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Antonello: What are the implications of computer technology for society?

00: 00: 52: 12 I guess I see myself as in some ways, only coincidentally involved in looking at computers. In a sense that what I'm really interested in is that process by which new technologies come to be developed, out of previous technologies. And computers are the current technology of choice. They do, I think, have some very special properties that make them consequential, special ways, in that respect I think the question of computers specifically in relation to the social world is important. I became interested in computers as an anthropologist from, there were ways in which the people who were designing computers talked about them, that I found very intriguing. I walked in here as a graduate student, I don't think I'd ever seen a computer before, not knowingly anyway, I probably had, but.....and what I was struck by pretty early on was the way the interactional metaphor, the ...making people and talk about interacting with previous technologies to some extent probably, but it's with the computer that that's really become the prevailing metaphor for people's relations with the machines. And so, and I came in as someone who was interested in human interaction, that was one of my primary concentrations as a graduate student, really understanding the detailed organization of face to face interaction.

00: 02: 45: 01 So I basically started looking at what, in what sense computers are interactive, what is it that leads us to talk about them in those ways and what are the limits to that metaphor. And that led me into looking at, well I essentially ended up doing a case study, looking at a particular system that was designed on, on the basis of a model that was very popular in artificial intelligence, still is, although it's being elaborated and modified in a lot of ways. Which was basically that action is intelligent to the extent that it is planned, that there is forethought, that there is the deliberation involved, that there's an analysis of some kind between one's goals and one's current state. And I did an analysis of on, there was a system that was designed here that was intended to be a kind of interactive intelligent interactive help system, so it's actually operating a very large photocopier, which is a very complicated photocopier, so they attached this computer to it. And the idea was that rather than using the existing controls on the photocopier, you would operate it through this computer system and it would give you instructions as you needed it, in a much more powerful way. And one of the very important premises was that this system would be able to track what you as a user, what you were trying to do. And in that way, give you much more relevent kinds of information.

00: 04: 38: 18 So that set up this question of how basically the user and the computer system were going to understand each other. And I made a series of video tapes of people encountering the system and I basically came up with a fairly simple framework in which to look at what was going on. I just, I laid it out in terms of, I guess the first thing I was struck by was that I could see all these interesting situations of misunderstanding whereas, where I in working with the videotape I could see what this person was trying to do and I could also see that the system was not getting it. And so that raised the

question of what was I using as a sort of fully fledged intelligent observer of this person's actions to make sense out of what was going on, that wasn't available to the machine. And so I basically sort of laid it out in terms of four columns essentially, I transcribed these tapes where the center two columns were the sort of human machine interface, narrowly defined that is they were, those things that were that people did that were available to the machine, and those were only those things that changed the machine's state. Because that's the only access the machines have to the world, and then in the outer column I put everything that I could see these people doing and from which I was making inferences about their intentions and their goals, that was totally unavailable to the machine. And similarly, I sort of on the other side, every time the machine did something, I tried to say well what was the design rationale, that is under what assumption was that the correct thing for the machine to do at this point.

00: 06: 40: 10 And in that way I was able to come up with these tremendous incongruities between the machine's view of the situation in some sense, and the users view of the situation. And basically try to convey to designers, this sense of the tremendous asymetry, so that if we're talking about people interacting with computer systems, we're talking about a situation where one of the participants in this interaction is severely limited in their abilities, and because I could see very clearly that out of all the things that the people were doing, there was this tiny little subset of those things that were available to the machine.
It was sort of like looking at something through a very very small keyhole and then trying to infer from that what was going on. And you know, then the sort of obvious questions, okay, what was the designers question is, how do we fix this? What should we do? Should we make the machine smarter? Give them better perceptual abilities, better reasoning abilities and I guess I wanted most to convey an appreciation for the difference. Because I think with all of the metaphors that are around, around computers tremendous amount of sociological metaphors, psychological metaphors, that we're losing sight of the difference which is just vast. And so, I wanted to in part, just bring back to designers an appreciation for this enormous difference.

00: 08: 27: 09 And then the question of how you mediate that difference. I, I mean, yes you can continue to push on increasing the abilities of machines to receive information from the world, make sense out of it, do intelligent things in response, but that is a very very difficult problem which I think we're much much farther from solving than a lot of the sort of talk around artificial intelligence, would lead us to believe. And on the other side we have these people who are endowed with enormous amounts of skills and intelligence, and the extent to which, I mean if you compare the difference between say, putting a new piece of technology into an office setting, and either

00: 09: 30: 03 ..one of the things that we've been working on here, is looking at the way in which local expertise grows up around new technology. So whenever you look at a place where new technologies are being introduced, they're always some people who....usually not because its an official part of their job description, but because they just have a special interest in technology, they become the local experts and everybody goes and asks them for questions. It's often a dilemna for those people because that role isn't acknowledged, and so they're doing that on top of everything else that they are suppose to be doing. So there, there's a whole nother way of thinking

about design, which is not just totally focused on the technology. Now how can we twiddle this technology, push it a little farther, come up with something really clever. But what's the whole setting in which the technology's embedded and where are the resources for actually making this stuff be useful for people, helping people acquire the kinds of knowledge and skills and understanding that they need to really appropiate the stuff and make use of it. And that's a whole different perspective on things, and obviously it's a set of potential avenues of change that are less interesting to people who are very technologically oriented. Because it doesn't draw on their expertise in the same way, it requires different kinds of perspectives, different kind of expertise, so, I guess, you know, I think there is no single impact of computers, i think they are in very important ways of continuation of previous technologies, there have been the same sort of consequences on, for social change that, that technologies of the industrial revolution have, I think. Whatever their new, the new properties that come with microelectronics and I think we are actually an extremely conservative period. I mean, as far as I'm concerned, very little innovation going on in relation to technology, in the senses that I'm actually interested in seeing it happen. Which have to do with how we understand the place of technology in the social world, in social relations, you know we're in a....that's very neglected, a very primimtive part of our understanding.

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Antonello: What are the social implications in the workplace when new technologies like the computer are introduced?

00: 13: 07: 07 I've looked at that from a particular perspective, so I haven't done extended historical or even kind of, before and after, evaluations of the changes that occur with various technologies. I mean, I'm aware of a lot of questions having to do with the displacement of people's jobs without any accompanying redesign of what their jobs could be, what kinds od skills could be, continue to be relevant. I guess the place that I've looked at, at the consequences of computers for the workplace, the most has to do with the limits of automation, the ...I think that we, that there was a wave of automation in offices, ... I have very little experience in industrial factory based automation but in offices was a wave of automation that, that addressed on, ...in one there is a wave of automation that addressed..one of the questions I think that's really important is how do people who are designing these technologies sort of carve out some subset of human activity as being something that can be delegated to machines basically. And in offices I think there was, there was a sort of strata of, of processes that were very amenable to that thing, like generating payrolls and on maintaining large kinds of data bases. And that, along with that has come a tremendous de....it's been very detrimental to the quality of the work of many people who are employed in those kinds of jobs, because the thing that computers really can't do, is get at things that are out in the world. So what you have is people put in, as the input devices basically, you get things like, in big insurance companies you get hundreds of people, largely women, who's work is simply to take stuff from media that have been generated by human activities out in the world paper forms and put transfer that into a form that the machine can deal with.
And it's an absolutely unrewarding human activity. But one that at this point, nobody has yet succeeded in inventing a machine that will do it. And then you look at a job like that and people are unquestionably working on technologies that will be able to send these forms in directly.

00: 16: 03: 10 And I think one of the big dilemnas is, what do we do about the fact that there are people...we live in a society where you need to work to survive. There are forms of work, that I don't think anyone would want to preserve, because they're so deadly. And yet there is absolutely no serious effort in place to think about the fate of those people who are either going to be working in deadly jobs or are going to be displaced if we can come up with a better technology that will do that work. So that's the sort of really dark side, I think, of the effects of computers on, in the workplace. And then, of course, the side that the technologists tend to focus on, has to do with people who's jobs are more secure because they, they're essentially better placed in a society, so professionals of various kinds, for whom I think computers have been a tremendously exciting new technology.
And too, had a lot more to say about how computers, what role computers are going to play in ther work. That I think is basically what we want for,

00: 17: 32: 02 I mean, it, it should be the goal in relation to all kinds of work, that people doing the work are brought in to the process of thinking about these technologies and what they should do. And that is not a simple process, because obviously one of the things that's happened is, we have an institutional arrangement that absolutely, that set up boundaries between those who know the technology and those who don't. and then we get into this sort of self perpetuating cycle where the people who know the technology who are designing it, say, well, we'd really like to bring these people in but they just don't understand the technology, so they can't participate in an intelligent way. And therefore, we're not going to involve them, it's too hard, they're too ignorant, we're just going to create these new technologies and then we're going to bring these technologies in like a bolt from the blue, and of course the response of people when they encounter these things is to go, oh my God, what is this, I don't understand it, and then the technologist look at that and they say, well you see these people just aren't, they have, they're phobic, they have irrational fears about technology.
And I see there's a viscious cycle where the people who are designing technology are basically totally ignorant of the actual work practicies and settings for which the technology are being designed. And the people in those settings have, know nothing about the technologies and the institutional arrangements are such that, that the seperation between those groups is maintained.

00: 19: 20: 20 It would take, I think, a real revolution in social order to change things around, so that technology was developed through real seriously cooperative endevours between people with different kinds of expertise.
I mean, what I would like to see is an equalization, so that technological expertise was not priviledged in the way it is now. There were people who knew a lot about technology, there are people who know alot about different forms of work and those people then negotiate with each other, set up a joint project, essentially, each bringing their particular expertise to bare. And in the process, there's a mutual education that goes on, such that each side comes to appreciate the other.
And I don't think it's the people who design technology have to become fullfledged practitioners of whatever the work is they're designing for. Or that, that, that people doing various kinds of work need to know the technology down to the bits, as they say, but there needs to be enough understanding on both sides that, that everybody can actually participate intelligently in thois process. And that, that's a reprioritization of where resources, energy would go in the whole technology development process that I

think would be a much greater revolution that any of the technological revolutions that have happened so far. And until that happens, I think, we are just perpetuating a set of relations that were established at the beginning of the industrial revolution and for which I think these new technologies are the logical extension, basically, business as usual.

00: 22: 04: 10 Wel, I mean, this is the you know, it comes down to basically how optimistic or pessimistic we are about....I think there are.....

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Antonello: Since the scientific revolution we have been discussing the idea of Progress..?

00: 22: 41: 16 Well, I think that, like all slogans, basically, the concept of progress has an uncertain relation to the actual improvement of people's lives. Now, you can certainly point, as people do, to instances, the examples, where technological innovation..science and technology have actually done things that relieved people of various kinds of pain that they had felt, but you can point to as many cases, if not more, where science and technology displaced, undermined in various ways, created pain. And i don't think we've actually anted up the balance between those two. And so the question is, whose, what's the ideology on, who's ideology is it? What's the relation between the ideology and any real attempts to look at some human situation and to assess what are the troubles here, what is it in the situation that is causing people to either, have anything from, have difficulty to suffer severely and what role could technology play in the solution of that? There's, I guess putting technology in its place is basically what real progress, I think, is going to require. And anything that just.. the invocation of progress as identical to science and technology, I think is just, you know, totally ideological, not founded in actual analysis of real situations, kind of a move.

00: 24: 52: 18 One of the things that really concerns me, is that I think there's tremendous imperative to technology. I look around for cases where a technology was developed and not used, and they're very hard to find. For cases where people assess the situation, and say, well I think we need to actually downgrade the technology here. You know, if we took this piece of technology and we threw it out, actually things would be a lot better. It's very very rare that that happens, and that's the way I think we've really become victims of this ideology, we just have this deeply ingrained assumption that any given situation could be made better by a new technology. And in particular, by the new technologies that happen to come along, and that's again this question of where does technology, from where does technology arrive, new technology. Does it come from within the experience of people for whom it's intended or is it actually as it is, being generated in centralized locations, basically. And then propagated out as the universal solution to problems where there, the appropriateness is seriously in question. I mean, in many cases just evidently the technology violates some really basic requirement of the situation.

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Antonello: Have some new technologies made the work situation worse?

00: 28: 24: 21 Well, I think this, the enlisting of computers in the service of control, is really what we're talking about. And I think that in

situations where management by control, is the prevailing philosophy. Then everything, every new technology that comes along is going to be enlisted in services that, and computers lend themselves too well to that. There, the possibility of building software that actually records, again, as you know, as I was saying in terms of looking at the so called interactions between people and computers, of course the things that can be monitired are very very limited, there are key strokes, there time between input, and so, those things that can be trapped by the machine become the measure of people's productivity. And there's, of course, no awareness of what it is that people are doing out there in the world that leaves behind as traces these key strokes, or these time intervals. So it perpetuates the whole sort of cult of measurement by making available a new set of data, but a very limited set of data.
So that, again, management organizes itself around those things that the machine can provide in a way of evidence of productivity and the whole effect, the whole definition of what productivity could be, and the assessment of productivity gets further reinforced in these extremely narrow calculative kinds of numbers, basically. Rather than any sense of what conditions you'd actually need to provide for people in order for them to thrive, and work productively in these jobs which would require being present to the work in a different way. It would require having a totally different ideology of what, what productivity, what needs to pr. ....what you would want to mean by productivity, what would lead to it, where the locus of control can be.

00: 31: 06: 05 I think one of the things that's reflected in this whole business of monitoring, in the Karen Nussbaum who is the founder of an organization called nine to five, national association of working women, has been speaking about monitoring and the extent to which what monitoring represents is replacing trust as a basis for management worker relations, with fear and control. And, so you basically get a situation of greater estrangement of the people who are supposed to be responsible for organizations and the work that goes on in them, from the actual work itself, and their reliance on these measures that become slavedrivers, literally, to the people who are doing the work.

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Antonello: What do you think about artificial intelligence?

00: 00: 51: 22 I've become somewhat involved in, as a critic of artificial intelligence. From the point of view of the again, the models of action, the models of communication that I see.
And the primary model that I've looked at is this planning model, and I wrote a critique of that, in which I basically, argued that AI has been identifying plans with actions, in such a way that, there's an assumption that action is just the execution of some things that are fundamentally mental in their nature. So that, what intelligence is about, is constructing mentally courses of action, which then when the time comes that they need to be carried out, are just executed according to those constructions. Now, one of the things that I was originally heard to say, when I made this critique, was there are no such things as plans, people just act in an improvisational adhoc way, and they're totally reactive to the world around them. And I've gone, we've gone through, through some cycles on this, where I tried to make it clear that I think that there's no question that there are such things as plans in the world, they are a very important aspect of the way we navigate the world.

That they are not, they stand in some relation to action, situated activity, that we don't actually quite understand.

00: 02: 59: 04 There was a really clear example of this, that that was provided to me by one of my colleagues, Randy T.., who is a white water canoer. And he gave the example of, if you're going down a river that has a lot of white water in it, in a canoe, you come up on a particularly difficult series of rapids, you're very likely to pull your canoe over to the side of the river and climb up on some high rock, where you can really get a view of the rapids, and spend a considerable amount of time there thinking about, talking about how you're going to make your way through. And you do that through a combination of reconstructions of your previous actions, so thinking back to occassions on which you've gone through either this rapid or ones like it, and projections forward to what's going to happen when you go through and you may spend a substantial amount of time planning that you're going to say..try very hard to get around this big rock and then back over to the other side and you may have some alternate plans. And the point I've been trying to make is you do all that work from above. Projecting yourself into the situation or reflecting back on previous situations but when you actually get into your canoe and shove off into the river the thing in the final analysis that gets you through those rapids are not those plans but the embodied skills reading and responding to the actual rushing water, you've acquired over repeated occasions of canoing. They're skills that are embedded in us in ways that cannot be reduced to the kind of reflection or projection basically mental activity that was going on up on the rock.

00: 05: 07: 06 Now then the interesting questions become not do we believe in one or the other of these things? Do we believe that intelligence is made up of deliberation or do we believe intelligence is made up of this very reactive, deeply engrained skill? But rather, what's the relationship between the two? That is to me the interesting question is those plans that you made up on the rock I believe are in some ways about positioning you when you get into the river in such a way that you can make the best possible use of those embodied skills that you have. And there's a very interesting relationship going on between those reflections and the actual situated activity. And that's that relationship and how those things come together work with each other is the thing I think, people who are interested in intelligence that to me that is intelligence. It's the bringing to bear of various kinds of formulations of situations of actions, bringing those to bear in a productive way on the requirements, the circumstances of a specific situation. So that's, my critique of Artificial Intelligence is largely that people it's as though again what's happened is that the aspects of human activity that are most amenable to computational representation have been picked off as now being intelligence. That is those things that are most compatible the repetoire of techniques and capabilities that the computer provides are the ones that get developed. And the really deadly thing then is that that gets proclaimed as intelligence and the rest of it gets denied effectively. Denied as being in some way peripheral or of a lower form is some sense. Rather than seeing the richness of the interaction between these things as the real interesting thing about intelligence that we should be trying to understand.

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Karen: What is computerized is what is repeatable?

00: 07: 46: 02 Right, it's a certian aspect it's a, part of what this has to do is the relationship between knowlege and articulation.
Articulation in the linguistic sense. In the sense of the things we can formulate. One of the things that makes it so hard to talk about those the kind of knowlege you have when you are in the canoe and actually going through the rapids is that it's unarticulated it's in your body. It's in your body. It's in your perceptual abilities. And not just in those places. In those places in a way that's richly connected to your experience your memories of your experience and all that but ..It's those parts that by definition we don't have good ways of talking about them. That than when people go to create some sort of a representation of a formalism that is supposed to capture the essenttial aspects of intelligence ..they don't know how to represent that in the same way they can represent things like plans and goals and various simple kinds of discriptions of situations.

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Karen: Can you give an example of applied AI in a military setting?

00: 09: 55: 15 One of the things that has come up in our conversation that is really critical here is the question of control. I think that one of the ways that technology has figured in the human endeavor is as a means of attempting to get a certain kind of control over the world, over the situations in which we operate over other people.
And but we're now have arrived at this paradoxical situation where we live in a world that is less and less graspable. Partly because ofthe technological complexity of it. So in 1983 I got involved in looking at a new program called the Strategic Computing Initiative. That was supposed to intorduce AI into military computing. And there were three parts to the program.
There was one for the army, one for the navy, and one for the airforce. The army was to get a autonomous vehicle. That is a robot tank. Something that could be sent out onto the battlefield on missions unmanned missions. The navy was to get a battle management system, Basically a system that would allow those responsible for commanding naval battles to maintain again control over the developing situation. The airforce was to get what they called a pilot's associate. It was to be essentially a robot copilot. That would make it possible for pilots who are currently being..have soma..many tasks loaded simultaneously that thy've reached the limits of their ability to manage them. And this would be a system that ..one of it's very important features would be that it could understand verbal commands. That you could essentially speak to this thing. You would have your eyes your hands everything else fully occupied with flying this fighter plane. So you could issue orders to this pilot's associate and get information back.

00: 12: 39: 24 Now we looked at these three proposed applications and each of them is absolutely beyond the bounds of anything in the current state of the art AI could hope to reach. I mean they are addressing some of the most diffuclt problems. The autonomous vehicle is addressing the problem of naviagation in the real world. Being able to pick out the enemy from the friends. Tremendous problems of recognition of actually moving through the world in a predictable way. The battlefield management system is talking about a developing very, very fast moving complex developing situation amenable to all sorts of interference in terms of where the information is coming from, of what its accuracy is. And the pilot's associate is talking about speech recognition. Natural language understanding, one of the hardest problems in AI. And moreover, the proposal is to take these applications which are

pressing the state of the art, put them into situation of maximum complexity, unpredictablity, battlefield conditions by the admission of the better military people are the most volatile. People are operating on the very edge of their ability of their reason. Everything is happening very fast and it has deadly consequences.

00: 14: 27: 21 So we tried to make the case that this was the hope that these technologies could restore control...a lot of the rational for the introduction of AI was there were parts of the proposal for the initiative that said..you know the current state of the battlefield with the level of technological complexity that it has has exceeded the ability of any commander to really be in control. Therefor we're going to introduce this new technology. Here we are again right. We have a situation that we experience as out of control and we are going to find a technological solution to that and the technological solution is going to be one of the more problematic of our new technologies. One where if you look at the places where AI has been successfully applied there are very very carefully circumscribed very limited domains where there's a tremendous amount of regularity, things happen the same way over and over. They're extremely well understood. And that's about as far from this battlefield situation as one can possibly get. So there's just an amazing sort of wishful thinking going on here combined with a lot of exploitation of the promise of this technology to get funds. And of course what happened was this money represented a huge infus..this program represented a huge infusion of money which essentially went for business as usual. That is people who were doing research projects on various aspects of AI kept doing the research projects they were doing and now of course they were applicable to the autonomous vechile, or the battle management system or the automatic pilot's associate.
So we get more of the same justified under this very dubious kind of story about what the technology is going to do for us.

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Antonello: What about women and technology?

00: 16: 46: 05 Well my ..I guess there are a couple of things. It's been very striking to me the number of times I will go and give a talk at a computer science department about the work that I do. And after the talk a woman will come up to me and she'll say "I was so glad to hear you speak, I'm a graduate student in computer science and I've been thinking that I was out of my mind because I feel so frustrated by...the narrowness of the things people seem to be interested in there are all these things I'd like to think about having to do with the way these technologies fit into human enterprises that nobody around here thinks are worth thinking about." Probably women come up to me because I'm a woman and they see me as a kindred spirit. But it seems to me that I see more women being frustrated with the status quo. Particularly with computer science education and computer science curicula. And wanting to expand it. Wanting to basically be more open and to actually grapple with questions about the technology that go beyond the very close technical bounds. Now they're also tremendously interested in the same kinds of tecnical puzzles that they're male colleagues are interested in. They're not interested in those puzzles for their own sake. They want the puzzles to be connected in to some larger enterprise. And I don't know fully why this seems to afflict women. This sense of frustration in the way that it does but it seems to me it does.

00: 18: 48: 23 And I think the other ways I've been thinking about the roles that women play or don't play in the development of these technologies again have to do with the kinds of models we have around. Of what expertise is, what intelligence is.
That again come out of a long tradition that has you know a fairly narrow, quite specific set of perspectives. And that is I think in many ways set up to pretty systematically ignore other forms of knowlege and expertise. And often women get the short end of the stick in this regard. So women end up in situations where the work that they're doing is not valued and is..the expertise, the knowlege that's involved in that work is not acknowledged in the prevailing models. They and they are silence basically.. They do not have a place in the discourse about technology and they experience the kinds of frustrations the kinds of alienation without any way of speaking it. And I think that some good things are happening in that regard.
I see increasingly I see women in computer science getting together and talking to each other about these things. I see in international development, which is another form of technology development, there of course have been longstanding, small, marginal efforts to really develop programs that take local knowlege seriously. Essentially view the people, the people in specific areas engaged in specific activities as being the best experts on that. But there are definately centers of power.
Those centers of power are have traditionally been dominated by men. They have their prevailing ideologies and prevailing perspectives. And there's a tremendous force to the perpetuation of those things that silences alternatives basically. I guess to me in my experience Women it's really about alternatives.
And maybe that's because we've been marginal so we can afford to think about alternatives in fact it's in our interest to think about alternatives where's it's not for those who would benefit from the status quo. But that, that to me is the really exciting potential that comes from getting more women involved in the technology game basically. It opens up new ways of thinking about it. New kinds of commitments to what it should be about.