a paper in the minimum of time and just get the words down as fast as you can, they're very helpful in doing that also. They make it possible to spend less time or more time than it's ever been convenient to spend before.

AK Let me ask from a slightly different viewpoint and invite you to react. My father was a writer and he wrote at home on a manual typewriter for many, many years. Toward the end of his life, he converted to an electric typewriter and that was a revolution in his mode of production. But he could still only compose about as fast as he could move his fingers which was faster than he could have written with a pencil or a pen, but not all that much faster. Now, if he'd had a computer— I've thought many times, wondered many times, how this would have changed his life. He was a professional writer so this is what he did every day, all day long. What if he'd had a computer to work on, rather than the Selectric II that was his last finest instrument of composition? Of course, sitting at a terminal, he'd still be typing at the keyboard and couldn't compose faster than he could at the typewriter. What he could do much faster is edit—eliminate, move blocks of text around, cut and paste, do things that required him, before, to go back and white out or, when he had the ribbon that allowed you to type over. You had to strike every single key in order to get the old line out. And I have sometimes thought—maybe this is more a reflection based on my own experience—that being able to edit so quickly and easily isn't necessarily such a good thing. This is back to the theory of frictions. I believe that most writing is re-writing; that is to say, the editing of your own work. That's where the labor comes in and that's what produces the beautiful sentence, nine times out of ten. But if it's too easy to edit, if there are no frictions in it, then it's too tempting to think that just having blocked out a certain chunk of text and flopped it up here or moved it down there has accomplished something. It habituates you to a certain ease of editorial re-composition that covers over the fact that it is the painstaking, word by word composition of each sentence that produces the lovely page at the end of the day. So I think, maybe, a Selectric II is the world historical optimal technology and you can't do better than that and we may be doing worse.

DG The hardest problem in art is knowing when to stop. And we see it again and again in so many different contexts. What you're saying, I think, is exactly right. That is, a tool that makes it easier to keep going cuts both ways. Sometimes, it's good, but it can also take you sailing past your goal. I've been recently writing a piece that has to do with the series of photographs that Matisse took to exhibiting, along with paintings, towards the end of his career. He'd have assistants and models photograph paintings at different stages of evolution and he'd exhibit those photographs—they were black and white photographs usually—along with the paintings. And when you look through these series of photographs, again and again you find that he overshot the mark. You can't know for sure because the photographs don't tell you everything about a painting. But again and again, in these sequences of photographs you find a point at maybe half way through, two-thirds of the way through, and you say, "That was exactly it and what a shame that that painting disappeared." And everybody who works on any piece of writing, any piece of painting, any piece of music, knows that while, on the one hand, you can hear and feel a resonance when something is exactly right, on the other hand, to work on any piece of art—as a writer, as a painter, as a composer—is to be an obsessive compulsive. That's the only kind of person capable of doing it and you have an urge to keep going, even when it's not in your own best interest to do it. And offering a writer a word processor, like offering an alcoholic a bottle, is not necessarily the best thing. And I, myself, say, on the one hand, "Computers are wonderful tools for prose," and I think that's true and I use them in that way every day and I'm grateful to them every day. I'm a heavy user every day. On the other hand, I began writing in high school or whatever, as all writers begin, whatever—in high school and college, when I was an undergraduate, before there were computers but there were word processors . . . When I compare the process of writing then to the process of writing now—I've been a writer but it has nothing to do with the computers. There's no qualitative difference in the basics. I revised a lot of times then and I revise a lot of times now. And the difference is that, then, the final copy was uglier. It was re-written and over-typed and all that stuff. And now I can produce a beautiful final copy.

Q You've been discussing the effect of computers on democracy. I wanted to look at it the other way around. The innovations or the invention of the computer and the invention of the Internet happened in

America and Britain, the democratic world, and I wondered if you think this has to do with the fact that they are democratic. Do you think the invention of the computer and the Internet came from capitalism? Do you think it came from the legal tradition? In other words, look at it as if democracy had never come to the world, do you think the computer still would have come?

DG If I understand you, you're asking if there was a connection between democracy and computers in the sense that it was not an accident that computers were invented in a democratic country as opposed to a communist or fascist dictatorship. It's an interesting question. The historical record is kind of complicated because, of course, there was pioneering work done on computers in 1930s Germany. There was a lot of brilliant work done on computers in the Soviet Union. It's hard to pin down exactly where computers came from. And yet, in the final analysis, the key engineering breakthroughs were made in Britain and in the United States. And did it have to do with the fact that Britain and the United States were democracies? In the final analysis, I have to say, absolutely. It had to do with the fact that these were free countries in two senses. The people who invented computers were free to think whatever weird thoughts they wanted to think without inhibition and many of the people who did develop computers were strange characters. But maybe even more important, many of the people who did the pioneering work on computers were not native born Americans or Englishmen. They were central Europeans or Europeans of other descriptions. Von Neumann, the great Hungarian Jewish mathematician who wrote the first description of a modern computing machine, came to the United States as so many other refugees came to the United States, and these people and many of their colleagues came here, ultimately, because this was a democracy incapable of the kind of behavior they were escaping from. So it's maybe not a direct matter about voting or not voting, but it's a matter of our fundamental character as a society and a nation.

AK Thank you, David. We have to bring it to a close at this point, but please join me in thanking David Galernter. This has been most interesting.