

HIP, HYPE AND HOPE - THE THREE FACES OF VIRTUAL WORLDS

**CHAIR:
BOB JACOBSON**

**PANELISTS:
WARREN ROBINETTE
JARON LANIER
WILLIAM BRICKEN
ESTHER DYSON
TIMOTHY LEARY
JOHN PERRY BARLOW**

Bob Jacobson:

I'm Bob Jacobson and I'm the chair of the panel. In my other life, I'm the associate director of the Human Interface Technology Laboratory, part of the Washington Technology Centers at the University of Washington. Our job is to develop virtual real technology to find applications for it, as is the job of all the other people you will hear today. There have been a couple of changes in the panel line-up. I think we amazingly exemplary panel. It keeps getting better. Nolan Bushnell could not be with us because he had to do some work elsewhere, and Tom Furness had the same situation. Our panel had the fortunate addition of Jaron Lanier and William Bricken and I think that you'll find that this is an incredible group of people. We sat down last night, very anxious about how we would interact before you and within fifteen minutes we had a discussion going that lasted for nearly two hours, so I hope we didn't talk ourselves out. I think you'll find that there is a lot of learning to go on. I also want to mention some of the other people who couldn't be on this panel. We only had the size of the table that you see. We're a small community of workers right now, and I think those people deserve some recognition also. Scott Fisher, who's in the audience, Michael McCready who's not. Eric Goldstein, who I hope is in the audience, and Patricia Gelband. Brenda Laurel who is our favorite dramaturgist of the entire VPL team and of course, our own R&D cowboys, Randal Walser could not be with us, he's doing some crash R&D work on a cyberspace project. His team is in the audience and I hope that during the question and answer period they will stand up and be willing to tell you a little bit about what they are doing.

The structure of the panel is quite simple, we broke it up into three one-hour segments. The first one hour will feature a discussion of the technological issues associated with virtual world technology, after that three speaker panel we will take a five minute break, three minutes into the break we will start a small video that is provided to us by Michael Naimark's students from the San Francisco Art Institute. His class on Immersive Virtual Environments, I think you'll get a kick out of their vision of the future. Those tapes are produced, helped by Brenda Laurel, Charles Lasser,

Susan Bonds and Chrisis Agin. That will happen again, we'll take another one hour discussion with our commentators discussing their view of virtual world technology and virtual reality. We'll take another break and then we'll go into a question and answer which can last up to 5 o'clock if you still have the energy for it.

Well the question arises, why virtual worlds, why is this panel so popular for example, and why is it happening at all. Well, last night while watching the SIGGRAPH tape of the winners so to speak, of the SIGGRAPH video competition, I was struck by the beauty of so many of the images, and by the intense horror stimulated by some of the others, and I kept saying to myself, if only I could be there, if only I could be amongst those images and dance among the beauty and cringe from the horror, and feel in myself, in my spatial self what was going on around me, all those images, those beautiful things to see and perhaps to touch. But I couldn't, I couldn't get past the screen, I couldn't get past the images on the two dimensional surface. So much of that work deserves to have translation into three dimensions, and in fact, for us, one of our missions is to take your two dimensional work and help you translate some of that into three dimensional imagery that in fact touches people deep in their spiritual selves.

We would like to be able to have people infuse these environments with some of their own experience and their own meaning, to work with you to actually change the environments that you think should be created for them. Now one must keep perspective on this, virtual worlds is all the talk, but in a nation that is poised on the brink of war, whose economy is none too secure, one has to keep these things in perspective. Nonetheless, we are on a technology cusp, we seem to be at the stroke of a paradigm shift, in the way that people related to computers and the way that computers are used to relate to people. We seem to be on the mark of finally putting the user, or as William Bricken says, the participant, in the center of things. The technology is somewhat primitive, you may admit, we will admit that as well, but it's advancing quite rapidly, we are bringing our best resources to bear, to make it happen more quickly, to serve you and to serve our ultimate beneficiaries, the people who see the things that we produce, who experience them and who learn by them.

Well, I've had my talk, you can read my little story in the current issue of Computer Graphic News, so I won't take anymore of your time. I did want to introduce the first of our panelists. Each of our panelists, in the interest of time and courtesy will introduce the next person following them, up to the intermission, and then we'll start over again. Well, I'm very pleased to introduce to you our first panelist, Warren Robinette, who has a long history of work in computer graphics and one of the decisive people in the field in bringing virtual reality to reality. In the late 1970's, Warren was

designing video games for Atari Corp., which was one of the seminal sources of energy and excitement in whole computer graphics movement. He was co-founder of the Learning Company, an educational software production firm which produced the very famous piece of software called Rocky's Boots. He created the software for the NASA head-mounted display project in '86 and '87. Remember, very acutely, his icon for rising on an elevator. You step forward onto these moving planes and rise in space and then step off and then step on again to descend. It really marked for me the beginning my immersion in virtual world paradigm. He's now manager of the head-mounted display project at the University of North Carolina, which is one of the foremost research centers in this area, he told me a little story that when he created his first, one of his first video games, he created one of the first Easter eggs, one of these little surprises that is stashed away inside of, completely inadvertently, had to do with getting credit for something that his employer didn't necessarily feel was policy. But now we are looking into his virtual worlds more carefully to find out where he has stashed the new ones. And you can do that to, so Warren. Thank you.

Warren Robinette:

Thanks Bob. The best way to appreciate virtual reality is to put your head into it, and I hope some of you all have gotten the chance to go out onto the floor and do that, but I think probably a lot of you haven't, so, to kind of get specific to start off with, I'd like to roll a video tape that shows some of the work that our team at the University of North Carolina at Chapel Hill is doing, and then we'll talk about where it might go from there.

TAPE

Thank you. I think that gives you some idea of where we are at right now. Things are kind of low res, if you get a chance to put on a head-mounted display, just 200 pixels across, but it's enough to be a compelling illusion that you're inside of a synthetic world with things happening inside of it. And now that we have grounded ourselves a little bit on where things are at, the obvious thing to do is to speculate a little bit about where it all might go. And we were talking about this a lot last night when the panel got together and we all concluded that if you prognosticated about the future you couldn't possibly be right and so out of deference to my distinguished fellow panelists, I'm going to speculate anyway, and let them rip me up in their talks.

And we were also talking about quibbling about names, I don't think reality is the point at issue in this stuff, even though the name virtual reality is catchy, it's a cute little oxymoron, and it's stuck, I don't think it's going to go away, but I think experience is more appropriate way to refer to this stuff, you get inside of this synthetic world and you experience it. You know it's not real, but you still experience it nevertheless, so. So I want to make a distinction between natural experience, what you, the experience of something you have with things right in front of you through your own senses, and synthetic experience where you are perceiving a representation or simulation of something that is not really there. For example, photograph, it's not really there, but yet you sort of feel like you're at the place where the photograph was taken when you look at it. And that same quality is the central essence of virtual reality or synthetic experience I think.

There are several different things you can do with a head-mounted display. You can put yourself in another place. For example, when you are talking with someone on the telephone, it's like you all of a sudden transported yourself from Dallas to California. Or you feel that way when you are talking to a person, when you look at a photograph, you've transported yourself to another time, when you look through a microscope you've transported yourself into a world that's a different scale, when you look at time-lapsed photographs, you've changed the time scale. And there are many forms of

energy and other things that we're just unable to perceive with our own senses but you can use appropriate instruments to make those things perceptible, something I call sensory transducer. So that's something that a head-mounted display is appropriate for, and then you can also enter into a completely simulated world that has no connection with the real world, which is what I think what we mean a lot of times when we talk about virtual reality.

So here is my predictions. What's going to happen in the future with the head-mounted display is that we are going to get all the senses involved, even smell. And the tactile senses, force feedback and of course, vision and hearing. I think it's hard to know what will really happen, but I think it is certainly plausible to image that a head-mounted display which is involved into something that is not much more than a pair of glasses with a way of playing some sounds to your ears and maybe some scents wafting out of it, could take the place of telephone, movies, television, music that you play through your stereo, and video games all rolled into one. Maybe it won't, maybe they'll stay separate implements, just out of, for reasons of historical accident or convenience, but certainly could happen. And we really don't know whether it will or won't, but it might. And a third thing that you can do with a head-mounted display, is you can take the synthetic world and superimpose it directly on top of the real world. This is particularly interesting from a visual point of view, because you can, for example, superimpose labels onto things that are out there in the real world. I'll show you a little drawing that kind of fleshes out that scenario. So here's, I have several drawings that kind of suggest some things that we think we'll be able to do with the head-mounted display in the not too distant future.

This one we call x-ray vision, and the idea there is that a physician is using a head-mounted display to see images that are being picked up an ultrasound scanner so that he has the impression of looking directly inside of the living tissue and seeing the fetus inside of the abdomen of the pregnant woman. And this is something that we are actively working on at UNC Chapel Hill and hope to have a prototype in a couple of years. It's like, I think this is really amazing, the x-ray vision, it's like Superman, you could look inside of something. And here we've got one that is the superimposed label idea or sometimes I call it annotation of reality, where if you have a means of knowing some information about say a complex piece of equipment, like an airplane engine, and the engine has got sensors in there that can detect malfunctions and so forth, you can put little pointers and arrows and exploded views of the parts to make it more difficult for the mechanic to put the little O-ring in the wrong place or whatever.

This one is sort of an architectural scenario where there is a building being planned and the two architects are seeing the building simulated in place. I don't know if you can tell that the roundish

stuff is made with dotted lines, which is supposed to signify that it is not really there. So their looking at the building superimposed where it is really going to go, and then they're kind of stretching it around, and so forth, sculpting it into a form that they are happy with, is the idea.

Here we've got the idea that if you have a lot of people or sensors out in the environment that are sensing or perceiving things that you can't see yourself, if you're able to construct a three dimensional of the stuff that anyone can see, you can make it available for everyone to see. So here's a threatening-looking vehicle coming around a hill, and the guy in the foreground can see it, see through the hill, because the guy up on top of the ridge there and the airplane both have it in their field of view and so they put it into his little database. This is the Green Man from the Naval Ocean Systems Center in Hawaii. I think that the area of tele-operation, tele-presence, tele-manipulation fits hand in glove with the virtual reality stuff. It really is the other side of the coin because, on the one hand you have simulation of a synthetic world, perhaps one that is simulated on the basis of properties of the real world and so that you simulation is telling you something about the real world or perhaps just a fantasy world, that's important, interesting, valuable in itself; on the other hand you have the ability to put on a head-mounted display that's connected to a remote robot, pair of cameras and microphones and then it's giving you a perception of that remote location, probably in a hazardous environment, those two things use the same equipment from the end that the human is on, and I think that they are both going to feed into one another and reinforce each other. They call this thing the Green Man because it has a lot of hydraulic actuators, and there is this green fluid that drips out all over it, sort of like green alien blood.

So here's a little scenario of something that I really want to do myself with tele-operation. First I should say that you can have a one to one scale robot that is the same size as me, and back in the back room, and if I put on the head-mounted display then I perceive what it sees with a normal size world. If you have a way of, if you make your tele-operator a tiny little thing, then you could enter into a microscopic world. For example, if you use a stereoscopic microscope and a micromanipulator then you could get into a world that's fifty or five hundred times expanded over what it normally is. So, I really am looking forward to the day when I'm in a beehive and I've got a four foot honeybee that's right in front of me and I'm tweaking it with my micromanipulator and it can't get me.

I think I mentioned earlier somewhere about the business of sensory transducers. We have in our faces and other parts of our bodies, what I like to think of as our built-in senses. Can perceive a certain range of the electromagnetic spectrum and we can hear certain frequencies of air vibrating, but a lot of things we can't directly perceive. And an interesting possibility with head-mounted

display is to take some of those things that we have sensors for, from an electronic point of view, and transform that information so that it's matched with our built-in senses. So, for example, you can, we do it now to some extent, with for example, x-rays at the hospital, but so you can see the x-rays, you can see radiation because you've got your head-mounted display coupled to your radiation sensor so you know your not going to walk into certain parts of the power plant that you are servicing or something. There's a list there of phenomena that it would be interesting to perceive.

So, an interesting issue that comes up is what do these imperceptible things look like? They don't look like anything, because they're imperceptible, so we have to invent something, right? You can do a bad job of inventing what things look like, and confuse people for generations, hopefully we won't do that. But, it's pretty arbitrary, although some things are given. And it's conventional so probably in some cases, a number of different representations will be invented and then we'll just have to wait for time to go by for things to settle out. And I have an example of this stuff. What does a molecule look like. Molecular graphics is something that Fred Brooks and others at University of North Carolina have been doing for a long time, and we used those in the head-mounted display you saw in the tape. So I've got just three different representations of what a molecule looks like here, to show you that, you might have thought that it just looks like those little plastic balls you may have seen sometime, but that's just one arbitrary choice of what it could look like. So, here's a computer graphic that is more or less the little plastic balls, a sphere for each atom and there's a color code for each atom type and I think I hardly need to say that it is pretty arbitrary that oxygen is red there. Let's look at another one. This is another representation of the same molecule that just shows the trace of where the polypeptide backbone of the protein goes. And this representation is more informative in some cases and maybe that is what a molecule looks like. Or at least a protein. Or maybe this is what it looks like. This is a common surface, where it's sort of like you took a little sphere of a certain size that represents the dimensions of a solvent and rolled it all over the whole surface of the molecule and it tells you where the solvent could penetrate into the molecule. And there are other representations you could use, but that is just an example to show you when things don't look like anything, they could look like anything.

Kind of reminds me of Dwight Eisenhower's quote of "Things are more like they are now than they ever have been before." So, to sum up, any phenomenon that can be recorded or simulated or remotely sensed, any phenomenon that we can pick up with any kind of sensor that we've got, no matter where it is, no matter what size it is, no matter what the sensor is, can use a head-mounted display to make it directly perceptible. And what they is going to allows is, be able to remember things better because you've recorded it, just like home movies for example, photographs, bring back the faded photograph bring backs the memory better than the fuzzy thing that you kept in your

head. Can imagine better, because you can simulate things, you can communicate better, manipulate with tele-operation, identify things better, more effectively with the superimposed labels and see things, observe things, that you wouldn't otherwise be able to perceive at all with the sensory transducer. So I think the head-mounted display is going to change the world.

So now it's my pleasure to introduce our next speaker. I think it is probably accurate to say that Jaron Lanier is the worlds only Jewish Rastafarian from New Mexico. And since Jaron came to California, he's been very active and has done a number of interesting things. He gained an interest in exotic musical instruments from his days of playing the flute out in the desert in New Mexico and has a wild collection of instruments from all over the world. He designed video games back in the days when that was really happening in Silicon Valley. And then he went on to be the founder of VPL, which manufacturers the only commercially available head-mounted display right now. So, Jaron Lanier.

Jaron Lanier:

Well, yowzza, Hip, Hype and Hope; I think in our daily lives, I was telling Bob we really deal with two other H words more, one is Hoops which we have to go through, which is just the work of making virtual reality better and the other one that I was going to add was Happening, which is that it is really becoming an application to use in the field. I been sort of shocked repeatedly that people, there is so many people, cab drivers, all kinds of people have gotten into this stuff and almost nobody realizes that it is actually a practical useful thing, already starting to make its way into the world and that's what we are sort of doing a VPL, is everyday slogging it out, trying to make that happen. The whole sort of virtual reality craze is something of an amazement, I made up that term some years ago, and it's a kind of a funny, it's funny what happens to the meaning of something when it's amplified out of a circle of friends or like a small community and then it becomes a sort of inflated and filtered in the media and mass culture and of course, if we had foreseen that happening we would have said something much more reserved at the time. I do want to make some comments about the origin of the term for the hell of it. I was unsatisfied with some of the terms that were around and the essential thing that I think is remarkable about this technology is what it demonstrates about human beings. Because this stuff is actually very crude of course, the displays are low resolution, the response time is slow, the rendering is clearly inferior to what you see in computer animation by a huge amount. And really, almost every other way, and if you look at the individual pieces, they're worse than other methods of getting at the same images or the same information. But what I think happens, is, this demonstrates a kind of, what a personal reality is for a person. My own sense of it is that you're body, your nervous system is, always has a, I was defining reality as a global application of one's nervous system. And at any given time, you have a particular reality that your in, which is generally the physical environment and your perception of it is actually a lot worse than it seems to be and ???. The people who study what you actually are able to perceive in your sense organs individually, discover extraordinary limitations. But what happens is, as a whole you have the sensation of really perceiving a whole lot in a continuous way. Now, what we do in a virtual reality system is by putting clothing over the sense organs and replacing for a short time the sensory perception that normally comes from physical objects with these simulated objects, if you just sort of reach a certain threshold where your nervous system is treating the synthetic objects as the reality that they are sort of enhancing, your experience towards, all of a sudden your body does all the work and makes it good. The human body is like our secret ally that let's us get away with all of this very weak technology or the best we can do at the present time, but nonetheless it's obviously very, very simple compared to what we want.

And that I think gets to the crux of why there is such a sort of electric excitement about this stuff, even among people who really haven't tried. How many people tried here? Just curious. Yow! Almost maybe, not quite a majority of the audience, maybe a third or something. So, we're getting there. But there's something very intimate and provocative on the most profound level about this stuff, because it just in a very simple way demonstrates some of what goes on in day to day perception and I think that's what's so exciting about it. It like a window on ourselves and new sort of one. There's also kind of, I tried to describe this a couple of times, and now I'm almost hesitant to talk about it, since this stuff is getting amplified by the media, but I think there is a sort of aesthetic and somewhat mystical attraction to the field, just because it does, it evokes childhood playfulness, it is kind of like a form of make believe but where the technology stamp of approval on it, so you can be adult and do it and feel good about it. And, that's one part and another part of it is there is this sort of suggestion of sharing, well virtual reality fits into just the same niche between people I think that the physical world normally does as the medium is shared. And I don't understand what that niche is exactly, and I find the whole, the fact that there is communication between in the physical world is just fundamentally mysterious and a very difficult thing to understand. But whatever the physical world does exactly, virtual reality would seem to fit into the same niche. But the thing that it does, that I think is different, is it is more easily variable, so it can be a tool of the imagination more readily. And so, you have this possibility of combining the sort of openness and lack of limitation on content that you normally associate with dreams or daydreaming, you have a possibility of combining that with the kind of objectivity that you have with the physical world. And I think that there is this contradiction in adulthood that people have to live with, that in order to be able to communicate reliably with other people, they have to, to a certain degree, not be zoned out in their own imagination all the time. And in virtual reality you can actually make your imagination your weird world, it's kind of real that other people can be there, so you can kind of get around something that's been a kind of Catch-22 for a long time.

So, actually there is one other point I want to make. Right now I think there's a, I'm sure a lot of this point will be made many times on the panel, there's a really serious danger of expectations being raised too high. And this is almost such an obvious thing to say, but obviously everybody has to say it. There have been some other fields, notably artificial intelligence, that have kind of gotten clobbered by being oversold and over-hyped and obviously virtual reality is still, even though there have been people working on it for decades, it's still a very early thing and it has a long way to go. And, there's sort of a huge number of, I was counting up just conferences I know of in the next year, and I believe there is actually more conferences taking place, than say researchers who have spent fifteen hours in a virtual reality machine and I'm not sure that that is right, but it is close to that intense, the level of interest is just a little premature. Maybe in a couple of years when the stuff is

more available, a bit more developed, we have more kinks out of it and so, I don't know what to say about that, so let me go on to the hoops, which is the ongoing development.

Let's see, the areas we are concentrating on now are as follows: the primary one really is making virtual worlds easier to specify and make. The whole idea is that of all places in a virtual reality system, the ability to make the reality quickly is absolutely essential, or otherwise, why are you bothering with it, you might as well hire sculptors and build a physical thing. So our central focus, really the company the reason it is called VPL, is visual programming tools to try to facilitate making things quickly. And our current system, which I suppose most people know has been on display on the floor, but it is too late to see it now because the floor will be closed by the time the panel's over. But our current system uses a visual programming technique to design the worlds and that's something that is very important to us. So we can have non-programmers making the stuff already. And for a while we had a real VPL that you couldn't get a demo unless you made your own world, but then it got to the point where it was just hard to do demo's at all, the demands too great.

The future I think will be designing virtual worlds from the inside while you are there. And that's sort of our basic software research direction. And so what this would be like, is you're inside virtual world and you pick up a virtual thingamajig and it turns out to be a tool for making or editing in some way the contents of the virtual world and some of them would be very straightforward thingamajigs that bond things together or measure them or duplicate them or that sort of thing. There is a bunch of wild ones I'm interested in, I guess I can mention a few. Like Warren mentioned I'm fanatic about musical instruments and the reason why is they seem to me to be the most eloquent technology that's been done. They're machines that just have this incredible expressive power that just never runs out and even though some of them are simple they are always very refined. And I sort of imagined these things that you pick up in the virtual world that you manipulate with your body and sort of play like an instrument and the point would be that there's aspect of reality are changing but you have a tight enough feedback where you can see the changes that you can get to know how they work without really explicitly being able to explain it. And I think that by being able to extend your grasp beyond your ability to explain it, you can make more powerful editors and some of the techniques say from neural networks, of being able to map one set of changes into another applicable and also a variety of other things. So, I imagine these instruments that you play reality with and I also like that one because it evokes kind of a sense of sharing that I like in virtual reality. Another concept floating around is the post-symbolic communication idea that in virtual reality, you can sort of just directly make up stuff to share with other people as opposed to using symbols to describe it or refer to it; so you can sort of just make

up things and cut off the middleman of symbols. Which is not to say that symbols are negative in anyway, but it is an interesting alternative to be able to explore and in a way the thing that is closest to that is improvising music with people on instruments where you are all doing things together. And the difference being that with music you don't have any specific content that you see out of all that, it's all just musical stuff; but with this you actually make the things and I imagine sort of bursting reality conversations where people are having collaborative waking dreams and that's sort of the vision I want to move towards. That's not just a creative goal, it's actually a practical one. For instance, and I'll get into the applications in a second, but in almost every application where there is some reason to put somebody inside a virtual world, the application is enormously expanded as soon as there is multiple people in it. If you can collaborate and talk about the thing while they are there. That's what post-symbolic communication is for. But anyway, back to editors. So some of the tools are instrument-like, one of the ones is that I'm real hot to do is a makeup mirror where you can adjust your being, you know. And so you can paint, you sit down in front of this mirror and you see yourself and in virtual reality you know, you have a body that you can design and sometimes they are realistic and sometimes they are crazy creatures. Not many people have this experience because usually you go into a demo and there is just sort of a pseudo-humanoid hand there, but it's a really great experience when you go in and you're a praying mantis or something and all the proportions are different and you get used to using that, it's a fascinating experience and it's sort of eerie how readily you can get used to it. No, it is, that's another reason I say it's a window on what human beings are, it's so interesting, I mean who, there was no way until we tried it that we would have known that would be easy to do, that you could sort of change the relative scales of all your parts and just be in this weird world and still be able to go and pick something up after it and actually you can learn to do that. It is very odd. And, it's almost as if that was a thing that never could have been variable in the process of evolution, so it just never bothered to become fixed. But, anyway, you sit down at this makeup mirror and you'd have species change knob and extra horns you could put on and snouts and twisters and all kinds of things. And this whole thing of changing, that one of the fundamental differences between virtual reality and other forms of user-interface is that you're really present in it, your body is represented and you can react with it as you, if I'm right about this threshold of choosing a particular reality, you just choose it as your reality and react with it as if it's your outside world, rather than interface to something. And the fact that you're in it, and that you define yourself is really fascinating.

Oftentimes, being able to change your own definition is actually part of a practical application. Like in the world we did last year, where an architect was designing a day care center and could change himself into a child and use it with a child's body and run faster and have different proportions and all that. So, this is really another editor. I can describe some of the odd ones, browsers are

important, how you get around worlds. Our current browser is a thing that is a starter world, where there are purple keyholes that represent the transit to other worlds, you sort of fly through them, then you end up in the other place. They are kind of iconic and represent the world, but eventually of course, what you want is just to see the world you're going to in miniature operating with all the other people in it running around like little animated sculptures. I think we'll have that before too long.

The goal we are working towards is to have the thing networked, which comes to another big hoop we are trying to go through this year, which is to bring the thing up on a long distance network as opposed to only a local one. For about two years now, we've been able to get more than one person into a virtual world at the same time, but only locally over Ethernet, and now we are making this leap to go long distance and we've just gotten available high bandwidth lines, so we have more bandwidth than we thought originally, and we're starting up a sort of small academic network as a starter thing with, if all goes well, with UNC and with Washington and with MIT, the three places with the most going on. And that should be pretty neat. And we'll be able to go in there and see each other and play ping-pong and see what monstrous creatures Warren sends over the net to attack us. I'll have some things. Missing, tape changed.

Then, another big hoop is integrating synthetic images with real world images. Thus far, for the most part, they've been really separate. There's on the one hand the work with stereo displays of many types, particularly for instance the work of Morton Helig, where you have a stereo display and you send a stereo camera around in the world and you can play it back. Then on the other hand, there is the sort of stream that is represented by the people here where you have an entirely synthetic world that's being generated in real time by some big graphics hardware thing and we're making stuff to synthesize those two. There is an early experiment shown on the floor this year which is called 'Video Sphere' where we have a revolving camera called Revolvitron that scoops in a scene, you put it down somewhere and it grabs the scene in a funny way, and you then you can play it back as sort of an outside kind of sphere at infinity that surrounds the virtual world. And it's a humble for a start, and I should mention John Bumgartner, Arthur Abraham, and Horizon Scan from Toronto who are all collaborators on that, Graham Smith from Horizon Scan. What it does is it allows you to do something like put the Revolvitron camera in the middle of an empty lot and it sort of grabs the lot, then go into it and put a virtual building there and see what you would see out the windows and that sort of thing. Approximately, obviously, it's not quite aligned perfectly since you only have one point to begin with. If the stuff is close by, you'll go out of alignment if you walk to far. Anyway, it's a beginning. We need to move that to moving images and be able to say, do a combined process of scanning in a physical shape and also grabbing the textures on the

surface of it and recreate that synthetically in the world, so that you have a possibility of sort of an object scooper than can make, easily make a virtual version of a thing. That's another that we have to do.

And then the area that Warren discussed, of having non-obscuring head-mounted display where you can let the world show through. Which is extremely challenging, because your virtual world has to really be low lag and accurate in order to line up with the physical world, which is the reason why the current EyePhone doesn't let you see the physical world, it would kind of ruin the effect. The other big hoops, 3-D sound is something that is just really starting to take off. There's been a lot of work in it, my favorite project and the one that we're continuing with now, was one started with a group of people including Scott Fisher and Beth Windsall, and mostly Scott Foster, and it's a thing called the Convolvitron which is a signal processor that recreates the filter effects that occur to sounds when they come at your head from different angles. The basic way this works is that your outer ear has a funny, irregular shape and one of the reasons for that is that it filters what sounds sound like from different directions. What the Convolvitron is, is it is a signal processor that works off of data collected from real people who had microphones inserted down their ears. A researcher named Dr. Fred Whiteman moved a speaker around and recorded what the sounds sounded like in an anechoic chamber and then using the original data set, the Convolvitron recreates the same transformation on the data through real time convolution. Anyway, it's an extraordinary thing, and we've combined it with some other cues, of wall reflections, exaggerated Doppler shift for small objects, which is sort of surreal, but it is actually very effective. Anyway, the whole group of these things clustered together, you really can have virtual sounds that move around. You can pick up an object and move it around your head. That's proved to be quite extraordinary. For instance, the way we are currently thinking about it, we noticed, Scott and the other people were over a few weeks ago, we noticed that spatializations work a lot better behind the head in general, and it almost seems like, when something's in front of you, you lock the sound source and the visual object together very readily. When it goes behind you, you have to rely on the sound source alone, which is an interesting transition when you move over the boundary. It's a fascinating thing to notice. Ideas like that come up just by the dozens when you're working with this stuff. That's my favorite thing about it, is how provocative it is, about human being work.

So anyway, that product is called the Audiosphere, and hopefully some of you got to try it. What other hoops, there's zillions of them. How's my time? It's over? Okay, my time is over, so thank you so very much for your attention.

I almost forgot, I have the pleasure to introduce William Bricken who is formally from many places, Atari, where amazingly enough I think, no you were gone by then, but Scott Fisher and William and I, but Mike Naimark and a bunch of other people in the field where all there. Kind of weird, so something came out of that after all. And then Autodesk, where William was central in the cyberspace project. And now at the hit lab at Washington, which is one of the great labs and aside from being one of the really important thinkers in virtual reality, he's also very important thinker in an area of mathematics that's fascinating to me, of boundary systems which he might explain, and that's a crummy introduction for a great man.

William Bricken:

Well, it's a great honor to be here to talk to you about some of the areas of growth of VR, and I was delighted to see how many people had had experience, since this is an experiential medium. Perhaps you'll recognize some of the comments that I have to make.

Here's the problem (slide of student staring into a monitor omitted)

VR was introduced to the public jointly by Autodesk and by VPL last year about this time.

Here are some early prototypes of a system that we built at Autodesk. Meredith there is making the quasi-mystical VR symbol of pointing to the Void.

Here is a snapshot of the Autodesk system (slide omitted). It turns out that picking up a book is a religious experience.

Here's the VPL system (slide omitted).

And here's the research agenda. VR is in a strange position, where it is commercially available before the academic community understands what it is. So far as we can identify, there is a suite of three technologies that need to be studied.

Sensory transducers, as Warren called them, or behavior transducers are basically maps of natural behavior onto digital input streams that run virtual realities. The maps are two way, both in terms of input -- movements that a person generates to control the virtual body -- and output from the virtual world transduced into a subjective perspective so that it feels like the experience is coming from inside your head. I think the criteria for evaluating what a behavior transducer should do is to look at a two year old. We're talking about waving your arms, pointing, single gestures, single word commands, toddling around; that's the kind of behavior that ought to be running computer systems.

At the software level, we're trying to develop inclusive computation. The idea is to build software that simulates environments rather than windows on environments.

And finally, as both of the speakers have mentioned before, the issue of psychology is central. What we are discovering with VR every time we look is that we are looking at ourselves, not at a digital input stream or the needs of symbol processing.

There has been a lot of talk asking “What is VR?” I feel that the essence is the notion of inclusion, of something that surrounds you, of something that is an environment. There is kind of a strange thing that happens when you take a picture and expand it in your visual field to past 60°. You get sucked in. It becomes a place. It also keys off an emotional response. There is a holism that goes on as the right side and the left side of the brain coalesce. Of course, there is the notion of moving from an outside observer to an inside experience. And the notion of moving from a receiver of information to a generator interactively.

Here’s some of the work that we are doing at HITL, just to give you an idea of the scope of the research. I should point out that we started last October, it's a fairly new lab. We have established an information clearing house and a USENET group called sci.virtual-worlds. We're building a simulation lab for experimenting with the hardware, the software and the biological components of VR.

Our primary objective right now is what we are calling the VEOS, the Virtual Environment Operating Shell. It used to be the operating System, but it turns out that we are wrapping around UNIX instead of building another operating system. It's the software that basically coordinates computational resources, both physical and algorithmic, that allows the connection of behavior transducers, of dynamic simulation packages, of construction packages, and of graphics rendering devices. Each of these aspects is being very adequately developed in the commercial marketplace and in research labs. What we would like to see is an ability to mix and match those packages in our VRs.

We're also very active in building virtual worlds for presentation and for evaluation and for experimentation. We have a contract, for instance, with Boeing doing virtual simulated cockpits and aircraft design. We're very interested in the telecommunications industry, the notion of distributed multiparticipant virtual environments. And we're starting to work in the education field building conducive environments for learning and for educational transfer. I should say there are also some things we would like to get into but we haven't really gotten funded yet: virtual prostheses and new head-mount and other display and I/O techniques.

And here is what a VR lab looks like.

This is a poor slide, but it was a very lovely one. Meredith is working with Rick Walsh who is paralyzed from the neck down. They had to synchronize their own behaviors to join in a symbiotic union. It was a wonderful thing to see.

This is Virtual Seattle (these worlds were built by Meredith Bricken). We were doing an experiment to see how far we could go with fifteen hundred polygons. There's an orca that runs back and forth -- this is actually in the VPL booth if you would like to experience it.

And here's the city. The buildings are not separate because that cost extra polygons. And the general notion is that people are tremendously plastic in a cognitive sense: this was a city to the people that went there.

Here's the Octopuses Garden. This was a fifteen hundred polygon experiment in interactivity. The fish would swim around and the octopus would chase you, and the rover would go around and mine things.

This is not a very good slide, it's trying to demonstrate the notion of Cyberseas where the person would be able to look underneath the ocean using fish sonar data and actually see the fish swimming around.

Here's the radar control and aviation application.

And the idea here is that we're also working on a head mount technology called a laser microscanner. Rather than put an optical image in front of your eyes, generated by a CRT or LCD, the idea is to bring that down to silicon and have an actual silicon-based, very low-power laser project the image on your retina. So instead of pixel addressing we are talking about rod and cone addressing.

Here's a few things we've learned. This is obvious: our body is our interface. The interface is not out there in the screen in any sense. Knowledge is in experience rather than in some database. And in fact data is in the environment rather than in some memory store. As I mentioned earlier, realism is not at all necessary. People will bring to the experience any amount of cognitive flexibility. Also, cyberspace is not a three dimensional simulation. You can travel in scale, you can travel in time. And most importantly, and again the previous speakers have mentioned this, perhaps Psychology is the Physics of VR.

Here are a couple of tools that we are working on. Our lab is an advocate of the Wand. I happen to have one here (holds up the laser pointer), but it is not connected to a VR system. The idea is to be able to generate a beam or a vector in a virtual space. I can use this vector for attaching to objects; or identifying things, asking “What’s that?” for instance; for moving objects; or perhaps run by a button or by a single word command to attach the object onto the end of the ray and move it around the virtual space; to indicate a direction of travel, “I’d like to go in that direction please.”; perhaps to measure distance, “How far is that over there?”; to build jacks so that I could say, “I would like to have my body over there so build a teleport point right there and then jack into it.”

Also, the virtual body that Jaron mentioned. When you come into the environment, you come in with a set of physical sensors on your physical body that are mapped onto some manifestation, some body, in virtual space. Of course -- no reason to stop there -- if I’m going to be working in a virtual environment, I want a virtual home with a cozy fireplace and a nice chair and a pussy cat in the corner. And of course, following that model a little bit further, instead of having E-mail which identifies people by cryptic addresses, over the hill or at least right next to me are my neighbors. And when I want to talk to them, I point at their house and say, “Let’s go there.” If there are people that I have less communication with, but I still want them in my community, then their houses are down the street a little bit.

We’re also building autonomous entities. Now, you can conceive of virtual reality, or cyberspace, as a domain, an environment inhabited by objects. Each object has physical processing powers, so it’s more of an entity, an object plus resources. The podium, for instance, would be an entity. And there might be a couple of tables to my right. Each of these is running internally the same loop as the participant in the virtual environment is running. The object itself has an input channel with input sensory devices, a process which is basically a map from input to output if it’s just going to be a reactive object, and then the output devices to be able to generate behavior in the virtual environment. With this kind of model, which is a direct union of computer graphics and AI, we could also increase the complexity of the internal processing loop. For instance, to have responsive agents: rather than the input just mapping directly onto output, the input could map onto a memory state. The agent could then process its own memory, its experiences so to speak, until it reaches a particular conclusion based on other rules which might be metarules about what it wants to know and find out about, and then generate behavior.

Another way that virtual reality has expanded, at least in my mind, programming is in the notion of totally inconsistent, yet at the same time, concurrent realities. It’s sort of like talking to somebody who really has a totally different definitional set on the words that you are using. You can still carry

on a conversation, but you know darn well that whatever is going on in that person's mind isn't mapping onto what's going on in your mind. Well, to give a graphical analogy: for me the color of the podium could be green; for you, each of you, you could choose your own color, blue, red, whatever. As long as we are not directly discussing what the color of the podium is, it doesn't matter. And since you're running on your own rendering engine, there is no reason at all that you can't have your own environment. Push that a little bit further: we're going to have a teleconference. You're sitting in your office. There is an empty chair in your office, your virtual office or your virtual home. I'm sitting in my virtual environment, there is an empty chair in mine. When we decide to conference, we port our virtual bodies into each other's environment and have our conference. The bodies are one to one maps, in the sense that when I move, what I see of my movement is the same as what you see. Everything else in the environment is unique and inconsistent.

We're also working, as Jaron mentioned, with the notion of concrete mathematics. These are visual models of abstract mathematics. It turns out you can build the entire foundations of mathematics without referring to linear symbols in anyway.

Here's what I see to be some interesting things coming up. We're working towards public domain VR. What I'm excited about is getting into the Landsat database and finding myself. So, in that sense, it's going to be necessary to segment massive databases in reference to a particular perspective.

Also, you should keep in mind that VR, a world, a virtual world, is composed of objects, locations, and space which is an abstract place. We want to be able to program the characteristics of space with, let's say, vector fields, gravitational fields, flow fields, just as much as we want to be able to address objects within that space.

Conversational programming is a natural outcome of having objects with their processing loop. You should just be able to talk to objects to get them to respond to you.

Negotiable group space is a natural consequence of inconsistent realities. Rather than this physical stuff dictating the assumed reality, we want to be in a situation of saying, "This part of my reality I am sharing with you explicitly." And we're able then to have a very explicit audit trail of what it is that we see to be our communal environment. And then when confusions or disagreements arise, let's say on a group work project, we can point to the explicitly agreed upon reality space and figure out why it is that we disagree.

It's a natural consequence, of course, that we want to have artificial life growing up in our artificial environments. We have life-like models simulated in batch mode now. I want to see the processing community bring us enough computational power to be able to walk around in there with autonomous computational entities. I think that is a common dream of all of us on the panel.

And finally, most exciting, the notion of cross-validation of realities. This is the first time in human history that we are able to say, "Well, if I were in this reality, and you are in that reality, what is it that we are sharing in common?" In other words, VR is the first scientific tool of metaphysics.

Now I'll do a little bit of a segue, setting up our discussion during the next phase of this panel. Here's some issues; these are not at all the panel's consensus issues, they are ones that seem to be important to me.

There's a pretty large confusion about terms, and with any classical definition of reality, you're going to find that. There is a lovely little paper about fifteen years ago in the Proceedings of the American Psychological Association, saying that nobody really knows what the definition of reality is. We don't have a good metaphor structure. We need to encourage a dialog on what it is we are talking about. People talk about escapism. If you look in the dictionary, escapism means going someplace else other than physical reality. Well, there is just no getting around that. People talk about addiction. Now this is not a chemically induced drug, it's very hard to argue that it is addictive. So then it gets stretched a little bit to psychological addiction. A good movie is psychologically addictive, you know that. So maybe we should talk about entertainment, maybe this is all a game. No, because you've already seen some very serious applications that will have profound effect on our productivity in the future. So, I don't know what the right metaphor is at this point. Perhaps that will show up in the discussion.

There's the notion of lack of experience, and this one is really puzzling to me. Lots of people, thousands, have seen five minutes of VR. There's no more than twenty to my knowledge who have been in there for fifteen hours. We are getting very, very excited about something we know nothing about.

And part of that nothing we know, at least for the folks that I know who've been in there a lot, they go through a process of cognitive remodeling. Things like dreaming in polygons. Now I know that for anybody who's hacked late into the night, this is a naturally occurring phenomenon, you just

keep on hacking after you go to sleep. The point that I want to make is not that it happens, but that we don't know anything about the mechanisms or the impacts on us or our culture.

There's also going to be a psychological effect from the notion of fluid bodies. We have tools here for sensory synesthesia. What happens when I cross my auditory with my visual channel? We have exchangeable body parts. What's it going to be like to have that? We have masslessness, tremendous feeling of empowerment. There's no longer this energy, this effort that it takes to move things around. These are, I think, significant research questions that many academic communities -- psychology, computer science, engineering -- all need to address. And one of the reasons that I'm up here is to encourage that to happen, so by this time next year we'll have technological and scientific papers at this conference to address the questions.

There are the questions of sensory overload and sensory ecstasy. Are there pathways to insanity just by changing our input? Are there pathways to joy? I think so.

There are significant questions about power and control. I don't mean that we're going to strap people into VR so they can't get out. You can always turn it off. So there is tremendous freedom in knowing that, but what will be the rules and regulations of spaces? Will somebody have the right to build objects that you can't interact with? When I have furnished my McDonald's reality, can I go in and remove the golden arches? Questions of who's running the show and whether or not cyberspace going to be in a sense an anarchy, or whatever other political and ethical systems that might develop. And of course this rolls right over into a simulation environment for social systems.

Which brings me to one of the most fascinating questions for me. We've lived in a culture and grown up in an environment where physical reality hasn't had a competitor. How is physical reality going to respond to another reality taking a little bit of the show away? Actually I believe that we're already in that overlaid environment. There's the mass world and there's the information world. I would suggest that virtual reality has evolved as the environment for dealing with information.

You know, I've been coming real close to going philosophical on you here. Here's some of the philosophical issues.

This is a world that's pervasive and that's not really a familiar concept. We live in a dualistic society with a dualistic language and dualistic concept structure: Either-Or. Virtual reality is Both-And. We still have a physical body in VR. In other words, when I put on the headphones I can still eat, I can be both physical and virtual. This is actually very close to the alchemist creed "As above, so

below." It's also very close to the fundamental operator in the logic of implication "If on the outside, then on the inside." That is, environments have rules of containers rather than rules of symbols. The environment surrounds and we can point to the inside of what surrounds as something that is inside. But you'll notice that space pervades. When I make a container, I have done nothing to the space on the outside or the space on the inside, except to distinguish the space on the inside as special. I have not carved space, I have not made it dual. I have made it pervasive.

There is also the issue of constructivism, basically the philosophy that mind and body co-participate in defining reality. Here we can test that.

There is a fundamental definitional change in the notion of semantics. Now, traditionally in logic and mathematics there is syntax and on the outside, at least in a different world, there is semantics. Semantics being meaning, what do I mean by the jottings, by these symbols, by this pixel array. We've turned that inside out. When you're in a virtual environment, your meaning is there with you as your experience. However, you are also totally immersed, surrounded by a computational digital environment as well.

I don't quite know how to address that, perhaps the next notion of immaterial realism comes up. The currency of VR is organization, not possession. We're in a world where the rules themselves are transmutable. It's fully representational, we can, in a sense, build what we can name. But VR is not rational, not empirical, and not verifiable. My question is "How is Big Science going to handle this one?"

Boundary mathematics is what I have been verging on talking about throughout the entire talk when I addressed the notion of inclusion. Boundary mathematics is a formal system in which context and participant are formal operators. From boundary mathematics, from the notion of a containment, we are able to build logic, set theory, and integer theory. What this means is that somewhere inherent in the nature of surrounding environments is all of formal computation. I personally feel -- and we are pursuing it very strongly at the lab -- that we are looking at a revision of the entire scientific language. Which is to say that we are talking about much more than reality. VR is not a physical simulation. In fact, when you are building systems in order to get a physical simulation, what you do is to take your VR and add constraints to it. Throw away the constraints, you're in something that is a bigger space than physical. We have new freedoms, we have new things to learn.

Now, innovations are classically first described in terms of what they replace. The automobile was first a horseless carriage. And it was built as though it were a carriage and it moved at the same speed as a carriage. It was fifty years later that we found that it transformed culture and our notion of space and our notion of travel. Television was first radio with pictures. Computers are replacing calculators and typewriters and desktops and filing cabinets. I'll suggest that VR marks the end of the infancy of computation. Computers are not symbol processors, they are reality generators.

And reality is in the eye of the beholder.

Bob Jacobson:

I want to dearly thank our first three panelists for introducing those of you who are new to the field to the questions and some of the answers dealing with virtual worlds. We're going to give you five minutes to think about it and then we are going to have a commentary about the purpose or the significance of virtual worlds in a larger context beyond the laboratory. In three minutes from now, that's three minutes from when we take the break, the San Francisco Art Institute Future of Virtual Reality will show, signaling you time to return to your seats, so don't go too far. Thank you.

BREAK

Bob Jacobson:

Those are from Michael Naimark's Immersive Virtual Environments classes at the San Francisco Art Institute where they are working with traditional media to portray the future. I now want to introduce the second part of our panel. Those of you who were out, please take your seats. We will do this in a way that will not be strictly a self-limiting panel. That is once the three have said their pieces, which will be considerably more to the point I suspect than longer of technology per se, we will go into a panel discussion. There were some interesting issues raised last night amongst us, that were not resolved purposely so that you could hear the resolution or at least the continuing debate. When that is concluded, we'll take another intermission, we'll then go to questions and answers from the floor and look forward to your participation as an active audience at that time. So, sit back and I now call to the podium, Esther Dyson who is probably well-known to most of you. The editor of Release One, she wanted to talk a little bit about why she came here today.

Esther Dyson:

Hi, good afternoon. I don't think I'm well-known to most of you. I write a newsletter that has no pictures and no graphics, I'm a real word nut and call words symbols. And so in a sense I was brought here to be, if not con versus pro, at least some kind of outside observer. Is there anyway to lower these lights? Okay, well, the first thing I'd like to say, is the reason I took on this task, was because I wanted to know a little more what I was talking about. And I've had a nice day and a half spending time with Jaron and John and the people here on the panel. And I've been very much impressed with how much smarter they are than their PR might indicate. So in a sense I find I'm fundamentally in agreement with most of what is being said here, but I am here as a commentator and rather than repeat what you've already heard, I'm going to make three points that if not con are at least amplifications or modifications or clarifications.

And they are, number one, what we are talking about is, as noticed, as pointed out, is communication, not the user and the computer, but the user communicating through the computer with another person. But that there is some illusion and deception to that promise.

Second, don't forget about symbols. They give you power, let's not abandon the power of symbols and metaphor for a simulation of reality.

And the third is just some of the social, psychological, philosophical issues that are raised. Most of which were already covered, but I've one or two others. The real problem with the word virtual reality as William Bricken pointed out, is that we're not simulating reality, we're in part, simulating physical reality which is only a part of reality, and we're also able to simulate what physical reality is not. We can do much more than we can do in physical reality. We don't want to just simulate reality, that's a waste of time. You can go buy something or build something or go somewhere, if you really want. We're not just trying to get a cheaper form of reality, we're trying to do something more and beyond that. So I'd rather call it, alternative physical reality or something that is never going to catch on, but when you think about it, virtual reality is a very misleading term.

Okay, let me get down to the communication thing. The best single sentence I've heard about communication with words is by a man called David Waltz from Thinking Machines and what he said is "Words are not carriers of meaning, but merely indexes or pointers to shared meaning." In other words, if the word I say doesn't evoke something in your mind, I'm not communicating, I may be saying a word, I may represent the word in a computer, but there is no communication going on. And so, in the same way, nine out of ten things that people communicate are not about physical

reality. What I'm trying to communicate to you isn't a picture of a girl sitting on a swing, it's not a particular apple on a desk, it's maybe the notion of food and an apple is too specific. Maybe it's an emotion I felt, or it's a political situation. I can simulate the Soviet Union or part of it for you, but I can't simulate the government system in virtual reality. I spent three weeks traveling through Eastern Europe and I'm coming back to report on it, and what I'm going to report on is not a simulation of my physical experience there, but rather trying to convey the meaning, I'm going to try and summarize it and use a lot of symbols and metaphors and things were we have shared experiences. Maybe, say, some of the government structure is like IBM and that has a lot meaning to many people here. So, remember that we're communicating about more than physical reality and what we can indicate.

Second, the notion of symbols giving you power, not just in terms of communication, but if I'm going to be building a virtual reality, and this is actually an area where I don't know enough, I'm going out to visit VPL research to get a better understanding of what their programming language embrace is all about. But rather than put five red balls around the room, I maybe want to say something like, every time there is a green wall, put some red balls on it. I want to be able to use rules, I want to be able to use generalizations. I don't want to have to point to the nineteen varieties of color that I consider to be red. So, again, you need some kind of language, some kind of generalization, some kind of abstraction to get the power and manipulation, the ability of a computer is not just the simulation but the programmability of it. Here, I don't know what I'm going to see, but let's not forget that what we want to be able to do is not just simulation but also abstraction.

Another interesting problem that comes up is one I can best illustrate with a story. Suppose you have a child, and you take the child to a pet store and you buy a very cute fifteen pound dog. And the kid loves the dog and he goes home and the dog immediately gets run over by a bus. So, you go back to the pet store and you say, here's this crying kid and his dog is lost and you want another pet for this charming little kid and the pet store says, well all I have left is cats and you say, well I want the equivalent cat to this dog. Now, if you don't have any symbols, the only thing you can do is kind of get a cat that looks as much like the dog as possible. But what you really want is you want a cat that's a good of a cat as this dog was a dog. And so you don't want a fifteen pound cat, you want maybe an eight pound cat. And so you want to be able to put in some notion of intentionality in here. What was the fifteen pounds in relation to the dogness, not the fifteen pounds as a feature in itself.

Okay, and the third point, are some of the social implications. The most interesting one to me is this representation of self. Traveling through Eastern Europe again, I began to realize how middle

class and bourgeois and how much of a luxury it is to have good dental care. I mean that's getting pretty basic, but we consider the quality of your dental care to have some kind of social implication when it is a physical reality in Eastern Europe. And so in the same way, we're going to have an interesting world where I think everybody is going to start applying this little virtual self-makeup. And so then you're going to say, well, gee Jaron is looking really scruffy, couldn't he hire a good designer. It's sort of like going to the right hairdresser or buying the right clothes and so then you're going to have teenagers and they're going to say, well my parents won't let me create some kind of self that all the other kids have. They all have green horns and my mother thinks those are terrible and so forth. And, round about November every year, people are going to say, Christmas comes so early, everybody is red and green already. So, the social implications, I mean that's kind of funny, but the long-term implications of this kind of thing, how you present yourself, how much of yourself now becomes a purchasable commodity, becomes a very interesting question.

And then the final issue is this notion of again, reality and do you communicate with the computer or do you communicate with other people through the computer. And at conferences like these, and at AI conferences, you hear more and more talk about friendly computers. You go and you look at programs, and the program says I didn't understand and to me that's off-putting, it could be scary. Either I'm really stupid if I think I'm talking to a real person, when it is just a computer or the computer system is very sinister, if it really has that impact, if it really carries that off. When I'm experiencing something, I was in the hot tub this morning in the swimming pool. It wasn't a lot of fun, because I was alone. And I really don't want a computer there or a simulated reality or anything else. I want a real person. Now maybe it is a simulated hot tub, but I want the person who is sharing the simulation to be real. And so, the thing that scares me the most is that people kind of create these electronic playmates or you start to, and we see it already, I mean you don't need to have a very good simulation of reality for some people to start getting personally hung-up with their computers or in other cases it can be chess. In this regard there is a very good book by Sherry Turkle, called the "Second Self" which is probably ten years old, but is well worth reading. Now, she made the very interesting point that in fact, this scary thing I just described is not generally the case, in fact, children who deal with computers understand much better what it is that makes them human. They understand the computer can think and it may be smart, and it can do homework, but it doesn't have emotions, it's not human like me. Just as when they think about their dog or their cat, they say well the dog and the cat are warm and fuzzy and it's alive but it can't talk and reason like me. And so, somehow I hope that we are capable of understanding that what we are simulating is not a substitute for reality but something else quite different, much as William Bricken pointed out, movies are not theatre on stage, television isn't radio with pictures. And this thing we call virtual

reality is not a kind of reality at all, but something very powerful, very exciting but quite different.
Thank you.

Well, Tim Leary you all know, and he can introduce himself, too.

Timothy Leary:

Now, you may not believe what I'm going to say, but I don't remember ever having been connected with the University of Pittsburgh. I know, I know. One of the great advantages of getting older is that I'm experiencing a lot of the experiences of being kind of high. A long term memory gain and a short term memory loss, but I swear that to the best of my knowledge and ability I've never been in a university in Pittsburgh and I apologize to the Carnegie Mellon, too. I think I know how this mistake happened, I had been appointed last year, believe it or not, to a university post as a visiting instructor at Penn State. When that was announced several state legislators, I don't know why, objected. So, I'm not on the faculty of Penn State. What I am doing is, they went to this, I'm going to be teaching extension courses at Penn State. Safely in California I will modeming in interactive courseware to Penn State. I may even go up to Pittsburgh.

I feel this room haunted by some people that I think would be very happy to be here if they could. As a real follower of Socrates, I think his friend Plato would be really happy to be here, because it was Plato after all, who spoke about the problem that we have these wonderful ideas in our minds but yet reality is only a poor fabrication or simulation of what we really feel inside, see inside and that hopefully, in fact, forms could exist. So what my words are for virtual reality is platonic realities. And while I'm on the subject of looking at the ghosts around this room, I see the quantum physicists, I really do. Am I hallucinating? Einstein you know, says it's all relative and that it takes two to make a reality. By the way, people say that quantum physics is counter-intuitive and somehow it violates common sense. Well, that's if you're a Newtonian. I think most of us in the room realize that the Newtonian laws turn out to be local ordinances. I got to speak for Werner Heisenberg, he said, you know, basically you just make up your reality, you think you are studying a particle or native tribe, but believe me they're studying you. And it's that horrible, horrible, frightening, scary truth to a Newtonian or to a feudal person, Sartre said it, like it or not, each one of us is out there in the nose cone of your own time ship hurtling into a dark future and we have no road maps and don't even know how to work the dials. We are creating our own realities. The upside there is that if you look around, like around this room, we're not alone. There are a lot of other neuro nuts in this room facing this confusing future that we've been trying to cheerfully to discuss today.

They talk about the Heisenberg principle, indeterminacy, that's the worse thing to a Newtonian. I like to talk about, you know, the self-determinacy and multi-determinacy. Anyway, certainly we've learned from our wonderful reality engineers that we can start fabricating our own realities. And then, people like Max Planck, said that hey, you know the universe and everything, matter and all

that from stars, galaxies down to atoms, are made up of quarks, like little off/on electronic shimmering fields and basically we are talking about creating your own world, interplaying in a relative sense with others, using quarks. While I'm praising the wonderful lineage from which we come, I must, I've got to, speak with great respect of two thinkers that have tremendous relevance to what we are doing. Marshall McLuhan, it is shocking to me, as I talk to university, good universities like University of Pittsburgh and North Carolina, that many students, the brightest students have never heard of Marshall McLuhan. Isn't that scary? Anyway, Marshall McLuhan, he said the medium is the message and now thanks to our wonderful reality engineers here, we can update that. The medium is the reality and if you use words you would have it an oral tradition and if you use electrons you can have it any fucking reality you want.

There's one problem with McLuhan, I knew him well, and really respect him. None of us is perfect. Marshall is a Catholic as you probably know, and when he said the global village, and where all into the global village now, he had in mind some kind of St. Augustine Catholic feudal beautiful thing, where there was no Pope or the Pope was a woman, I don't know what he would have done. He didn't really get into the idea of interactivity, or of personal responsibility or personal reality formation. And the other man, the person I'm going to mention here, who really taught my generation and I think younger generations, this basic, Heisenberg principle that you know that you create your own world, is Dr. Benjamin Spock. He told parents after WWII the most subversive thing that anyone has ever said in a social sense, treat your kids as individuals. And I think that he would be happy to see what we are talking about, however incoherently, today. I think that, you know this is one of the most important meetings ever held by human beings. If we have a sense of humor we can say that. It's only virtual anyway. And I mean, when I say it is an important meeting to human beings, I ain't saying much, think about it.

To give you my vision of what we are talking about today, I have to thank with tremendous affection and honor, Jaron Lanier, because his approach is human approach to me. I get a chill when I think about it. I had the great privilege about a month ago to be in Jaron's magic electronic reality shop in Palo Alto with Momoko Eto and Mimi Eto, part of this incredible family of, friends in Tokyo who are trying to build up a interactive interplay between America and Japanese and, when they asked Jaron what it was all about, and I'm paraphrasing, but he said something like this, that the main purpose of this is to empower the individual. Didn't you say something like that? Yeah, you forget, too. As Robin says about the 60's, if you remember it you weren't there. Jaron, I think he said that it is a reality built for two or more and that one of the main functions of this is to intercommunicate and to share, not just to create realities and studying them. When he said RB2, I got another one of the chills and the third thing he said, I think, was that one of the hopes or the goals would be to that

we would lower the boundaries that keep classes and countries and linguistic groups, something about making it global. Well, anyway, I thank you for some of that.

What are we going to call this phenomenon we are involved in? I think it is wonderful that there are so many different names. Gibson said something, William Gibson, another one of our great profits, he said, I think, that the street has it's own uses for things that we come out with. Another way to put it is that the street produces the labels and the words. My dear, dear partner John Perry Barlow, is writing a book, I think the title of it is "Everything We Know Is Wrong" or something like that, okay. And I would, to amend each other, I would have a footnote or something, everything we know is just out of date. Because we are trying to impose the language of the industrial society, maybe even a feudal society upon a new civilization, a new order that we have. Back in the psychedelic days at Harvard, I can remember the first emissaries, pilgrims from the west coast, namely, Kesey's crowd and the Grateful Dead crowd showed up at Harvard and Millbrook and we would say something like "Well, we're conducting a conscious expansion sessions with psychotropic foods and drugs." And they would say "Man, you mean you're dropping acid and tripping out." It's amazing and amusing and somewhat humiliating to us to see that the street terms somehow popped up and I'm sure, although this is probably not the right comparison to make, that words will come out to describe what we are doing and probably come out from people much younger than me, and maybe younger than us on the platform.

I love a concept that Brenda Laurel, Scott Fisher came out with, tele-presence. I like that. How about telescope, no that's been taken. I love teleportation, but nah. I must tell you that one of the visions that I have in mind, the goals that I have in mind for what can come out of all of this, is I keep in mind, I have for the last few years, I think the most important America, and that is the kid in the inner city, because I think you share my liberal belief that America can get no greater than the person that is most deprived. When I talk, as I do, about these matters in college audiences, many, all of the thoughtful questions come up. They distrust the technology, and I have to explain, hey, there are two kinds of technologies, there is the industrial-mechanical polluting technology and the technology of electrons. Sticks and stones and pollution can hurt your bones, but electrons can only fuck your head up.

And another thoughtful objection, to our discussion today would be the person who says, well, aren't you developing a horrible two-tiered society. Where we are going around with all the equipment, but what about the kid in the inner city? And it's my hope and my vision that within a few years, the price of goggles and a running suit hooked up with sensors, those will be certainly less than a Walkman, and probably less than a pair of Nikes. And what that means is, that suddenly

the barriers of class and linguistics and education and nationality and all of that is gone. The kid in the inner city can slip on, or whatever you call it. And talking to young people in China or Russia and having flirtations with people in Japan, in other words, to me something wonderfully democratic about cyberspace. If it's virtual you can be anyone, you can be anything this time around. But literally, we are getting close to a place where that is feasible.

Another metaphor I use in trying to explain to myself and to other people less technological than you about what is going on, is I have come to love the telephone. It is amazing how you get, you learn a little more, then you look back and you say I never fucking appreciated the telephone. It's an incredibly democratic device, because the thing about the telephone is that it has one mouthpiece and one earpiece for one individual. It's the ultimately singular empowering. Except, what good does it do to have a telephone unless it's a reality built for two. You got to have someone else on the telephone or you sit there and talk, whoops. My friend Harry Nielson and Terry Southern and then Woopie Goldberg had that wonderful, that movie, did you ever hear about the telephone, where this woman is on the telephone, Woopie Goldberg, and suddenly at the end of the play, you realize that she is talking to herself? The telephone man comes to turn it on or something. The point I'm making is that the telephone links up, it creates a virtual reality for just two people. Except for Big Brother trying to tap your phone. I often found it amusing that at the height of WWII and the Germans were getting the rockets and we were getting the atom bomb, you know Stalin named scientific task was? I learned this from Solzhenitsyn's book "The Seven Circle," he took all the top scientists in Russia and put them into this special prison, where their main job was to learn how to tap phones at a distance. Before my pal Gorby, I'm very sympathetic to Gorbachev, I know how he feels, give people freedom and everyone gets mad at you. I'm going to send Gorby a telegram saying, if it gets hard, Gorby, come over here and you can debate G. Gordon Liddy.

I see the computer, have for some time now, as a like a headphone or a mindphone. And that's where we get back to RB2. I'd like to make a comment about SIGGRAPH, you know, I've not been a regular visitor to these conferences. To tell you the truth, you know, I'm such a slow learner, it took me a long time to figure out that graphics were the key to the whole business. We were developing programs, and we had text and we described great poetry, we had one with William Gibson and William Burrows writing text for us, and I want again give credit to, I don't know if he is here, but if he is not here, he certainly in this room. A man that talked to me all the time about graphics and graphics, and why are you talking about graphics. I was talking of course to Ted Nelson. I mean, among the many prophetic and wonderful forecasts Ted made, he was the first one to tell me about how important graphics is, and then you think about it.

I was reading on the plane here, natural history, I only read natural history and Scientific American when I'm on a plane. And this guy, Stephen Gould from Harvard made the comment that primates are really the only species we know of that you the eye. Dog's nose is five thousand times greater than ours and all that, but it is the eye gives you this distance. Think about it, I just figured this out three days ago. I can look at my eyes and see a star. Light from a star, I'm picking it up. That's an empowerment of the eye I learned this graduate school, but I forgot it, the eye, I'm not going to talk about memory anymore, unless I forget. They told us in graduate school, that the eyes are the direct membrane extensions of the brain. So when you see something, it's actually your brain registering it in pixels, no they don't call it pixels, they call it rods and cones. Sound, all that mechanical shit, it hits the hammer. Taste, all those chemical things, smell and touch and all that. But the eye is, spooky when you think of it, the eye is really you're brain right out there.

What are we going to do with this wonderful possibility. And I think you saw on that board a list Warren did, Jaron and the fifty bumper stickers that William put up there. Can I have the merchandising rights to your notes? How about t-shirts? Like the one about worlds, creating worlds. Sometimes I think of the situation we're facing now, the situation was facing twenty-five thousand years ago by a group like us, sitting around a river bank, and we've just learned how to chip stones. Hey, we can take skin and maybe, and suddenly someone looks at us, you know what, we can chip and make stones, we can make clubs, we can lay them down and make little roads, we can cross the river with it and then someone else says yeah, we can even make caves of it, we can make our own caves. If they could have known then, that in twenty thousand years most urban Americans live in an environment where they hardly ever see green grass or look around, talk about artificial reality. And what a wonderful thing our human race has done to build and to construct and of course it is pretty untidy, you have to run around and dig the oil and the coal and all that, but what a wonderful thing we have done over this twenty thousand years to do this. And now, we are going to start all over again, and we have to create, and it's more complicated this time, because it is not just simulating bridges and all that. The thing about creating worlds in cyberspace is that you are kind of creating as you go along. And also, the staggering statistic that we are facing is that information overload.

Okay, we've got this kid in the inner city, and suddenly she's got all the equipment. And then with fiber optic plugs, I'm told I believe, that within about ten years it's possible that fiber optic outlets would be like nothing. You walk around in streets, there's water, you can go to a water fountain. You can walk anywhere and there will be a place you can plug in your fiber optics stuff and getting billions of it, bytes with it a minute or second. I'm not good at measurements, I like rpm, that's how I measure my brain, that's realities per minute. We are going to have to take all this information,

which again Ted Nelson forecast, store it in these enormous banks and somehow you have got to be able to, you have highways going down and you turn left and the Middle Ages. The main job of a lot of us in the next fifteen years is to construct the Cyberworld, or the virtual world in such a way that we can access it. About time for me to stop? Okay, I'll stop with one more little illustration here.

When I try to explain to people what is going on, I really get held to the literacy and I call it letters and the keyboard is three rows of Phoenician soldiers with spears to keep my mind away from yours. Letters are codes, the Phoenician used so the Romans wouldn't know what they were scamming them on. Literacy is a code. Anyway, in the future, if I write 'the boy fell out of the tree' in the time it takes me to write that, got your goggles on?, I got it all done and with my little thing, and juk, juk, juk, and there on your screen, my screen there is a palm tree, a tall palm tree, the boy is a Polynesian kid with a pink bikini and he is doing a back flip twice into a swimming pool made up of marshmallow fluff. McLuhan's right, the meaning is the message and there is no more messing around with what do I mean. And then you can say, no put a banana on it. Anyway, three or four names I want to mention here. Feel bad if I don't, to talk about Scott Fisher and Brenda Laurel and Eric Gullichsen and also, listen, I spend most of my time in the last eight years, not bullshitting about stuff, I've been doing programs. Software programs, I got my hands dirty with cyber stuff and all that, but it is true, I play what I think is a very important function in this society, that of popularizing, personalizing and humanizing stuff that is scary or frightening to people that don't understand what it is. And I want to say that I'm just one of a wonderful group of people who are doing this necessary. I speak of Howard Rheingold, how about applause for Howard. And Steve Ditlea who is here, and another man, it's hard for me to praise him because he's Scotch and I'm Irish, but we've got to give a tremendous amount of applause to Stuart Brand. Steve Levy and Ted Nelson and Ruddy Rucker. I could go on, but I say on eloquent, articulate, funny, lyrical humanizers, popularizers of what we are doing is the man I'm going to introduce next. He is a man that I've come to know and love very deeply, Gibson talked about hackers being cowboys, outlaws and all that, among his many accomplishments and achievements Barlow is the first cowboy in cyberspace. John Barlow.

John Barlow:

You know, I've been following Tim Leary for years and it's served me very well. I'm actually wondering about it at the moment. I don't think I'm going to be that funny. But you know, I might. The reason I've been following Tim for years, and I didn't realize this until fairly recently, but Tim is kind of like a cultural chameleon of some sort, sort of like a Zelig of the zeitgeist, and whatever is happening, he's doing it. In the 40's he was in the army, he was at West Point as a matter of fact, which was a pretty appropriate thing to do; in the 50's he was a tweedy professor, neurotic and martini drinking and troubled, post-Freudian. In the 60's he was Timothy Leary, which was really right. And in the 70's he was a political prisoner, as were many of us by one means or another. He spent the 80's in Beverly Hills and now he enters the 90's all rattled up about cyberspace and virtual reality, which I take to be a sign that this is a good place to start.

I'm mean, he's a little bit like the inverse of a canary in the coal mine. He's the first canary that starts jumping up and down talking about how great the air is in here. And this leaves him vulnerable to certain kinds of criticism. Some people don't dig it and they don't dig that they don't dig it. So, he gets accused a lot of going around selling Dr. Leary's virtual tonic or some such thing. And I just want to say for starters, that he's not the first doctor who is selling what might or might not be snake oil. And snake oil has an interesting way of transforming itself into real medicine. There's a recursive process that takes place between innovation and charlatanism that I think we forget sometimes. I mean, personally I think that the relationship between humbug and technology is very thin. I mean, you go back and you look at pictures of Alexander Graham Bell and some of his first road shows or Edison at the 1876 World's Fair and it's pretty close to a medicine show. And electricity, the whole story of electricity, the way in which electricity got popularized was just, I mean it got reported to have magical properties and that it may yet turn out to have.

More recently, and I'm real sorry that Nolan isn't here to defend himself, but those of you who know Nolan Bushnell, know that he harkens back to a certain kind of nineteenth century American character, who was a Yankee trader, and I think that Pong, which in many ways is the source of all of what we have here, was a perfect example of something that might have been regarded as a humbug that was really fundamental. I just wanted to dispense with this hip, hype, hope thing because I think, personally that bullshit is the grease for the skids on which we ride into the future. That is self-serving. I freely admit it. I was having a conversation the other day with Rudy Rucker, I don't know where he gets off, but he just recently moved into virtual reality out of cellular automata, and he's another guy to watch, by the way. And he was talking about cyberdudes and cyberdoers and making it pretty clear which one I was. And how he didn't think, he thought that the

panel was a little short on cyberdoers, which I kind of agree with, but especially, and another thing, I have a bone to pick with you guys. I would like it a lot better if the nerds could just be nerdy and right code and talk obscure stuff and the smoke shovelers could shovel smoke and you people are pretty much eliminated. I mean, one of the reasons I'm temporizing here, is that William Bricken said every single thing I was going to say. And said it quite a bit better than I will.

This is an interesting field, I would be here just for the conversation, even if I didn't think it was the greatest opportunity for bullshit artiste since pro-football. But it does lend itself to a certain amount of over-hype. And when I'm thinking about virtual reality, I think a lot about something that a friend of mine, Paul Saffo, at the Institute for the Future, talks about which is macro-myopia. Macro-myopia is society's tendency to overestimate the short term results of any technology and to underestimate their long term results. Because it takes a certain length of time for enough people to die, actually, to assimilate a completely new technology paradigm. So, I think, you know, wild statements about what virtual reality will mean in the next little bit, I think are probably misplaced, but give it about twenty-five years and look out. Because it is going to be intense. It's going to change, I think, every single thing, fundamentally. But, you know, there will also be all kinds of miserable side effects. I was watching a guy yesterday, in Jaron's VR booth, and very ordinary-looking fellow, I mean kind of a potato, I didn't really expect much out of him. He wasn't having much reaction to being in VR and he came out and I said "What do you think?" And he said, well it reminds of something that Lily Tomlin said about how drugs make us more creative than we really are. I decided he wasn't a potato after all. Pretty good. And I think that's right, you know, you lay on people a tool as powerful as this, and as open-ended, and you know, I personally feel, I think of myself as being a reasonably creative guy, and I feel just kind of overwhelmed by the potential. I mean there is just kind of a lot of cognitive staggering about in the presence of such a thing.

And I want to talk a little bit about what this is and what it is good for. I think Warren did a really beautiful job of talking about what it is good for in a practical sense. And I don't understand, I mean just another parenthetical, I don't understand why the programs in this field are funded the way they are. I mean this is bizarre to me. This ought to be the best funded stuff in America. These people have to scratch for any penny they get, so if any of you out there represent any major corporation, check it out. You could get in on the ground floor. It's still for sale.

But I think there are practical uses right now. I want to also, I think, now I am going to dip into the philosophical barrel here, see if I can retrieve some shards that William has left me. But, I think that what we are in the middle of now, and this is a manifestation of probably the most significant in the history of humanity. Really, because what we are doing is leaving the landscape and moving onto

the map. I mean, we have spent our history thus far, dealing with tangible things, down in the dirt, talking about abstractions as a luxury. And having a very located sense of place and body and form and physicality. And we are now increasingly in an environment where the forms are all cognitive and cerebral. I mean, if you don't think that virtual reality is here, take a look at downtown Dallas. Seriously, not New York, I think New York is pretty real, New York is plenty real. But this stuff out here, I could do this in an afternoon with swivel 3-D. It's crazy. And you know, you get down into the bottom of these buildings and they have no commerce whatsoever with the street. I mean they are just big shaded solids that got landed there. People are kind of scratching around and looking up at this stuff, and thinking well, you know, what am I and what is this?

You got the global suburbs, which is a line I got from Tim, I was grousing about how McLuhan was plumb wrong about (missing tape changed) It's not a concept I like that much. I see things, manifestations like the fact that the suburbs outside of Las Vegas are identical to the suburbs outside of Pittsburgh. As though the country were the same. I mean, there is no communication between that map and that landscape at all. Which I think is a very disorienting thing for us to be doing to ourselves. Especially when combined with television. Which is the ultimate sort of inhabitation of the non-place map. I mean, you ever see any place in TV? There is never any place. It all takes place in television land, I guess. And for somebody who lives in a small town in Wyoming, this is really disturbing and offensive. I think it is hard on people. Because I think we are hardwired for community and we're hardwired for connectedness to place and to landscape. And being ripped away from it without any choice in the matter is doing bad things to society. I mean, I think this society is in a stupor, largely. It's in a kind of TV narcosis most of the time. Really, and it is in data shock. You know, everybody just kind of been hosed down with this continuous torrent of information, until they are against the ropes and they're just kind of dopy and brain-glazed.

So what does this have to do with that. I think, I'm going to propose that this, if not the answer, at least the goodest, the goodest, the best one I know. I do come from Wyoming. Try to talk like you fancy people, but. Because most of what we are getting now is either one-way, as television, or is very thin as in telephones or computer networks, which are text-based. I think that cyberspace, itself, actually exists, now. And has for some time. And I want to distinguish cyberspace from virtual reality and Jaron will give me a hard time, but hell with it. Cyberspace is that zone in which all these kinds of electronic informational interactions take place. I mean, cyberspace is the place where you go when you talk on the phone. Cyberspace is the place where your money is. That brings it a little closer to home, doesn't it? But it is. Much of what, of commerce in society at this time takes place in this fairly unidentified zone, which I used to call the data sphere and then I

decided that William Gibson had already gotten there first with the better word, so I call it cyberspace. And I think that this is wild country, basically. It's a frontier kind of place. It takes a lot to maneuver around in it. Very few people, just real desperados and a few vigilantes are out there at the moment.

And I think that the answer to feeling against the ropes and feeling alienated and the answer to data shock, is to a large extent, being able to inhabit cyberspace as a place. Being able to actually go in there and be somebody. And that's what we are talking about. We aren't talking about computers as other human beings and I don't why we keep wanting to do that, I guess we're lonely. We're talking about the ability to inhabit another place, which is really the place of platonic reality. I mean Tim is right, I think platonic reality would have been a pretty good term for this.

This is a way for us, there is an Old English nursery rhyme that I am referring to which is 'There was a man who lived in town, and he was wondrous wise. He jumped into a bramble bush and scratched out both his eyes. And when he saw what he had done, with all his might and main, he jumped back in the bramble bush and scratched them in again.' And I think that's what we have the opportunity to do here. I think computers have alienated us and put us on the end of a data stream that at fifty bits a second, simply unassimilable. Now, what we have to do is us computers to develop full band width relationship to information. Just like we've been doing for the last forty thousand years. That's what virtual reality is for. Getting in to information, inhabiting it, integrating it and turning it into experience instead of, as Jaron very appropriately put it, alienate experience, which is what most information is right now. It's been stripped away from experience, it's been compressed into ASCII and believe me stuff happens when you do that. Stuff gets lost. And then it has to be decompressed and God knows what way, and every other mind that experiences it.

I'm a writer so I feel the alienation of that compression process very acutely. Every time I sit down to try to describe something, I feel like I'm trying to build a working scale model of a fog bank out of bricks. Really, it's just, these are inappropriate tools. And I agree with Esther, I mean, the wonderful thing about poetry is sort of the achievement of being able to do so much with so little. Taking these incredibly clumsy crude little things and turning them into beauty. It's an accomplishment. And something I hope continues, but I'd like to be able to actually show you the fog bank sometimes and not have to describe it. And that's what we are talking about here.

The other thing that we are talking about is communication. I have this hippy, mystic sense that humanity is about some great work. Which to me is the assembly of the collective unconscious as consciousness. Wiring the human race. I don't know why we want to do that, but I just think we

do. And this is the means by which we will do that. And then we'll see what happens. But it's not about experiences so much, as it is about shared experiences. It's not the television, it's the telephone. I think that is a very important thing to get straight. And it seems like every article I read about it, that gets left out. What VR is about, is other people, by far the most interesting thing on this planet. We need to figure out ways to get back together and reintegrate ourselves with ourselves. And if this becomes a tool for that, then it is worth the trouble.

The other thing that it is worth the trouble for, is two thousand years of epistemology has stumbled around grappling with, well reality is great but compared to what. Well, we have a standard of comparison. Now I actually thought that we would come up with something like that a little bit ago. I mean one of the great things about working for the Grateful Dead for twenty years is you don't have to go around, like some of you probably do, pretending that you're not an acid head. And please, if there is anybody here from the press, this is not electronic LSD. As somebody from Autodesk said recently, it's going to be a long time before it begins to approximate the price/performance ration of LSD. But it is, it is a real good tool for getting people, who might be a little Newtonian and deterministic, to recognize that reality is an opinion and not a fact. And it is this ability in some folks, which I think is at the core, I mean this and fear, is at the core of practically every wickedness perpetrates on himself. This is the seat of intolerance. I mean, if my reality is the reality, I can do anything I want in the service of that reality. If on the other hand, I recognize that, hey, whatever, that's an inhibition to certain kinds of control-freak behavior, I think. So I guess, old hippies die hard. I'm still at it, I hope the rest of you don't give up, because I think we may actually be on to something again. Thanks.

Bob Jacobson:

Sounds like we may have struck a chord. Thank you all. We discussed when all this was going on the idea of having our own inner panel conversation. We'll do that, but we thought we would go right to questions and answers, so if those of you, are there questions out there? Yeah, must be a few, what we'll do is take a very short break, please go out of the room and come back in, stand up and be comfortable and we'll start in about four minutes and do some questions and answers. Those of you that have to go, thanks for showing up.

To those of you that have questions, there are mikes liberally sprinkled in the audience in the aisles. One, two, three, four and then there are some upstairs. We'll try to start with those, as the panelists reassemble, like you, there will be some commentary amongst them as well. I wanted to say one thing, too, I left out something that is very important to us. One of our colleagues at the HIT lab in Washington, Meredith Bricken, who has been a close collaborator with William and the rest of us in developing this technology, so thanks Meredith. Now, we'll go on to the questions and answers. Why don't I start logically, my own reality at the left and we'll take the first one there. Can you raise the volume a bit?

(Audience)

My question is political philosophical question. I get very worried about technology utopianism and as far as I'm aware there is never been an empowering technology that the powerful have not used to oppress the powerless, and I'd like to know from the panel how virtual reality technology might be any different.

(Panel)

The one that is like that is the telephone. Essentially, I'm actually real skeptic on technology, too. And some are familiar with my tests, that if all of technology does is make people more powerful, or even smarter or more informed, we should consider that it is not really contributing anything of value, necessarily; and maybe even consider it bad. But I think the right measure of a technology is whether it improves connections between to some degree. I think, I might also say, given your question, you'll probably think that is way over the idealistic, but I sometimes think that if a camera is a metaphor for an egoistic approach to life, that virtual reality is something of an empathetic metaphor, because but for a wave of a hand and a gesture you could be anything or anybody in environment. And there's this very interesting, sort of multi-viewed sense of a situation that you have. I think overall, it should have a broadening effect on people's approach to the world rather than a narrowing one, which is what television is so bad, because

(Esther)

I just have one sentence, which is I think you're probably right and so we should work hard and make it as cheap as possible as fast as possible, so that the poor guys get as well as the powerful ones.

(Timothy)

The delightful thing about virtual reality is that only one person can put it on at a time. And I've done the demonstrations with large groups and it comes down to only one person. Technology in the hands of the individual is the dread of every dictator. I cite you the FAX machine in China, as long as it is available to the individuals, and it puts us into communication.

(John)

And I would suggest that technology is basically a zero sum game all by itself. Except in so far as it inspires us to think about ethics and the development of ethics is never a zero sum game.

(Bob)

Thanks, we'll move to mike number two.

(Audience)

In an evangelical sense, this stuff creeps me out, it, let me say in thirty seconds, try to ask a question, a couple of things that William Bricken said, then Tim Leary said something, I'll attend to that. He said that the essence is inclusion. And then later on he says that psychology is the physics of virtual reality. And what creeps me out initially is this immersiveness. I'm not sure how different it is ultimately from TV land and I wonder if the more bandwidth you add, as the bandwidth will certainly come along, if it just isn't going to become more and more like a TV land? And then when you apply to that psychology, which maybe in Tim Leary's term, a sort of local ordinance of the late 20th century. Jerry Bruner said in a book that I think was called "Notes From the Left Hand" that there were elements of the human experience that psychology couldn't touch and couldn't say anything about. And I'm really concerned about this cycle of an immersive environment controlled by the ideas that are current in the strange time that we live in. In my time in high-tech, I've come to really believe in the hardware and be real afraid of the ideas that a lot of the people come up with. So, I wonder if it is not just more TV land?

(Panel)

I suppose I would like to hear William's response, if he has one.

(William)

Well, I come at it from a scientific perspective. Inclusion is a mathematical phenomenon. What I'm trying to say is, I have no idea how this will unfold culturally, nor do I feel empowered to even comment on it. But the point is, it has revised mathematics and mathematics itself is hard to turn your back on.

(Audience again)

But then you spoke about psychology, and that's cultural.

(William)

Actually, when we were making those slides up there was a long discussion about whether psychology was the right word and since you brought it up, I'll renege. It's the wrong word, because psychology as a scientific discipline is far too narrow of a concept. Perhaps empowerment, perhaps intention, perhaps some other word to get to the central notion that the core of VR is not hardware or software, it's the person.

(Panel)

Life, if your leading it right, is a pretty thorough immersion. It's not something out here. The problem with television is that it's out here. The difference, and this is just pure McLuhanism, the difference is participation. If you're participating, if you're an actor in the situation, it is a whole different paradigm than if it is just coming at you.

(Audience again)

You're putting clothes on all of my senses, aren't you.

(Panel)

One thing I find most fun in virtual reality is that the most precious moment is really when you like take off the clothes and look at a tree, or something. And it's really, in terms of just being in touch with nature, it's actually a neat tool for that. And, it's really something like, using it is more like having a conversation with somebody in a more expanded form, or using a tool for awhile or something. It's not like you really just go into it forever and I think that's a ridiculous view of the future and will never happen.

(Panel)

We'll move to number three, is that okay.

(Audience)

I just want to make a quick comment, that if this is one of the most important meetings in the history of the world, I think that the panel might have been structured with more than Esther, who is a very powerful person, having had time to think about some critical aspects.

(Panel)

I probably could go on with that, with the long history of how the panel was formed, but I won't. Could I have microphone number three?

(Esther)

Just one second, though. The point is these guys have thought about some of these aspects. I may come from outside, so I came to it fresh, but as I mentioned, what I was impressed with was the journalists who might have taken down their most controversial or exciting remarks might not have thought about these issues, but they in fact, have.

(Panel)

Go to mike three.

(Steve Ditlea)

Just before the session began, something very disturbing happened. I gave Bob Jacobson an article that used the term artificial reality, he took one look at it and said, "Humph, nobody uses that term anymore." Now, unfortunately Bob, you are representing a rather limited view of what virtual reality or artificial reality really is. You're only, represented on that panel are only the people that believe in encumbrances that help you have virtual reality. In other words, gloves, clothing, and goggles. There happens to be a person in this room, who invented the term artificial reality, and who sees a time when you don't need these encumbrances. That's a long term view. He belongs on that panel, he belonged on the panel at SIGGRAPH last year and his name is Myron Krueger.

(Bob)

Let me respond to that because I've had questions raised earlier this morning.

(Myron)

Wait a second, I'm on the panel. Step aside, come on.

(Bob)

I find this exceptionally rude and he didn't give me a chance to explain why the panel is structured as it was.

(Myron)

It doesn't matter. That's right.

(Audience again)

Just let me finish one thing. There is a term that has not been used today, and Tim Leary is responsible for, I think might be the best term, it's called alternate realities. There isn't just one version of virtual reality, there's lots of them. And let a thousand flowers bloom.

(Myron)

Well, I can't word dance like the rest of the folks, because I'm not really prepared, but I have spent twenty years, over that, I think Jaron was eight years old when I started, working on this stuff. I coined the term artificial reality initially, very carefully constructed to make a point that people have had to clarify on this panel, that Myron Krueger

(Jaron)

This is Myron Krueger who is a wonderful pioneer, I've been influenced by him, I respect him enormously and I appreciate him incredibly.

(Panel)

I want to apologize for the fact that I intended to introduce Myron in my speech and I just got sort of fumbly and forgot. I would also like at some point to introduce Mort Helig, who is another great man of virtual reality. There he is right there.

(Panel)

Mort had an artificial reality running in 1965.

(Helig)

No, '56.

(Myron)

Let me say a couple of words, everybody, Steve Ditlea has made a point here, that there is an orthodoxy that has been established that prevented, it's the same kind of orthodoxy that prevented

this work from being done for the last twenty years. In other words, there are preferred approaches, these dominate, they get done at the right institutions, nobody else is allowed to do anything. And during the 70's all these ideas were proposed to all of the people who are supposed to support research. This is not a triumph of America research, it's just the opposite. It's an example of the pioneering work being left out and orphaned for ten, fifteen years. Nobody is allowed to do it. Let me give you a couple of examples, in '74 I went to NSF, DARPA and NASA and places like that, and NSF said that sounds like engineering, DARPA said that man-machine interaction has been done. The real enabling event for all of this later second wave, has been the decomposition of the taking apart of a Japanese consumer product. That's really what enabled the second wave here.

So, many of the ideas that have stated here, in fact most of them, were reported in my book, *Artificial Reality*, which came out in '82. That book was written in '72, it just took ten years to get it published. And there will a follow-up on that book coming out at the end of the year. But I think, let me describe just in a few words what the alternate opinion might be. Obviously if you were going to image the ultimate in this technology you would not wear anything. So starting in '69 and '70, I set out to do that. And with some success, in '70 and '71 you would stand in the middle of the room, full body interaction, and the interacting in a graphic world. Now obviously, wearing glasses gives you some advantages, but gloves. The idea that people are going to put on gloves and put scuba gear, essentially, to go to work in the morning, at least requires some skepticism. Technological skepticism, not cultural skepticism. In other words, there should be a debate on this issue. And it isn't just that this debate didn't occur on this panel. This isn't an isolated event.

I love to be able to do this, because it's probably the first I've ever heard it done, Trish Wald, the reporter for the NY Times, during an interview with me, told me that a number of the protagonists of the west coast school of virtual reality explicitly told here not to speak to me. My work was very significant, but I was just an artist. I think that that is perhaps worth knowing because the orthodoxy is being enforced here. And I think that, just to give an example, right from the beginning my environments were teleconferencing environments. Two people in different places, wearing nothing, and just nothing but come as you are, and the idea was you could reach out and touch somebody, just as proposed here, but you had, potentially you had a face. Now image a virtual reality as somebody here might describe it, used for teleconference, you've got your face obscured. Now, if had as an alternative, I've heard people speak of face detectors. Now, I've heard of such a thing, it's called a video camera and once you've done that, once you are using a video camera for face detection, you may as well use it for body detection as well, which is what I do. And then you have, what will be the ultimate for teleconferencing. You've got to have a face, if you're going to teleconference. It's...

(Panel)

Hey Myron. I think we should, I want to say something and then I think we should go on to some other things. I think that Myron Krueger is an important pioneer in this field, and I think that to me artificial reality, virtual reality, cyberspace are all synonymous. I'm glad Myron got to come up here and say a few words. It's been a struggle for a lot of people over the years. I think we should recognize what he has done over the years.

(Bob)

And now I would like to reply. The truth of the matter is, well you have your realities and let me tell you what mine is. The truth of the matter is if we had everyone of the pioneers up here this table would stretch off this panel and probably fall off into the doors. The intention was to talk about one specific phenomena, one type of so-called artificial reality. That is the virtual world, the spatial environment, the 3-D environment that encompasses. This was discussed at great length with the panel committee, before I accepted the responsibility of putting together this particular panel. It was not a discussion of artificial reality in the universal sense, it was a discussion of one particular application of that technology. In my opinion, although Myron Krueger's work is ground-breaking, his concepts are very ground-breaking, this was not the 3-D technology that we were speaking about. That was my understanding of my charge from the panel's committee. Now, that's my reply. And well, I thought I did the best job I could.

(Panel)

Why don't we have a pioneer's panel next year? We should.

(Bob)

Let me tell you, there actually should be two panels, one dealing with technology, which could have encompassed the entire world of virtual realities, and one dealing with the commentators, which could encompass another whole generation. The fact is, we couldn't do it within the time lines allowed to us, nor within the scheduling restraints of this particular session. And this was the final decision made, not necessarily by me alone, but by a lot of people who thought that this panel would be one that would satisfy you're inquires. I like the fact that artists think they have a special right to dominate these things, personally, I'm sorry. As one who was pushed away from the podium, but was not asked to surrender voluntarily but was pushed away from the podium, I feel strongly about that. I think it is very undemocratic and very selfish. I'm very naive. Could we go to the next microphone.

(Audience)

Let me say that I think that there is something that could be said to maybe some of the schism that is going on. I don't think it is really a very complicated issue. I think that everything that has been said here, has all been, this isn't about devices. Devices are a means of picking up what are bodies do and that's an extension of our minds and how they express themselves. Whatever devices are involved, gloves, video cameras, whatever, should be irrelevant. And if we build software architectures around this generation of devices, then just have to replace it for the next one. We've really gained very little. So, I think it is really important to recognize right off, there is sort of a goal here, and that goal is to respond to the human body and its expressive organs, which are its muscles. So I think this has really very little to do with research into specific devices, and I don't think that should be the basis of any schism within the group. The other thing I have to say about it, is that, well the most encumbering thing I know of is to be forced to stand a long period of time in a single room. So, I think that issue is another question. But my real question, my reason for standing here, I have a question for Warren. His list of sensors is probably the most complete that I've seen, I thank you for that, but there is I think a list missing, sensors for underperceived aspects of the self, electroencephalogram, electrocardiogram, conductive skin response, blood alcohol level, all of these things that give us important cues about what is going on inside our bodies.

(Warren)

Yeah, I'd be happy to add those to my list. One thing I've wanted to do for a long time is make a pair of earrings that would blink when your heart beats.

(Audience again)

How beautiful. I think of these things as a source for some Warren's behavioral transducers. I just like to get some response from the panel on the idea of a virtual mirror, something that would enable us to do something a little less superficial than just fixing our ties and checking our make-up, but maybe help us stop smoking and driving drunk.

(Panel)

I've implemented a virtual mirror. I didn't have room in the video tape to show it, but one interesting thing, it's a mirror that you can fly through and get into the mirror worlds, so that everything is reversed once you go through it. And one thing I think Louis Carroll never thought about it, when you fly, when you go through the looking glass, there's no way you can avoid slamming into your own face.

(Audience again)

That's still a visual thing.

(Esther)

Go foot first.

(Panel)

Or backwards.

(Panel)

Also, we did one with a photophismagraph?? which is just shining light through the skin and measuring it back, and Walter Greenley, of Greenley Metaphone and I got, it's seven years now we did a thing where on the screen, we derived a breathing and pulse and how your guts were moving, and it was real interesting.

(Audience again)

Did you use it for biofeedback?

(Panel)

Yeah, it was a biofeedback device.

(William)

We're also able to construct multiple bodies across several organisms or across several people, so let's get out of the notion that our body is the only thing that we are interested in measuring and ask questions about whether or not the average pulse rate in the audience is worth looking at as an expression.

(Bob)

Can we come back to this microphone over here?

(Audience)

My question is about virtual economy. We are going to have to, the people, the poor guy in the inner city who is going to spend the money, instead of buying the Nike, he's going to buy the suit or the goggles or he's going to spend money to a VR room. He's going to get something back for that. And in terms of survival, what is VR buying him are the survival skills to leave, on the physical body. Can someone actually do work with it, or is it just purely entertainment? Because if he goes

into a room, he buys the suit, he has an experience and he has not improved his chance of survival afterwards, there is no difference between spending his money on VR or the Nike.

(John)

One of the things that I think has been happening, is a culture that separates information workers from non-information workers at a time when there isn't much to do if you deal in tangible goods. I know that, having been a rancher, they don't pay well for that. People in the inner city get lost in that shuffle. ASCII is not what they are good at. If you can have something that makes it possible for those folks to use dance and information and get into the information in some kind of much more direct intuitive way, than sort of the white boy way we do it, I think you are doing them a favor and making it possible for people to work in fields where they might not otherwise been able to work.

(Panel)

Can I answer that also? The model I'm hoping will be followed with it, is the one that was followed with the telephone. One of the reasons I like the telephone metaphor where until fairly recently the phones were pre, in anticipation of service, so that a large network kind of amortized the expense of the equipment and I'm hoping that this kind of simulation sharing medium, by whatever form it exactly comes out, will work on this same principle.

(Panel)

I think your question was about, partly about, doing real productive work in a virtual environment and I'd like to remind you, if you can remember back two hours ago to the video tape I showed, where there was someone planning how to do radiation treatment for cancer patients in virtual reality, it's a real three dimensional positioning task. It saves someone's life, I'd called that

(Audience again)

He had a great deal of previous training, so it's not the, the technology will enable, it's not like something you buy and you grow with it, you have already to get to a certain state, a certain elite to profit from those tools.

(Esther)

I don't want to go into long detail, but I think the implications of this for education are great and obvious, bring it into the schools early.

(Bob)

I'd just like to say we are doing some important work with our educational community in our state and also doing some work with some of the public agencies who are doing, for example, design planning and wanting to involve more of the public in the actual review before things go to developers for final determination. The number two mike.

(Audience)

About Tim Leary's statement about the eyes actually being an extension of the brain was very telling, in particular in regards to some of the hardware discussed. When you are triggering the retina with a... essentially making the retina a monitor, you are intentionally individually triggering brain cells, which is in some sense the ultimate resolution possible. I wondered if the panel had some comments on further direction in that kind of technology.

(William)

I think it's unexplored territory.

(?)

Next mike.

(?)

I'm going to pass on that one.

(?)

Semi-explored territory.

(Bob)

OK, third mike.

(Audience)

Hello, this is mostly for Warren. As Myron Krueger talks about the advent of the consumer product being taken apart and helping make these glasses possible. And the PowerGlove has come out and sort of brought virtual reality down to \$5 a day, according some peoples notion. What would you want in the mass consumer market, or what goal should people be going for in the sensor technology? You've got this long list of sensors. What design goals are you doing in your next sensor that you're working on. What should we be trying to build as opposed to what's out there right now and costs so much and doesn't work near metal and stuff like that.

(Warren)

We'd like to build a multi-sensory virtual reality system that covers every sense you've got. But there's some that are easier to do and some that are more important. Clearly vision and hearing are more important than the others. I'm not sure that's obvious, but at least, considering what's easy and what are the important senses, vision and hearing are the ones to start with, and then force feedback and tactile senses are pretty obvious next step. Then, you've got things like hot and cold, and smells, which is one I'm kind of intrigued with. I'd like to work in there somewhere. One thing that occurred to me. I never thought much about smell until I met Mort Helig, the guy we talked about a little bit earlier, who built this sensorama machine in the '50s that you could get into and it gave you a multi-sensory film experience. It was prerecorded. Thinking about the smells made me cast my mind back to what people must have thought about the idea of recording sounds, or recording images before it was possible. Before the photograph was invented, the idea... Well, there was paintings. So, let's say recording sounds. That's kind of a strange idea if it was never possible before. Though nowadays, we talk, I'm bringing up recording smells, that's possible too. A smell recorder and a smell replayer. And it might be pretty provocative. And evocative.

(?)

Mort, by the way, had a belly dancer as one of his virtual realities.

(Ester)

That is a nice idea, but there is a difference. With sound, there's a much tighter resolution, there's sort of a grammar of sound, which is music. There's rhythm, there's a much more defined time element. I mean, smells are tremendously evocative, and so forth and so on. But I think it is a different issue.

(?)

It's different. An interesting thing that comes up is smell metaphors. In other words, you can map smells to things that they are not naturally associated with.

(Mort Helig)

I just wanted to comment on a few of the questions that were brought up, because as Myron has been doing it for a long time, I've been fighting these wars for a long time too. And there are certain things that are rather obvious to me and perhaps would answer some of the questions that are going around here. Number 1, I think we should never confuse apples with oranges, which I think the young lady has done here. I think you have your technical form of your art, which is one thing.

And it should not be ever confused with the esthetic manipulation of that art, or certainly the content of the art. They are entirely different questions. Cocteau, for example said "What do I care?" You know, on what size the paper you write a poem. It doesn't matter to me if the paper is small or big. He said that in response to people such as myself, who were trying to expand the sensory information, going from a small screen of that type to perhaps an IMAX or OMNIMAX screen, a totally surround. One thing has absolutely nothing to do to the other. If you put a very powerful technical medium in the hands of a klutz, you're going to wind up with nothing. Or if you put this medium in the hands of a person who is destructive, you're going have a destructive message. Obviously, no matter what the technical form is, whether it's painting, music, poetry, or whatever, it has to be put in the hands of somebody who has something meaningful to communicate, and who is an artist. When that is done, it doesn't matter what the technical form is, it's going to be something very beneficial and very constructive. So I think, to clarify the discussion, you always have to be sure that you're not mixing apples and oranges because when you do that, you muddy the waters and you create a lot of confusion. The other thing I'd like to say is, there is a cultural tendency, I guess it's a sort of egotism, that when somebody stumbles across a new discovery or new technology, they tend to overestimate their self importance, and they think "God, this is totally revolutionary. It's never been done before." Those of you who are familiar, I am more familiar with the history of motion picture technology. I mean, there are guys, Abel Gans, way back in 1910, so was working on his famous film "Napoleon, spreading the image right. There is a tremendous tradition, going all the way back to the cave man, of people who, in the arts in one fashion or another, have tried to immerse the spectator in an environment and give him as powerful and complete an illusion of reality as they could. They were limited with the technological means at their disposal at the time. Now, we have this marvelous new medium of video and the computer, obviously enormously extending their power. But, let us not have any illusions that we are operating without a tradition. We have a tremendous tradition behind us. The roots are rather obscured, but they are there. The other thing we always have to keep in mind is that this, the whole idea of virtual reality is really not a totally new thing. We all dream, don't we? We have our dreams. And when we enter the world of our dreams and reverie, it's a very curious thing about a dream. We're all the star of our own dreams. You're always the center of your own dream. Occasionally, you objectify yourself, and you see yourself out there, but by and large, the whole dream revolves about you. Have you ever asked yourself, as I have done many times, and it's kind of an interesting question. Do I dream in color? Or do I dream in black and white? Do I dream in two dimensions? Or do I dream in three dimensions? Do I smell things in my dream? Or don't I smell things in my dream? These are not easy questions. I have my ideas, I'm sure you have yours. But the point is, we all have, from time immemorial, we probably shared it with animals and whatever, we all have an interior psychic world and dreams. Now, what technology is giving us now

is the capacity to express that, to communicate it, and to experience the dreams and internal world of other people. That's a marvelous power. I think it has great potential. And the only other thing I'd like to say, which is rather a banal point, is that I don't care what the invention is, whether it's fire, or a knife, or the atomic bomb, or atomic energy, let's put it, everything has a potential to be used positively, creatively, to extend life, or in the wrong hands, it can be used negatively, destructively, and can destroy the human beings on this planet. My major thought, and the reason I've worked at this for so many years, and I'm very optimistic, is because I really believe, in the hands of the right people, this probably does represent one of the greatest opportunities the human race has of saving itself from self-destruction. Because, when you stop and think about it, another technology, such as nuclear energy has come along, Man has this enormous extension of his physical power. I mean, primitive man could pick up a stick and he could club another man. I mean, these are obvious analogies and so forth. Now, a guy in some silo somewhere, can, with the action of one finger, can push a button, and blow, and you know, and kill 20 or 30 million people across the Earth, perhaps wipe out the entire human race. So, what you have here is, technology has enormously extended mans capacity for physical action. What we don't have, and this is the first time we've every had such a dangerous disproportion. We have not had the capacity to psychologically comprehend and experience the result of our actions. And this is what I think virtually.

(?)

So we have a curious disproportion here. We have some kind of physical giant. Technology has made us the Schwarzenegger, the tremendous physical giant, where we can do things that psychologically, we cannot hear the cry of the baby we've incinerated. We cannot smell the burnt flesh. We can't do any of the things that a primitive man could do, and therefore there was always an automatic self-regulation in his behavior. I mean, if somebody said "You know, here's a club, go out and kill a million people." He couldn't do it, because by the time you killed the third person, and heard his screams, and smelt his blood, there would be an automatic feedback mechanism operating, which is built in, and he would stop. OK, but now, you can... (tape ends)

There's no way of you controlling your own behavior because it's gone beyond the sensory input which that is necessary to control that behavior. So, the great hope here is that by suddenly getting that psychic information to come back to us, we'll have an opportunity to put things more in balance again, so our ability to understand our behavior and feel and emotionally respond to our behavior will be proportional to our capacity to act. And that, I think, is the greatest way that we're going to save the human race.

(Bob)

It's difficult to imagine what other questions would add to that. The fact is, the stage crew has said that the time is almost up, and I'd like you to see the very last minute from Naimark's class at San Francisco Art Institute as you leave the room.

(?)

I hate it when that happens.

(Bob)

I do too. We'll have to take other questions informally, if that's OK. Thank you for your attendance here.

(Alyce Kaprow)

I would like to add my two cents. My name is Alyce Kaprow, and I'm the Panels Chair for SIGGRAPH 1990. Yesterday, when Jackie Wollner spoke to the opening session, she spoke about artificial, I mean virtual reality as being a topic for a panel that is a special session. You have all spent the last number of hours here in that capacity listening to this. There has been some controversy. Perhaps Jackie's words will come true, that in a few years from now, we will be offering an introductory course on virtual reality, and everybody will have their own equipment sitting at their desks. Right now, because of some of the controversy that was created here, and some of the boos and yells and everything else, I would like to just add my two cents and to say that this panel has created an environment that only exemplifies SIGGRAPH; that it is a place for controversy and conversation and dialog. And I'd like to very personally thank the members of the panel, and especially Bob Jacobson. We've been in discussion about this panel as a special session since March, actually since February, and I would like to extend a very, very thankful warm hand to him and the rest of the panelists.