

# The Perestroika of Epistemological Politics

Closing address to the 1990 World Computer Education Conference

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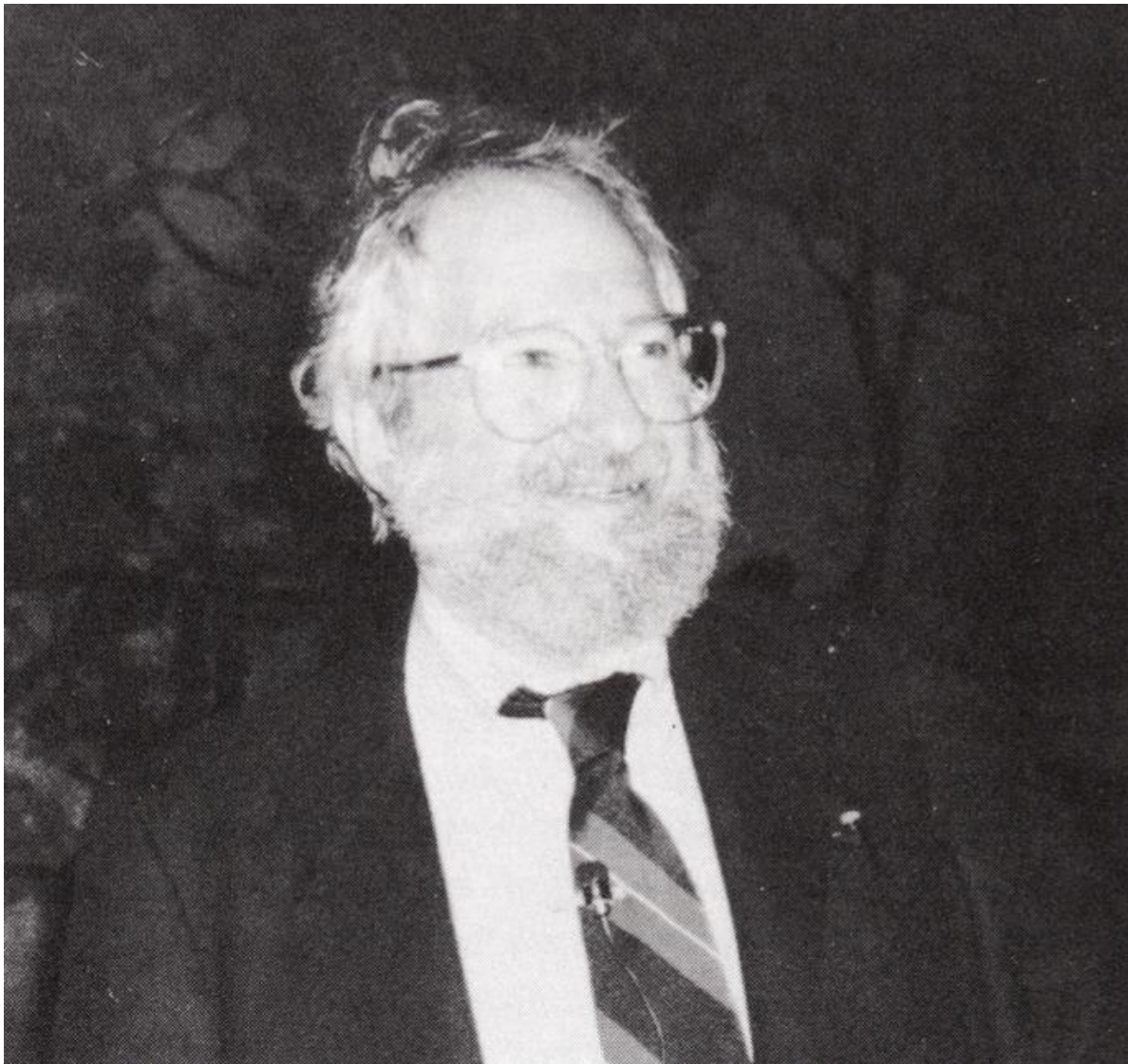
*Seymour Papert, whose ideas and inventions transformed how children around the world create and learn, died this month. The following keynote presentation was made to the IFIP Fifth World Conference in Computer Education held in Sydney, Australian in 1990, and printed in AEC Vol 5 No 1. It captures his vision of education and remains as relevant today as it was over 25 years ago.*

*“Papert’s career traversed a trio of influential movements: child development, artificial intelligence, and educational technologies. Based on his insights into children’s thinking and learning, Papert recognised that computers could be used not just to deliver information and instruction, but also to empower children to experiment, explore, and express themselves. The central tenet of his Constructionist theory of learning is that people build knowledge most effectively when they are actively engaged in constructing things in the world. As early as 1968, Papert introduced the idea that computer programming and debugging can provide children with a way to think about their own thinking and learn about their own learning.*

*Papert was among the first to recognise the revolutionary potential of computers in education. In the late 1960s, at a time when computers still cost hundreds of thousands of dollars, Papert came up with the idea for Logo, the first programming language for children. Children used Logo to program the movements of a “turtle”—either in the form of a small mechanical robot or a graphic object on the computer screen. In his seminal book *Mindstorms: Children, Computers and Powerful Ideas* (1980), Papert argued against “the computer being used to program the child.” He presented an alternative approach in which “the child programs the computer and, in doing so, both acquires a sense of mastery over a piece of the most modern and powerful technology and establishes an intimate contact with some of the deepest ideas from science, from mathematics, and from the art of intellectual model building.”*

*Papert’s work inspired generations of educators and researchers around the world. He received numerous awards, including a Guggenheim fellowship in 1980, a Marconi International fellowship in 1981, the Smithsonian Award from Computerworld in 1997, and in 2001, Newsweek named him “one of the America’s 10 top innovators in education.”*

In Memory: Seymour Papert  
MIT News, 1 August, 2016



Hello, Hi. I guess most of you, like me, during this week, have been immersed in lots of exciting, detailed, focused activities and discussions; encounters about the actual use of computers and actual activities of children. It is appropriate though at the beginning and at the end of the week to enlarge our perspective and look at some larger issues. I couldn't be happier with a counterpart in this sort of sandwich with two slices of bread on the sides of the lovely butter and the stuff in between, to have had Alan at the beginning.

I'm going to use Alan Kay and his position in his initial talk to define some lines of demarcation, as I see them now, in the field of battle; I should Say, about the future of education. The battle goes far beyond computers, in fact, goes far beyond education. I think we are facing a battle which you could see on the one hand is a battle for the minds of children, on the other side you can see the battle for the survival of the planet. I think it is becoming more and more apparent to more and more people that our planet is in dire danger and that the only thing that can save it is radical change in the way people think, and that is what the word education ought to be about. That is why I have chosen a political theme Perestroika and Epistemological Politics to put a focus on these larger issues, on the seriousness, and, on the high place in the battle in front of us.

I am going to try to draw certain battle-lines or if you like a more peaceful metaphor, a certain line of cleavage in the division in how computers can enter education and indeed visions of education. In the drawing of those lines, I see myself pretty well always on the same side as Alan Kay. I will use our commonality in part to define what I think of as the major line that divides different perspectives on how computers will enter education in the future. That is not to say I don't disagree with Alan Kay on other issues. One of them may be just a matter of taste in that I have a taste for a lower key technology.

One thing I did not like about Alan's presentation was the fancy fish which looked like Hollywood images. It didn't look to me like a child had drawn those fish. I think that is an important, issue that we ought to bear in mind when we think about creating media for children. If the children don't draw in that media or create in that media things that look like they came from children, there is something wrong. But that is a minor issue. I think that on the major line that I could draw, Alan and I are very much on the same side, and one of these is about the kind of change you can expect in education. I would like to say something about calibrating change. If one says, as I often have, that education has not really changed very much all this century, people jump up and down and get very excited, and say, "Oh, but it has. Look how schools are different: we use different curricula, we use Cuisenaire rods and manipulables, etc, etc." Is that change or isn't it? Clearly, that is change, but how big is that change?

I would like to share with you a metaphor, a parable I find useful for calibrating change to see whether what we count is real change. I like to imagine a group of time travellers from it doesn't matter where, from the 1800s let's say, who have the opportunity to travel in a time machine to 1990 to see how people nowadays do things. Among them is a surgeon who finds himself suddenly projected into an operating room 1990 style. Imagine his bewilderment. What is going on here? There are flashing screens, beeping electronics; even anaesthesia is something totally new to him, so is antisepsis. Indeed, I think it is reasonable to say that nothing that is going on there makes any sense to him. Certainly, if the surgeon were to have to leave the room for a moment, he would not be in a position to take over. Now think of his colleague the School Master, also projected into a school room of 1990. Now there might be something in that school room he wouldn't recognise, that funny little box... what is going on there? Pictures? Maybe there are people behind there, that glass; Maybe it's sort of a window. But most of what is going on in the classroom he would understand perfectly well, and if his host teacher had to leave the room, he wouldn't have the slightest problem taking over teaching the multiplication tables or spelling. He might have a few weird ideas about some words, but basically it would be the same.

So let me say that in some departments of human activities, for example, surgery or telecommunications, or transportation, and a lot of others, we have seen, in the wake of scientific and technological progress, mega-change. Change that is so radical that these fields have become unrecognisable. Your satellite television to Norway versus smoke signals or pigeons. It is just a different ballpark. Then there are other departments, for example, education, where nothing very different has happened. Now you might say, and certainly would argue, well, that is not surprising. It is not appropriate for such change to happen in education. Not all activities are apt to change in this way, for example eating. The basic act of eating, it might be charged, is little supported by technology - you open your mouth, and you put in the food and chew it, and hopefully you enjoy it, and you swallow it down. Whether it was cooked in a microwave oven or an open fire or not at all, does not seem to be deemed a radical change in the nature of the act.

Eating is a natural act, not a technical act. A natural act that can be supported or modified by the technological field around it, but it doesn't depend on it, and it doesn't change radically. We don't expect and wouldn't welcome mega-change in the act of eating. Isn't learning of that same nature? Isn't learning a natural act and if so, why would we expect, and if we could, should we welcome, mega-change in learning?

Well, I agree learning is a natural act and shouldn't be subject to mega-change. Or rather, I agree with that if the kind of learning you are talking about is how a baby learns to talk, to walk, to love, to play. All that is a natural act and I don't welcome any radical change in how it might happen. But school is not a natural act. School, is in fact a technical act, and I do think there will be, and I certainly would welcome, mega-change in the nature of school.

What kind of mega-change might one anticipate? How should one think about the possibilities of such change and the circumstances under which it might happen? Well, first of all I would like to elaborate just a little on the sense in which I think school is a technical act. Also I would like to focus on the fact that the teacher in the school is cast in the role of technician, carrying out procedures that are laid down as part of the so-called syllabus or curriculum designed in a hierarchy, laid down from up top, and dictated to the teacher. I am not saying that is what actually happens. In each classroom, there is a tension, a sort of dialectical struggle between this role in which the system tries to cast the teacher, and the fact that teachers are only natural human beings who laugh and relate to people, and know what it is to learn and to encourage development. Therefore, no teacher falls completely into this role, but this is the role into which the system tries to force the teacher. Whenever (as happened recently in Britain, somewhere in America, and I believe here) politicians get excited about the fact that something is wrong with education, they start shouting about accountability, tighten it up, more hierarchical control, let's have national tests. You see constantly the system trying to force the teacher back into this role as technician. The kind of change I want to talk about, the aspect of the change I want to emphasise and talk about, is releasing the teacher from that role of technician and allowing the teacher to participate in learning (indeed as a natural act) and I do believe that doing this will constitute a mega-change.

Let's go back to our time traveller, the time travelling teacher. There are some classrooms, and I have heard some descriptions of classrooms here in Australia, where you might see activities that the teacher from 1800 would not recognise as proper activities for a classroom, as something comparable to the familiar activities back home in time. For example, some of you might have seen last weekend, children right here in workshops building robots and other machines out of Lego, connecting them to computers and writing programs in Logo to control them. I think the teacher who wandered into that from the 1800s would be a little lost. Like the 1800s surgeon wandering into the modern operating room. What is going on here? It wouldn't really make sense in its nature or as a way of learning. I think that in this situation we see little glimmers of what a different kind of learning environment would be like. One in which the children are engaged in the construction of something; they are engaged in a meaningful activity, and they are learning a lot passionately.

The role of the teacher? Well, to guide them, to act as a consultant, to help when they are in trouble, maybe to spot that this child is in a sort of cul de sac, on a plateau and could be encouraged to take a leap forward. There is an extensive role for the teacher in this. In fact I think that this description of the teacher, not as a technician, not as a policeman, not as an enforcer of a curriculum, but as somebody who is part of a learning community .... it is the





image of the teacher really being a teacher, being able to exercise at each moment an individual judgement, individual decision about where to go and what to do, what action to take. It is this freedom of the teacher to decide, and indeed the freedom of the children to decide, that is perhaps most horrifying to the bureaucrats who stand at the head of the current education systems. How can we tell if teachers are really doing their job properly? How do we enforce accountability? What type of quality control is there? Let's go back to the curriculum and make sure that from day to day, from hour to hour, it is laid down what the teacher should be doing and this way we can check up on it.

Well, this is an illusion. It is an illusion from lots of points of view. It is not a humanistic method of education but looking for an effective way of ensuring quality. It is only a way of, I don't know, (is it O.K. to say?) covering ass! I mean everybody can say, "I did my best, I did my lesson plan today and wrote it down in the book." So nobody can be accused of not doing the job. But it really doesn't work and it has got nothing to do with what the output is. In fact, those teachers who do good work and get good results are exercising judgement and doing things in a personal way often under cover.

So the change in education that I am thinking about can be seen from at least two or three different points of view. We are talking about a very different content matter with children building robots rather than doing maths, doing physics, doing writing and spelling. We are talking about a different total process, a different process of control and organisation of the school system.

I am going to say something about each of those, but I think this is the right time to come back to my title. I use the word Perestroika. Of course, this is Mikhail Gorbachev's word for restructuring, as he sees it, in the reorganisation of the Soviet political and economic system. I find what is happening in the Soviet Union, Eastern Europe, an extremely powerful metaphor for a number of reasons. First of all, there is the most elemental one, and that is that these systems, not so long ago, I mean just five or six years ago, were thought by everybody in the world to be impregnable and unchangeable, as solid as the stone that the Berlin Wall was built out of. Hardly any experts (maybe none) predicted that in such a short time this wall would have crumbled even though it was made of stone. Because it is not the stone but the social systems that hold it up. When we see how rapidly that change happened, it is sobering or maybe the opposite of sobering, maybe it is drunk-making, in relation to the attitude that many people have towards the education systems that we know here. We all say: "Yes, it is bad, everyone knows it is bad, but it will never change. You can't change that." Well, I think we have had some dramatic examples recently that show that things that didn't seem to be changeable might change. But there is another side to it too, in a sense an opposite side, that while these winds of change that we see in the Soviet Union and other countries invite us to believe that change can happen when we all thought it couldn't, they also tell us a lot about the pain and difficulty of changing a large stable social structure.

When Gorbachev first began talking about Perisnoika (it's apparent from his speeches, and I think it is clear from an analysis of everything that has happened there) he did not have any idea that there was going to be so much change so quickly. It is clear that he thought that they could restructure a little bit, they could sort of jigger, tinker with the bureaucratic organisation, make it better, and everybody would be happier.

We have seen that something else happens, that once you start moving the system away from its equilibrium, it does not stay where you put it, but like something that is tilted too far it

goes into its own ballistic orbit, it takes control - and we have seen that in the Soviet Union. There has been a progression from an idea of fixing a bureaucratic structure, of fixing organisations that move rapidly to a point that questions the fundamental concepts on which that system was based.

In education, we are seeing very much the same thing. Actually, the metaphor's closer in my mind than I have indicated explicitly in my text, by what I was saying about bureaucracies and centralised control in organisations and education. It is part of my perception that what we have in our society that is closest to what is collapsing in those Soviet societies, what we have that is closest to their system, is our education. I would read in the collapse of the economy of the Soviet Union the bankruptcy, the unworkability of the system of centralised control. The unworkability of a hierarchical system where the people at the top will make plans and give orders, and it will all get carried down to the base of people who carry out what they are told to do. It doesn't work. Yet in our schools, this is what we constantly try to do.

The very idea of a centralised curriculum, the way we try to organise our schools is hierarchical and planned in the same way. The curriculum is our boss plan'. It is becoming apparent to more and more people that our system doesn't work either or can't work well enough for the demands of the modern world. I think it could have worked at an earlier stage because the demands weren't there. There have been stages in history where it has been sufficient for the education system to throw up a small number of people capable of leadership and critical thought and problem solving, and to throw up a large number of people who would be 'sheep', followers. But this is no longer sufficient. We need something much more. When we look at the demands of the modern world, when we look at what goes into making any great technological marvel such as putting the Hubble telescope up there (they have made one mistake, or two) you can think of how many problems had to be solved in getting that thing there, how many decisions had to be made ... arguably you might say that in putting that thing up as many decisions were made as by everybody in the world in the 19th century. I don't want to scare you, don't take it too literally, but I think there is a point in which this is metaphorically true. So we need a different kind of person. We need people capable of quicker reactions, more change, more flexibility - I don't have to emphasise that, everybody knows that. The question is how will we get that.

My analogy with Perestroika and the Soviet Union leads to a reflection on the education world in social and political terms. I would like to say a few words about the history, give a very brief potted history of computers in education as I see it, the history in this kind of respect.

When I first saw microcomputers in schools, that was the late 1970s. The first one I saw was made by a teacher who had built it over a summer from a kit with his son and brought it to his school. We then saw them popping up here and there, always driven by a visionary teacher who had the romantic idea that computers could make learning in his or her classroom more exciting, better, more wonderful. In other words, those computers were first of all in the mainstream of the learning situation in the hands of visionary teachers.

In the course of the '80s things began to change as computers became more and more present, as they filtered into schools, not because of any, I think, educational considerations, but more the image of the office out there, is of a computer on every desk, the more the infiltration to everybody's image of the school, that there should be a computer on every desk, and so there

is a slow drift in that direction. After a while, the school administrations start taking over and after a while, they begin to think of organisational forms for the computer. They put the computer in a special lab with a special computer teacher and a special computer curriculum taking it out of the mainstream of learning, making it just another piece of curriculum. Now, as I said about that teacher at the beginning, this is the tendency of the bureaucratic administrative structure in schools. Not all computer teachers do this; not all people in charge of these computer labs use them in an isolated way. Many try to do the same kind of visionary things with them as they were doing before, but the trend is that way, towards what I would call normalising. What seemed to be at the beginning, an instrument of revolutionary change, becomes appropriated by the system, neutralised, made part of the system and turned into, in fact turned into something that could be described as, is often seen as, a Band-Aid for the problems of the system rather than an instrument for real change. In my image of the children building these robots, they are doing something very different from what has been the envisaged model of the school, even different from the curriculum. But when a school introduces a computer lab and then try to patch up the faulty maths course by doing a lot of drill and practice with computers (to take the extreme case) the computer is being used as a Band-Aid, not as an instrument for revolutionary change. This is the response of a bureaucracy like any other organism to a threatening foreign body. This vision defines one of those battle lines mentioned at the beginning. If you look through the world of the people engaged in the computers in education business there is this first big division between those who maintain the vision of the computer (it is just the beginning at the moment but if it is projected in the future), as part of the deep, radical mega-change in how we think about school and learning, versus those on the other side of this line who see it in terms of the existing system, in terms of bolstering the system, in terms of correcting some of its faults, whose image of the computer might involve a lot of computers. However, a lot of computers are a computer on every desk in an otherwise unchanged school system. So that is one line.

A second line digs a bit more deeply down into the conceptual foundations of how to think about education and learning. It is a line which I have recently been using: instructionism and constructionism. We can think of two ways of producing improvement in education. One is, I believe, absolutely dominant in the literature on educational research, and that is the idea that you improve learning by having better instruction, and you see this concept reflected in the phrase computer-aided instruction.

You see it all over the place. Now I am not questioning the value of instruction. Instruction is inevitable; you need sometimes to show people how to do things that we know how to do, and they don't. However, I don't think that the route to better learning in our schools is better instruction. Consider my example of building of robots, giving children computers to program. To this I would add examples of allowing children, and giving them the means, to become activists for environmental actions; all these lead to better learning not through improvement of instruction but through giving children better opportunities to construct, to build, to make (and I am using the word constructionism to stand for that approach); that we will improve education by making better things for children to do. In the wake of that comes a lot of other issues. If you want to see where constructionism can lead, we need to re-examine a lot of our fundamental questions. Let us consider for example the question of controllability and accountability. I mention the role of the curriculum as a way to exert authority over teachers to make sure they are responsible, that they do what they are supposed to do. You can raise the same argument about children: if children are allowed to just go into this environment and freely make things and build what they want to build, how do you know if they are learning at all. What if they are just playing? Well, I think there is something

fundamentally wrong with that. Anybody who watches children in real environments can see that while they might want to play, they don't want it easy. In fact, if you look at play you will find some of the hardest work ever, anywhere. If you look at children in sports or, recently we have been looking, taking a fresh look at children playing video games like Nintendo games. They work hard. It is very interesting to see. You see these children working hard at their Nintendo games and what is the reward for doing this hard act? Their only reward is to get an even harder act, and they avidly admire the other kids who have gotten into the harder tasks, and are doing these harder tasks.

In the same spirit, I picked up a phrase listening to children working at Logo. This was something that was reported to me by someone in a school in California in San Jose, Project Mindstorms. Somebody overheard a child, a first day child, coming out of the logo class and being asked by some other children who were coming in for the first time, "What is it like? What goes on in there?" The child said: "It is fun" and as if to explain why it was fun, "It is hard" and then added, "it's called Logo".

I think the concept of 'hard fun' is very obvious once you watch children and in the same way as once you meet a word and look it up in the dictionary (if you have not noticed it before) and in the next three months you meet that word twenty times and you wonder how come people have been hiding this word from me and just been popping it out recently', I have been listening to children, and I hear that phrase hard fun and its synonyms very often. I think we see that children are pining to learn, they want to learn hard, but school is not learning, it is play learning. It is sitting there filling in little squares on blank paper, filling in figures on square paper in a mindless way. Children object to it, turn their minds against it not because it is hard but because it is boring, meaningless, maybe because it is too easy. 'Well, if we believe this we change our attitude, and we try to create conditions where children can do things that are meaningful like building those robots, like playing those games. Instead of trying to make children learn maths, we try to make maths that children will learn, and so we invented the concept that some of you, I am sure many of you, know about, too many of you to need recounting now. We invented in logo the concept of a turtle and turtle geometry, a way to do maths in the course of writing programs. They achieve other purposes than getting a grade; children write programs to make graphics on the screen to make games, to simulate something or just to test out their own abilities. To do this, you need a somewhat different maths, but it is mathematics nonetheless. It has the same concepts and above all, it involves mathematical ways of thinking and leads children into thinking like mathematicians, and I think in that image I see what is most fundamental about this technology.

What has the technology to do with all this? Almost everything I have said now could have been said in the nineteenth century, eighteenth century, seventeenth century. Indeed, it was. You know what Plato said about learning. Certainly, Rousseau said it, and Montessori and Piaget and many others said very similar things. Why should I link this to computers? What is special now?

I think what is special now is that computers provide a context in which children can enter into a different relationship with knowledge. This leads to a second reason for school. By school I mean, there will always no doubt be places where children will congregate for learning but by school, I mean divided by classes, sorted by ages, with an authoritarian teacher, with a curriculum - all the stuff associated with the modern school as we have known it. One reason for it, as I have said earlier, was that we did not really need a lot of highly developed intellects, in fact, maybe society in the earlier stages was better off without too



many troublemakers. There is another reason for school, and that is that we did not have the technological support for the kind of constructionist environment that I believe is now possible.

It is true that many thinkers in the past formulated ideas from the same family as those that I am trying to say here. There have also been movements in education that went under names like open school, free school or open education or active learning. There has been a whole slew of movements; every now and then such a movement started, and they didn't really get very far. They somehow didn't catch on. The reason they didn't catch on is a rather complex business involving many political and social considerations. Among others, there was the fact that while some activities, some learnings that you want to have in schools, could be well performed in such contexts, they were unable to handle the more formal aspects such as mathematics or grammar and many parts of science. So as long as this was the case, there were tensions in this idea of non-coercive school because some activities could not be inserted into it. The reason why they couldn't, was that there really is nothing in the lives of most children that makes mathematics (take this example as the extreme case) something really exciting, really powerful that can be used in a really powerful way in their lives. The computer suddenly changes that because the computer is a technology which is not mathematical in its nature so much as it provides a technological context in which mathematics, science... many, many powerful ideas can be used for an individual purpose. Those children building those robots, are encountering a very large range of difficult concepts, skills and ways of thinking that we associate with mathematics, science and technology. In other words, they are able then to exercise the knowledge that we would like them to acquire and because we can now make a context in which children can exercise that knowledge, we can break away from the previous situation. The previous situation was one in which you had to feed out the knowledge in a mode where the children would store it in their heads but not really use it; they would learn it now for use in ten years' time, when they got out of school. That is not a congenial and effective, pleasant way for anybody to learn. The technology opens up new approaches to learning, it opens up the possibility of a constructionist approach that means we don't have to so carefully plan a curriculum where we break the knowledge up for the teachers to feed it out in meaningless spoonful's but rather people can learn it in the context where they use it.

Well now, if that is the role of the computer we come to our next point which I have labelled technocentrism versus a cultural perspective. People often ask what is the effect of the computer on how children think or how children learn and they want to do experiments on how inserting a computer into the rigid school structure will change the way children learn there. I think that is putting things backwards. I think that research that says let's use hard-nosed science to find out what the effect of Logo is, for example, and to do that you create a situation in which you insert some Logo but keep everything else unchanged.... well, it's perverse because the whole point about bringing Logo or the computer or any of these other exciting things into the lives of children is so that everything else can change. What we are interested in is not what will happen if you bring in the technology and change nothing else, what we are interested in is how having that technology allows us to rethink everything else. So I want to abandon the idea that it is the technology that makes the change.

The technology is only the matter, the material, the medium out of which you forge something else and that something else that you forge is in the nature of a culture, rather than in the nature of a tool or an instrument or a treatment. So we have to move from a technocentric perspective which sees the computer or the technology as the cause. We have

to move into cultural perspective that says what can that new culture do, what is the culture of the new school - by culture I mean intellectual standards, ways of thinking, senses of humour, language, social relations and all of the rest. I have emphasised how that leads quickly to the issues of centralisation and decentralisation and questions of hierarchical organisation versus hierarchy to stand for the opposite of that.

And so we have a bunch of issues each of which defines a line of cleavage. Are we talking about mega-change or are we talking about Band-Aids? Are we talking about instructionism or constructionism? Are we thinking in a narrow perspective about what can a computer do or are we thinking of the whole range of social relations and ways of thinking that we can rethink now that we have the computer? Are we thinking of the computer as a centralising agent? I have seen models of a school of the future in which there is a computer on every desk wired up to the teacher's computer, the teacher can see what every child is doing and then the teachers' computers are wired up to the principal's computer, the principal can see what every teacher is doing and all the principals' computers are wired up to... well, you know where.

These are the lines of cleavage, and these are the battle lines along which the big issues of debate in the coming years are drawn. I mentioned the process of normalisation in schools as the way that the computer lab and the specialised computer teacher and the computer curriculum normalises the computer, recuperates it from being an instrument of revolutionary change, makes it a Band-Aid. But that does not always happen. There is room for insertion of individual acts there to subvert it. I think a useful metaphor is the Trojan horse; I think with Logo it is the Trojan horse. Lego/Logo is a very good Trojan horse. It is something that looks acceptable to people who just want to do, say, technology studies so these kids will be computer literate, technology literate, so the bureaucracy will accept it because it seems to be innocuous. In fact, within it is the seed, if you only want to nurture that seed, of real, deep restructuring of relationships and ways of thinking about education.

There is another way in which the computer lab normalisation is breaking down. We are beginning to see in the United States that there now seem to be too many computers to put into a computer lab, and so they are overflowing back again, and the question arises, what do we do with them? Do we put them back into the mainstream of learning? Will we put them back into the classrooms or will we make another computer lab with another specialised computer teacher? I hope we spill them over into the mainstream of learning.

And I would like to conclude by saying something about what this implies for those computer teachers. Although some of the things I have said might be felt uncomfortably by a computer teacher, because I am describing him or her as cast in this role of an agent of the reaction, I don't mean to do that. Although it is true that this teacher might be cast in that role, the teacher does not have to follow that role. As we see it now, as the computers tend to spill out of those labs back into the mainstream, the person who knows about the computer has the opportunity to take on a new role, one much more excitingly drafted within that school because now it's her or his opportunity to become the person who can help participate in an essential way in the rethinking of the whole learning environment of the school, of the whole structure of the school, of how the computer can allow us to rethink the learning of all those other subjects or the merging of all those other subjects or the development of a project that touches on all of them and brings them together so that they can enrich one another. Therefore, I see a period in which the person who was the computer teacher is becoming the educational philosopher, the intellectual leader of the school, of the education world.



I want to stop on that note except to re-emphasise it by saying, well, this is called a World Conference on Computers in Education. It was said at one of the reflection sessions this morning: "You know, compared with the earlier conferences, WCCE, this one, is much less about computers and much more about education." I would like to add: well, how many more WCCEs should we have? Isn't it time for us to grow up and as we grow up, not see ourselves as specialists of computers in education. That casts us in the role of a kind of service profession, letting other people decide what the big goals of education are, what the curriculum is, how learning happens, what is a school and we talk about how they can be served by the computers. Well, fine up to a point, there could even be a revolutionary act at the stage of crafting these Trojan horses that we can throw out into the system. However, at some point, we have to break out of that and take on our true role and true responsibility which is not one of service to other teachers. At some point, it should become as ridiculous to have a world conference on computers in education as to have a world conference on pencils in education.

And with that I will stop, thank you.