Oral History of Malcolm Blanchard

Interviewed by:
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Spicer: Good morning, everyone. It's Thursday January 14th, 2021. We're here with Malcolm Blanchard. I'm Dag Spicer from the Computer History Museum. Malcolm, we're delighted to have you here. By the way, just before we start, is that a harpsichord behind you?

Blanchard: No, it's a baby grand piano.

Spicer: Oh, a baby grand. Okay, I was wondering. That's very interesting looking. Well, usually, Malcolm, we like to begin our interview with the earliest years of your life to sort of get a measure of your whole career, not necessarily just where you worked, but your whole life. So, with that in mind, could you tell us a bit about where you grew up and your parents, what they did, what your family was like, and those kind of things?

Blanchard: Okay, I was born in Oregon City, Oregon, which is at the end of the Oregon Trail. At the time, though, my parents were living in a little logging community up in the coast range of Oregon called Valsetz. My father worked in the forests, and my mother was a schoolteacher, and we-- she demanded to give birth to me in Oregon City, so my father had a very long drive that night I understand and I was born there. Later, we moved to a town near Oregon City called Canby, and that's where I went to primary school, and in 1959, we moved to Arcata in Humboldt County, California. And so, that's really where I think of where I grew up because that was from, oh, about fourth grade on until-- through high school.

Spicer: Right, and now what kind of kid were you? Were you into science or sports or… ?

Blanchard: Not sports. Science, yeah. Science and math were definitely the things that interested me. I have an uncle, and had him at the time, who's very much into biology. He owned a company that provided specimens for educational institutions. So, if you've ever dissected a cat, he might have embalmed it. And so, I was very interested in science and things like that, and he certainly encouraged it quite a bit.

Spicer: That's wonderful. It often just takes one person, doesn't it?

Blanchard: Yeah, the interesting thing about it, my brother and I occasionally would, in the summer, go up and work with him in his lab, and in order to preserve all these specimens, they just used huge amounts of formaldehyde, and the lab was just awash in formaldehyde. So, you could walk in, and it would take about a week or two before you could get used to it enough that you wouldn't just be constantly crying as you went in. And I'm kind of amused that everyone is so concerned about breathing in formaldehyde this day. My uncle spent his whole life doing that. He is going to turn a hundred and two in April. So, maybe that preserved him.

Spicer: Yes, perhaps it has a preservative effect <laughs> in living tissues.

Blanchard: Yeah.

Spicer: Anyway, well that's wonderful. And now, you mentioned your brother. So, just tell us about your siblings and what--

Blanchard: I have two older brothers. One is eleven years older than I, and he didn't make the move to California. He stayed in Oregon and is still there with his family because he had just married before we moved, and then I have the next older brother is still in Arcata, and he's four years older than I am, four or five.

Spicer: Did they pursue the same kind of career as you?

Blanchard: No.

Spicer: A technical career?

Blanchard: Not at all. We're very different people in many ways. Actually, my-- the middle brother ended up being a mortician for a lot of his life and then was in-- selling insurance. And my oldest-- the oldest brother was a salesman for building supplies, windows and doors and things like that, but no, I was pretty much the nerd of the family.

Spicer: Yeah, now I always ask people who came of age in the 1960s or so what influences from the world at large might have played a role in their lives, for example, the space program or the Vietnam War or those kind of things?

Blanchard: Definitely, I was very much interested in the space program and followed that very closely. Gee, I even remember there was I think, at the time, Cheerios boxes, cereal boxes, would have printed on the back a building that you could cut out and fold up and create a little building. So, we had a whole space launch pad I had gotten from those cereal boxes, and you could send away for a plastic model of the Mercury space stuff. So, that was-- yeah, very much involved in that. Vietnam didn't really play much of a part until college, but in high school it really didn't loom very large because that would have-- so, I was in high school from 1964 to '68. So, it was kind of the beginning of all that, but it wasn't as big a thing as it was later.

Spicer: Right, and you were of the age where you could have been drafted quite easily.

Blanchard: Yes, well jumping ahead a little bit, I was-- the year I was eligible was the first year they had the lottery. So, you could kind of have some idea of what was going to happen, and I think they announced them from the least likely to get picked to the most likely as we were listening to it on the TV or radio or wherever it was, and I missed the first few. And it turns out I was one of the first few, so that put me way at the end of the list, which I was very fortunate for that. So, I-- it was not-- I didn't feel the pressure that I was about to be drafted as soon as I got out of college because that would-- I would still have an educational deferment until then…

Spicer: Right. Now, with high school, you mentioned, this was in Arcata?

Blanchard: Yes.

Spicer: Okay, and you graduated in which year?

Blanchard: 1968.

Spicer: So what was going through your mind when you were in your last year -- about a career or the road ahead?

Blanchard: Yeah, well I was very much, again, interested in science and math, and this-- and computers were just starting to be around. I was also-- loved those-- in the 1950s and early '60s to see science fiction movies that would always have this computer room with the tapes rolling and all the consoles were all kind of rounded off, and that looked really neat with lots of flashing lights and such. So, in my senior year in high school, I was able to take a computer programming class at Humboldt State, which is now actually called Humboldt State University. It was Humboldt State College at the time, which is Arcata. And so, I learned to program in Fortran in my senior year using one of the three computers that were in the county. There was one at the college. The county administrators had a computer, and then there was some accounting firm -- a payroll company -- had the third computer in all of the county.

Spicer: Wow, was this a standalone machine or a timeshared system?

Blanchard: It was standalone, yeah, yeah. You'd go in with, you know, with the punched cards and feed your deck in through the card reader. And, you know, there weren't that many people using it at the college because it was early-on days, and it hadn't really boomed yet.

Spicer: Yes, any idea what machine it was?

Blanchard: Well it was an IBM--

Spicer: 1401 maybe?

Blanchard: I don't remember now.[1]

Spicer: Yeah, that was a pretty popular one about that time.

Blanchard: Yeah, it could have been.

Spicer: Or 360 possibly.

Blanchard: Yeah-- no, it wasn't that big.

Spicer: Well, that's interesting. So, you cut your teeth on some Fortran at a very early stage.

Blanchard: Yeah. Yeah.

Spicer: Tell us a bit more about that. What was it like learning Fortran in that environment?

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[1] [Interviewee's note] I believe it was an IBM 1620.

Blanchard: Yeah, well, you know, those punched cards, that environment lasted all through my college years, too. So, it wasn't until out of college I got kind of away from the cards. I don't have too many memories of that. I know I just enjoyed it a lot. I liked the logic of it, the formality, the formal logic, and all of that. So, I learned how to do some simple programming, nothing very extensive. So, that wasn't until I went into college.

Somewhere in my senior year, I think my mother read an article in like in *Saturday Review* about this new college campus, a new UC campus in Santa Cruz, and it sounded very interesting to me. So, I put my sights on getting into UC Santa Cruz. I eventually did, but I went down, and I visited. I actually knew a brother of a friend who was there, and I stayed in the dorms overnight and really got a good feel for it and was very much looking forward to going there. They announced that they were eventually going to have a computer science department but didn't have one quite yet when I showed up in my freshman year. David Huffman of Huffman coding fame headed up the department and, at that time, I think he had some graduate students, but there was no undergraduate program in place yet. But they were planning it, and, in fact, it started my sophomore year that they had a department, and back then it was called "Information and Computer Science," and that's what I ended up majoring in.

Spicer: Right. Now, in a way, you're kind of fortunate to be in on the first-- it's kind of a blessing and a curse to be in the first year of a program of a department because their professors area also working through their thoughts and how to teach them, but how was the program overall for you?

Blanchard: Oh, it was great, absolutely. Yeah, I really loved it, and the nice thing about that too is that there were only, gosh, maybe twenty students in the program as opposed to now. You go down. There are thousands I think probably taking computer science classes. So, you knew the professors, knew them very well, and they knew us. It was a very nice environment to be in.

Spicer: Were there any specific areas of computer science that you gravitated towards at that early stage?

Blanchard: It wasn't until my senior year. I was essentially just taking all the basic classes in both programming and logic and such, very much more on the software side rather than hardware. There was a little bit of hardware going on there, but I didn't really delve into that much at all. Then in my senior year, a researcher from Bell Labs, Ken Knowlton, came and spent a year sabbatical, teaching at Santa Cruz. And this is when I first heard of computer graphics. I'd never-- didn't realize that was a possibility until then, and that immediately clicked. That was what I wanted to do. I'm a pretty visual person, and that combined with computers was just perfect for me.

Spicer: Ken Knowlton of course is very famous and accomplished artist-engineer, a wonderful opportunity for you to learn from a real master.

Blanchard: He was at Bell Labs then, and of course you know the hardware for doing graphics was pretty primitive then. I think we had a pen plotter, and that was about it. I mean you certainly weren't putting anything up on a CRT that looked like shaded graphics -- we didn't even have any sort of real-time line drawing systems. And also a printer to do different kind of grey shades but very, very coarse stuff, but

I had the basic ideas down, I think. So, my senior thesis, I wrote a program called Balls and Rod in which you-- I could input a definition of spheres, and it computed a line drawing version view of the spheres intersecting and removing hidden lines and all that. That was-- for the time, was-- I thought was pretty good.

Spicer: Yes, and now this was for your bachelor's degree, is that right?

Blanchard: Yes, correct.

Spicer: Right, and so, you graduated with a computer science degree from there, and you had this one course from Ken Knowlton as your exposure to computer graphics.

Blanchard: Right.

Spicer: And now, what were you thinking once you finished your degree? What was going through your head?

Blanchard: I was going to go to grad school. In fact, the other great thing that Ken Knowlton did for me was that he showed me some pictures that had been done at the University of Utah, and this was the first time I'd ever seen shaded computer graphics, full color. Of course, at that time, it was mostly polygons. And I said, "Wow, that's where I want to go." This is cutting edge computer graphics [that] was happening there. So, I also applied to MIT and Stanford University and the University of Utah. At the time, Santa Cruz had a pass/fail system. So, I didn't actually have a GPA, which I think kind of-- unless you were really standout, I think that kind of hurt a little bit at some of the graduate schools. So, I didn't get into Stanford or MIT, but I was-- happily, I was accepted at Utah and went out there.

Spicer: One of the things about Utah that always intrigues me is how it became this world center for computer graphics research…

Blanchard: I don't know-- I don't have all the details, but my understanding is it started with Dave Evans. He was the chairman of the department, and he'd been at Berkeley I think before then and was recruited to go to head of department at Utah, and somehow-- I don’t know how he connected with Ivan Sutherland, but that was what did it as far as making the place a big computer graphics center. As you know, Ivan did Sketchpad early on at MIT and so was one of the early pioneers in computer graphics.

And so, he came out to Utah. He had also been part of ARPA, Advanced Research Projects Agency, at the defense department and had a lot of contacts there and a lot of pull. I think he'd actually worked for them or worked there at some time. And he was able to get a huge, multi-year, multi-million-dollar grants from ARPA to just do basic computer graphics research. There weren’t really any goals that were set down from the defense department, but we had money, and that really got I think the ball rolling. Plus the graduate students there were just phenomenal. They all kind of ended up being the people running the whole industry at some point. There was Ed Catmull there, who I kind of latched on to that star over my career, but there was also Jim Clark, Bui Tuong Phong, who unfortunately died fairly young, but he was there, from Phong shading. You may recognize some of these names. Henri Gouraud was there, and I'm

sure I'm overlooking some people that I should mention but a phenomenal group of graduate students that were there and doing lots of good stuff.

Spicer: Yes, it really is. It's an amazing-- it's almost like the phrase Camelot comes to mind.

Blanchard: Yeah.

Spicer: It was this incredibly fertile place for a couple of decades that all this amazing stuff came from.

Blanchard: Yeah.

Spicer: So, okay, you're starting at Utah and did-- you must have met or chosen an advisor at some point.

Blanchard: Yeah.

Spicer: Discussed your goals?

Blanchard: Martin Newell ended up being my advisor, of the Utah teapot fame. In fact, I think I've drunk tea that was brewed in the Utah teapot. It was actually his home teapot that he just brought in and digitized, and so I knew about that a lot. And I actually started doing some hardware at Utah, which I hadn't done much previously, and my master's thesis was to design a clipping divider, and this was-- Jim Clark needed that for his PhD thesis, and so I worked very closely with Jim to design and build this piece of equipment. Now, a clipping divider was for a line drawing system. So, the lines that were generated could be outside the frustum of the field of view of a camera, and so you need to have a device that figures out where those lines intersect with the edge of the field of view. That's the clipping part so that you don't get numerical wraparound and stuff like that. And then, the dividing part was that we were doing everything in homogeneous coordinates, that is four-dimensional space, and then just before you displayed things, you have to do a division that allows it-- projects it into a three-dimensional space, the four to the three. So, that was the thing I did. It was called the Alpha Clipper and I successfully designed and built that, and Jim used it for his thesis.

Spicer: All right, tell us about how long you were at Utah and how did it go; what were some of the milestones you encountered there on the way to graduation?

Blanchard: I was-- just a couple of years. I spent most of the time designing the Clipper, but took classes and seminars with Ivan Sutherland and a lot of other of the professors there. Ivan is an interesting character. He's probably one of the smartest people I've ever met in my life, and I've met a lot of smart people. He was really incredible and a little arrogant about it I think too, but he still was a good professor.

I remember his trick was-- by then, a lot of people wanted to sign up for computer graphics classes, and he taught the introductory class to computer graphics, and he-- the first day of class, he would come in. He would write a matrix on the chalkboard and say, "Okay, please now invert this matrix and hand it in," and that usually got rid of about half the people that wanted to take the class because they just-- the math scared them away. And so the classes got down to a smaller size, and he was a very good professor and

able to teach us really well. The thing there is now we've started to have a lot of equipment that we obviously didn't have at Santa Cruz. We had real-time line drawing systems, for instance, and we had the ability to scan out a raster image onto a Polaroid film for instance. There was also equipment there to scan photographs into the computer, which were not -- there weren't very many places where they could do that sort of thing at the time. So, there were a lot of opportunities for picking up some low hanging fruit. And so, one of the projects I did in Ivan's seminar was to say, "Well, I could scan in a photograph and then combine that with a computer-generated shaded image, and that would be kind of a neat thing to do." And so, that turned out to be I think the first time that anyone ever combined a digital image with a photographic background plate, which everybody does all the time these days, but that was probably the first time it was ever done.

Spicer: Wow. As an aside, the Museum actually has in our exhibit on computer graphics, Ivan Sutherland's Volkswagen that got digitized. Was that relevant to your work in any way?

Blanchard: That had happened before I got there, but there were several datasets around that people used to do experiments on, but, you know, the big area of research at the time was how to solve the hidden surface problem. That is, you have a full 3D representation of an object, but from a particular point of view, some of that is hidden, and some of it's visible. And so, there were a lot of creative ideas about how you do that, and so there were these datasets that people were using in order to test their algorithms on. The teapot was a particularly interesting one because it's an interesting geometry. There are places where there's kind of a singularity where everything comes to just-- like at the very top of the lid, and it's kind of interesting geometry, and you have a handle. So, you have this place with a hole, and it's-- it was just a way of testing out those algorithms.

Interestingly enough, at the time Ed Catmull came up with the idea of solving the problem by just having a memory buffer[2]. So as you go through and start to generate the shade of each pixel that's on the screen, you also remember at what depth it was, what the Z value was, and if you just store that in a memory, then when you come in and find another pixel that's going to go at the same spot from a different polygon, let's say, just compare the Zs and say, "Oh, the one that's closer, that's the one you use." And that really bummed out Ivan because it turned out that was just the brute force method.

It wasn't very elegant, but it worked really well, and that's pretty much what people have used ever since -- the memory buffer. I think shortly after I left Utah, Ivan didn't do computer graphics as much anymore. He just felt that brute force was a thing, and it wasn't elegant, and he wasn't interested.

Spicer: I'm curious how Sutherland raised this money because, typically, I know ARPA is very forward looking, but there's often some kind of military application in mind. I wonder if maybe flight simulators were--

Blanchard: Definitely. And I think they were already underway. So, Dave Evans and Ivan Sutherland had their own company called Evans and Sutherland, which was a private company making and selling computer graphics equipment, and flight simulators were definitely some of the things that they did. So, I

[2] [Interviewee's note] "Depth Buffer" or "Z Buffer."

think that was what they were hoping -- that things like that would happen. The other big application was ship design. The designing of ships' hulls is an interesting problem, and they were hoping that computer graphics would help in that endeavor, which it has, I think. But you know, day to day there was no like, "Okay, you have to figure out this battlefield situation," or some sort of equipment that we could use. It really was just completely free-form.

The other interesting thing that was going on at Utah, at the time, was that the ARPANET was just getting built, which is the precursor to today's Internet. I can remember looking at, gosh, a couple years ago a complete map of the ARPANET. I think there were eleven nodes on it, and Utah was one of them. So, I also was at the very beginning of that whole ARPANET era, and I think I used it once to run a program remotely at Stanford. When I was doing that Alpha Clipper, this was-- it was wire wrap technology. I don't know if that means anything to you, but you would take individual chips and you would plug them into a socket, and there would be a pin sticking out the back of the socket, and the way you did the circuit was you would wrap a wire around that pin and connect it to some pin that's connected to another chip. So, there was this whole problem of how you route all these signals and do the most efficient way of wrapping wires. And Stanford had a program that actually did that computing so you could say, "Okay, I need--" I could describe the circuit, and they would say, "Okay, well you'd wrap this wire to that pin, this pin, and that pin, and then to come out," and that was the one time I think I actually used the ARPANET to run that program remotely.

Spicer: I think, if memory serves, Utah had an SDS-940, but I'm not a hundred percent sure, you know, Scientific Data Systems?

Blanchard: No, we had PDP-- no, it was PDP-10s.

Spicer: Ah, PDP-10. That's right.

Blanchard: Yeah, there were two. There were two there. There was one that was timeshared, and you actually input things by using a teletype. So, it was a clunk, clunk, clunk, clunk to actually type something in, and then the other one was single user. So, you could sign up and just go in and use--

Spicer: That makes sense. Now, I have a feeling the hardware, the wire-wrap layout program you may have used, was called SCALD, S-C-A-L-D, by Kurt Widdoes, Jr, a Stanford University graduate student. [SCALD = Structured Computer-Aided Logic Design].

Spicer: It's quite famous, and the timeline is exactly right, but I'm curious where you picked up your hardware knowledge because, so far, your education is pretty software focused.

Blanchard: Yeah, it was at Utah. I took a couple of hardware classes there and I, you know, it's probably not fair for me to call myself a hardware designer because I was more of a logic designer, and so I could, you know, I could figure out how to build things using NAND gates and that sort of thing, but basic electricity baffles me. You know, I wouldn't know where to put in a capacitor and a resistor and that sort of thing, but I could do a logic design. That was pretty much the extent of my hardware abilities.

Spicer: Right. It's interesting how certain inflection points in the history of computing arise because the developments are themselves reliant on acquiring a new piece of hardware. So for example, the frame buffer really transformed computer graphics, I think.

Blanchard: Completely. Yes.

Spicer: Just that one piece of hardware, let alone all the other ones, so...

Blanchard: Yeah.

Spicer: So tell us a bit about what happened post-Utah. You're just graduating, and anything happening in the family front? Personal?

Blanchard: Oh, let's see. Yes. I actually was married when I left-- actually, when I graduated from Santa Cruz, like two days later was our wedding, and so-- and we headed off to Utah together. That was my first wife. <laughs> That didn't last all that long, but anyway, I was married at the time, and I don't know that much else to say about that. In my senior year there-- or my last year at Utah, there was a vice president of a CAD/CAM company in Boston [who] came through and talked to graduate students about possible job opportunities, and this was Fontaine Richardson of Applicon, and so at some point I was getting really tired of being in school and I was ready to go out and do stuff in the real world, and so I applied to Applicon and was hired, and went out.

And this, you know, is probably '74[3], some time around there, and they had a program they were selling, which was a 2D design program, and it was used mainly to lay out circuit boards and that sort of thing, but they hired me along to join the team working on a 3D design product. And so I went out and worked on that, doing a 3D computer-aided design and computer-aided manufacturing [system], and that product was eventually successful and went out into the real world. About a year or so after I was there, they ended up hiring Ed Catmull from Utah, and he and I were sharing an office at Applicon, and gosh, it wasn't that long-- it was within a week or two of him arriving, he got a call from the New York Institute of Technology.

They were wanting to set up a computer graphics lab and they had found out about Ed. Backtrack a little bit here with -- the president of New York Institute of Technology-- by the way, it's a private commuter college out on Long Island and academically is not very well-known. Not to be confused with Massachusetts Institute of Technology. New York Institute of Technology [was a] very different beast. Alex Schure, president of NYIT, for some reason got very interested in animation and he kind of thought of himself as kind of going to be the new Walt Disney, and in fact he'd hired a group of old-school cel animators and had been working on a feature called "Tubby the Tuba," and he got into-- once he realized what the old-school technology was like he realized why it wasn't being done much anymore -- because it's really expensive to do all that handwork -- and so he looked around and thought, "Well, maybe this computer graphics stuff might help out with doing animated movies."

[3] [Interviewee's note] Fall 1973.

So somehow he found out about the University of Utah, went out there and essentially said, “Okay. I want to buy one of everything,” and so he just, you know, he bought frame buffers, he bought line drawing systems. You know, he bought plotters and just, you know, all this equipment and then, you know, kind of turned to the folks at Utah and said, “Well, who do I get to run this?” and they said, “Well, you know, you just missed your perfect guy. Ed Catmull just graduated. He’s not here, but he would be perfect for this job,” and indeed, Ed was ideal. From the very beginning, that was Ed’s dream -- to make movies with computers, as he’s always said that he wanted to be an animator himself but that his artistic drawing skills were just not up to it. And so that was what got him interested in doing computer graphics: he thought, “Well, I can do the computer stuff and the technical stuff,” and then-- but his dream was then to use that technology to make animated movies. So of course when Ed got this phone call from New York Tech that says, “Hey, we’re setting up a computer graphics lab in order to do animated films,” it was like, “My God.” This is, you know, his dream-come-true job, and poor Ed had just come to Applicon like weeks before all this happened. Now, of course, I’m sitting here in the same office with Ed and I’m overhearing this conversation and what’s going on and I go, “Yeah, that sounds awfully interesting. Hey, Ed, you need some help? You need someone to come down with you?” and he said, “Sure. Come on down.” So Ed went down and kind of got the lab started and I followed, oh, about a month later I went down and started working at New York Tech.

Spicer: Just before we dig into the New York Tech story, can you tell us, for the benefit of the people reading and watching, what a frame buffer is and how much they cost back then?

Blanchard: Oh, gosh.

Spicer: Because I think that’s quite quite impressive and gives you an idea of how rare these instruments were.

Blanchard: Yeah. Okay. A frame buffer is a memory system that you can store a color at for each spot on the screen in the memory, and then it will generate a video signal by scanning that through the memory and creating a video signal or driving a CRT or something like that. One image on the screen is called a ‘frame’ hence the name frame buffer, something that temporarily stores an image. You could take a frame of film, for ins-- or, you know, a image and you can buffer it, put into memory, which of course, you know, we all carry those around in our pockets all the time now, but at the time, the only ones available I think at the time were from Evans & Sutherland. Xerox PARC had sort of one also, and we’ll get to the connection to Xerox PARC in a minute, but Dick Shoup had, I think, built a framebuffer there also but generally, [the frame buffer] wasn’t commercially available. So Evans & Sutherland had frame buffers that they would sell and they were 512 by 512 pixels, and 8 bits per pixel, and, you know, I’m probably-- I’m going to get the numbers wrong, but they were very expensive. I mean, that kind of memory was just unheard of because of cost…

Spicer:. Many tens of thousands of dollars.

Blanchard: Oh, yes. Yeah, many.

Spicer: And by the way, didn't Alex Schure buy three of them, one for each of the three colors, the RGB?

Blanchard: Yes. I'm trying to remember the-- three or four. We weren't up to alpha channel yet. No. I think it was three, yeah. <laughs> That was about when the alpha channel started to come out. He bought three of them and we were able to gang them together so we could have R, G and B. Normally what you do with an 8-bit one was you would go through a color map, so you would be able to have a total of, you know, 256 different colors in an image and so you'd use the 8 bits to go through a color map but then create the RGB output. But we actually had three, so we could do it directly without a color map. Only place in the world at the time.

Blanchard: So Alex Schure was a very interesting guy. He wasn't afraid to obviously buy a lot of equipment and he just loved our little group, and as time went on over the years, at the end of the day he would always stop by our lab on the way home just to see what was going on. He always had a little bit of problem kind of accepting people that didn't have credentials. He wasn't very good at judging people on their own merits and trust himself, I think, and that was really apparent with some of the people that he had doing the conventional animation. I mean, there were some good, solid people there, but, you know, they weren't credentialed, and-- but, you know, Ed and I had some credentials and so we were-- he was willing to let us do our work. Very shortly after I showed up-- I think I showed up in January-- I believe it was in April, we got a knock on the door and these two guys showed up wanting to know what was going on and if there was any possibility they could work with us, and this was Alvy Ray Smith and David DiFrancesco.

They had had been previously working at Xerox PARC with Dick Shoup and using his frame buffer. Alvy has a PhD and was well credentialed, and he was pursuing doing color computer graphics. This was kind of his interest in particular, and at the time, Xerox PARC were doing computer graphics stuff and starting to invent a lot of office stuff and how to hook computers together and network them in an office, and Xerox at some point, corporate said, "Well, you know, there's no real future in color in the office, so we're not going to support this color research anymore," and so that was the end of Alvy and David's tenure there. They too ended up heading to Utah and saying, "Well, what--" you know, "Where can we find some work or where can we do some more research?" and again they said, "Well, you really need to go to New York. There's this new lab that's just been set up, has lots of equipment, you know, about everything that E&S sells, and you really should go talk to them."

So they got in Alvy's car and drove cross country and showed up at our door and said, "Do you need some help?" <laughs> and Ed said, "Sure." You know, Alvy was very much into doing paint systems, so drawing on a computer. That was kind of his specialty, and in color stuff. David was more of a combination of an artist, and I think that was where his degree is actually, in art, as opposed to, you know, any technical thing, but he's very hands-on, knows how, you know, he can rebuild cars, and his specialty and throughout his career, was to figure out how to put pictures onto-- computer pictures -- onto film. So scanning devices and things like that, which were just not around, and technology for that was very young, and so he spent a lot of time in that realm, and Alex, as I said, had a hard time judging people on his own, and David wasn't exactly-- he didn't have the right credentials, but Alex allowed him to use the equipment.

David went off to the NEA, I think, in order to get a grant, and so he brought in grants to support himself but he had access to the equipment, so that was the tradeoff that was made there, and so that was the beginning of New York Tech, which over the years, a lot of great stuff happened there. Other than kind of the general idea that, "Oh, eventually we're going to make animated films with this equipment," there really wasn't a real set plan to figure out how to do that, you know, what exactly had to be done in order for that to happen, and so it was, again, it was a very-- it was like Utah. It was just very open-ended. People could kind of decide, "Oh, I'm going to go do this," or, "I'm going to do that," and they were pretty much left on their own to do that.

Spicer: So did Alex Schure really give you any deadlines or milestones?

Blanchard: No. <laughs> Ed was trying to do an "in-betweening" program. So in conventional animation, the master animators will draw a pose that happens at, you know, frame 10 and then another pose that's at frame 15, and then they give that, those two frames, to a junior animator who will then draw the cels in-between." So they will do the transition from this pose to that pose. So that was kind of Ed's first idea: "Well, maybe we could solve that problem using the computer. We could scan in those two poses and then figure out what the in-betweens are." Turns out that's a real hard problem to do if you're working from just two-dimensional images, and there was some work being done on that at the time in Canada with the Canadian Film Bureau, and--

Spicer: Oh, "Hunger."

Blanchard: Yes.

Blanchard: There were two guys that did that[4]. And if you look at it, it's a really weird effect.

Spicer: Yes.

Blanchard: Because the in-between is like, "Well, you have this recognizable image and then it kind of goes jumbled up together and then ends up being this other recognizable image," and there was no sense that this really was a smooth sort of, or didn't make any sense in between those two extremes, and we found that that was the problem too. After a few years we realized you really needed to know, understand, what those three-dimensional objects were in order to do anything intelligent in between.

Spicer: It's interesting how he was using the old ways of doing things to, you know, modeling the old way of doing things?

Blanchard: Yes.

[4] [Interviewee's note] Nestor Burtnyk and Marcelli Wein developed the technology, which was used by Peter Foldès to make the National Film Board of Canada production, *Hunger (La faim).*

Spicer: Sometimes computers let you move away from the old way and come up with a completely new way, but I guess that's often your first step is to kind of look at the old way and...

Blanchard: And, you know, I think you kind of want to understand that process to know where you can do it differently. It also makes it, I think, easier for the professionals that are already doing it to move to the new technology. This has always been kind of an interesting thing in both New York Tech and then later out here in California: we tended to scare the shit out of conventional animators and people doing conventional effects work, because their fear was, "Oh, computers are just going to put us out of business, or take it over and we're not going to be able to do anything," rather than realizing that this, a tool for them to do, use, to get the result that they want, and so I think-- so one of the things of trying to do, you know, model old ways of doing things is to kind of ease that transition and not scare people so much.

Spicer: I remember in another interview that you gave speaking about EditDroid and how the editing timeline is actually reversed from the way nonlinear editors work today because that's the way it was edited using film.

Blanchard: Yeah, yeah, yeah, so-- oh, we'll get to all that in a bit, I think.

Spicer: Yeah, we'll get to that later. That's much later, but yeah.

Blanchard: <laughs>

Spicer: It's just a little parallel, I thought, but...

Blanchard: Yeah. So let's see. At New York Tech I was helping Ed a little bit with his in-between program. One of the interesting things about Ed is the process he goes through for programming, or did then. He hasn't done any programming in a very long time, I think, but he would write the whole program out on a legal pad, longhand, and he would go through and kind of debug it in his head and go back and, you know, change it, and so he had this big stack of legal pad papers with the program written on it and then he'd go over to the computer, sit down and start typing it all in, <laughs> which was just a strange way of doing it. Course, you know, back then it wasn't all that easy to edit a program on the computer because it was all hard type printouts. Wasn't a CRT with being able to look at characters on a screen and going to move things around and edit it…

Spicer: Yeah, yeah, when each edit cycle is like 10 hours or a day or...

Blanchard: Yeah. <laughs>

Spicer: Or whatever the turnaround is.

Blanchard: Yeah.

Spicer: You start to pay more attention to your statements, I think. <laughs>

Blanchard: Yeah, yes, that's true. That's true.

Spicer: Yeah. Oh, by the way, are you using Fortran at NYIT?

Blanchard: We were early on. Excuse me. But that was one of the things that Alvy also brought with him when he walked in. We were using DOS, and this was the DEC operating system at the time, and we were doing Fortran, and Alvy said, "I'm not doing Fortran," and I was actually doing some assembly code. Getting really close to the hardware. But he was not going to have any of this Fortran stuff, and so he, yeah, would've known from Xerox about this new operating system that came out of Bell Labs called UNIX, and so very early on we adopted UNIX there and started programming in C, and we were one of the very first places, to do that. So that was another kind of a first for that, that lab.

Spicer: That's really advanced for that time.

Blanchard: Yeah. Personally, since I was one person that had any sort of hardware experience, I was kind of in charge of whenever a new piece of equipment came in. I was the one that was kind of integrating it into the [larger] system and I was also like the systems guy. Alex [Schure] was constantly buying stuff and dropping it on at door and saying, "Okay. Here. See if you can use this." <laughs>

Spicer: Wow. Kind of a nice problem to have though.

Blanchard: It is, but, you know, <laughs> it gets old after a while, but yeah. Yeah. One of the first pieces of equipment was a video disk, came out of Ampex, and I think they were using in broadcast television for replays and things like that, but our idea was that if we could control it properly, if we could go in and drop a single frame at a time onto the disk, we'd be able to play it back, so, you know, it solved some of these problems of not having to do things in real-time. You could actually record it that way. This device was so fragile though that it ended up just not working. It had record heads that were just very close to the surface and anything, any little dust or thing, could cause the heads to crash into the disk and it would ruin the disk. I spent a lot of time building a hardware interface for it, so that we could, you know, try to use it. We got to that point but it was just too fragile to deal with.

Spicer: Sounds like the old hard disks of old that they--

Blanchard: Yeah. <laughs>

Spicer: When the head crashed it turned into a lathe, basically. <laughs>

Blanchard: Yeah, yes. Exactly.

Spicer: You lost everything. Yeah.

Blanchard: Yeah. Yeah, and this was-- and as I recall at the time, you know, we had hard disks. We were using them for data. These heads were even, like, you know, 10 times closer to the surface. It was just like ridiculously fragile to deal with. Let's see, also-- gosh, at that time I-- this was the last time I ever saw this, but I remember we bought some expanded memory for our computer and we were using DEC PDP-11s there at the time, and we actually bought some core memory, real, honest-to-God core memory with little toruses, you know, magnets with wires going through them. I'm trying to remember what size it was. It certainly wasn't anywhere near a megabyte. It was some sort of kilobytes of memory, and I remember just seeing this, you know, this frame with all of these, this wires and the core in it, so real core memory.

Spicer: We have that almost exact board, I bet you, on display.

Blanchard: <laughs>

Spicer: It's from DEC also, and it's got the core in the middle and it's surrounded by integrated circuits.

Blanchard: Oh. <laughs>

Spicer: As though, you know, this is the last stand for core, right, before the ICs take over.

Blanchard: Well, as I said, there really-- it was a little unorganized for my taste at New York Tech. It was a big playpen and I didn't really see us getting to the point of actually making a film there. I just, I kind of felt a little frustrated with that. My wife at the time was also getting a little frustrated with New York and wanted to go back to Boston, to Massachusetts, and so, yeah, I guess that was in '78, around there, I decided, "Okay. I'm going to go back to Applicon and see what happens there." So at that time, I left NYIT and went back to Applicon. Let's see. New York Tech kind of continued on, was-- afterwards Jim Clark came out and worked there for a little while.

Spicer: Oh. Didn't know that.

Blanchard: Yeah, and Jim Blinn was there, another-- some names you may recognize.

Spicer: Oh, yeah.

Blanchard: And it was interesting, Professor Greenberg from Cornell. Forgetting his first name, but he would-- every few months would bring a bunch of Cornell students down just to look at the lab and see what we were doing, you know, so there were always a lot of interesting people coming in and out and-- but yeah, Jim Clark was there. , Jim got-- don't remember exactly what happened, but at some point he wrote a letter to somebody that was very critical of Alex Schure, and somehow that letter ended up on Alex's desk and Jim got fired. So after that Jim went to Stanford. Oh, actually, I think he went to Santa Cruz first, and then ended up at Stanford, and then with-- as technology moved on, he ended up designing a graphics chip that was the basis of Silicon Graphics.

Spicer: The geometry engine.

Blanchard: Yeah, yeah, the geometry engine out there. So he claims that Alex firing him was one of the best things that ever happened to him in his life, <laughs> because that set him out and got him going and--

Spicer: Seems to have worked out for him.

Blanchard: Yeah. <laughs> That's for sure. Okay. So I'm back at-- yeah. So I'm back in Boston working for Applicon. They're still down there doing their research, and at some point there, George Lucas out at Lucasfilm here in California, was really getting frustrated with the old technology, with having to deal with film in particular. The first Star Wars film had come out, so he, you know, had lot of resources, had his special effects lab, Industrial Light & Magic, ILM, in San Rafael. But he thought that there should be some new technology that could be applied to this filmmaking stuff, and actually, you know, he's good friends with Francis Ford Coppola, who also was very much into technology, and so I think the two of them were really wanting to see if something could be done to, you know, to improve this whole process.

Spicer: Do you know what part of the process in particular they were trying to improve? Like, was it the appearance of special effects or the production process itself?

Blanchard: Production process itself. In particular, George did a lot of film editing, which, you know, at that time, the way you edited a film was you took the physical film, you cut it, cut another one next to it, put them together and put scotch tape over them essentially, fancy scotch tape, but essentially just taped them together, and that's how you made your cuts, and, you know, if you want to change your mind then you have to take the tape off and you have to... da-da-da, all this.

So it was a very frustrating process for him, and so that was his primary interest. He wanted to see if something could be done with the editing process. So, anyway, he'd somehow heard about New York Tech, and Ed was then contacted saying, "You want to come out and set up a research group here at Lucasfilm?" And of course, at the time "Star Wars" had just been out, and they were working on the second one, the second "Star Wars" film. And so, it was a high-status place to be. And I think they were getting a little frustrated with Alex, too, just that Alex didn't know how to make films. And you know, Ed realized that in order to make films you have to have some people that knew that industry and those techniques. And so, he pretty much jumped at the chance to come out and set up the Computer Graphics Lab at Lucasfilm. It was actually called the Computer Division, but we were doing kind of some research, applied research, for the filmmaking.

Spicer: Can I ask what the difference is between ILM and the Computer Division of Lucasfilm? How were they related, if at all?

Blanchard: Siblings, I would say, is kind of how that worked. There were several divisions at Lucasfilm. ILM was obviously the biggest and most prominent one. There was another division called Sprocket System, which was doing sound and film editing -- post-production stuff for doing that. Ben Burtt was the

big sound guy there. The guy who invented all those great sounds from the "Star Wars" movies. And there was also a division that was building George's ranch out in Marin County. I don't know if you're familiar with that, but he has this beautiful big ranch with these gorgeous buildings that are all beautifully designed with stained glass and beautiful redwood stuff. And at the time that that was being built so there was a whole division that was in charge of building the ranch. Yeah, interestingly when we first set up offices in Marin, we were in the same complex as the stained-glass studio. <laughs> So, we could go over and watch them making all these beautiful windows that were going in.

Spicer: Yes.

Blanchard: Let's see, how am I getting ahead of myself here? Anyway, so Ed then started kind of secretly recruiting other people to come out and do this work at Lucasfilm. And I heard through the grapevine that this was going on. That Ed was going to be setting up a lab at Lucasfilm, of all places, and working with George Lucas! And so, I called up Ed and said, "Ed! Need some help?" And he said, "Yeah, come on out and let's talk!" And so, that's how I kind of got back onto that train after spending a couple of years back in Boston. I ended up going there. There were-- and this time they actually had a plan. They had three projects that had real goals and so that-- you know, Ed was starting to learn managerial skills and it was coming together.

So, the three projects were for George who wanted to do editing. So, that was kind trying to put together some sort of system that we could do the editing on the computer instead of having to cut pieces of film together. And that's what ended up being called EditDroid . There was another project for doing digital audio. And that was a big hardware design to kind of do a digital sound board. And then the third project was how to scan film in and out of the computer and do the bluescreen techniques, or emulate the bluescreen techniques, doing compositing sort of stuff. So, those were the three projects that were really well-defined, hard goals: try and figure out how to do it and design it and build it.

Spicer: About how many people were working at--

Blanchard: Well, over time it changed.

Spicer: Just right now about this time? How many?

Blanchard: Dozens.

Spicer: Wow, very small.

Blanchard: Oh, yeah! No, we were-- well, we-- the very first offices I was in, we were in what used to be a laundromat and they'd put-- fixed it up with some offices. And there was, I don't know, 20 people maybe max there. So, yeah, it's a small group. And but they're, you know, recruiting more people and it did grow.

Spicer: The funding was mainly from "Star Wars"?

Blanchard: Yeah.

Spicer: The profits?

Blanchard: In fact, Ed was hired and was doing a lot of the planning and such and was not given the go-ahead to expand until after the second "Star Wars" film came out. And if that had been a flop, then that would have been the end of it. But it, too, was fabulously successful. And so, Ed was given the green light to go ahead and start all these projects. When I first went out there, though, and this is what you were saying was the connection between that and ILM, I worked on a smaller project which was to build an asset management system for ILM. One of the things I did when I'd gone back to Applicon was work on database systems and hadn't really done much with databases before then. But I kind of learned the techniques and how that stuff works. And so, that was what Ed had me do was to build an asset management system, so they could keep track of all those little pieces of film that were going around ILM from the camera department through editorial and all the effects stuff and compositing.

Spicer: So, I'm sorry, at this point, you're literally tracking slices of film, or canisters of film or what? The basic unit of--

Blanchard: The basic unit was a take.

Spicer: Oh, okay.

Blanchard: So, yeah, as it came out of the camera department, off the stage, there would be this scene, this take, and keeping track of all those takes. So, this was, again, this was fairly early on, and so we didn't buy a database management system, I wrote one. So, spent some time writing one, which was a fun experience. And it worked pretty well. It certainly was not at scale to anything like an Oracle would do these days, but it was up to the task of doing the asset management. So, I built a general-purpose database management system, and then wrote an asset management system on top of that for ILM.

Spicer: At this point, is that system actually handling digital files, or just pointers to them?

Blanchard: No, it's pointing to pieces of film.

Spicer: Okay, got it.

Blanchard: So, the records are, it's this shot, this take, and what other descriptions I would have been whatever, you know?

Spicer: So, you're in that transitional period in that the assets themselves are not digital yet.

Blanchard: Correct. Very much all analog at that point. So, that took me, oh, a year or so to kind of get that together, and they used it on some early films that I would just lie awake at night saying, "Oh, god, don't crash, don't crash." <laughter> Because I mean, this is--

Spicer: I think a lot of programmers have that syndrome.

Blanchard: Yeah.

Spicer: So, that was the asset management thing. The two other things you mentioned were what became EditDroid and then the Digital Sound project. Could you tell us a bit about those two?

Blanchard: Yeah, the digital sound project was headed up by Andy Moore-- I'm being the right-- name's wrong. Anyway, a good sound guy who was-- what was his name? Oh, well, I'll think of it and let you know later![5] <laughs>

Spicer: We can fix it later, yeah.

Blanchard: And so, that was to essentially do a soundboard. At the time soundboards were in order to mix together multi-track soundtracks it was all analog stuff up until then, and this was to be done as a digital one. Which allows them to do a lot more audio effects and handle stuff. I wasn't really that close to that project. But you know, saw it going on.

Spicer: Was the audio itself in digital form for this?

Blanchard: It was digitized. You know, the original stuff was still on tape.

Spicer: Gotcha!

Blanchard: And in fact, Ben Burtt and his sound department, you know, all that stuff was on tape.

Spicer: Okay., Did they interact at all with say, Dolby or other people to actually improve theater sound, the sound in the theater itself?

Blanchard: Oh, yes. There was-- that was a project that was also run out of Sprocket Systems, which it ended up being called THX.

Spicer: Oh, yeah, right.

Blanchard: So, at the time, and this was early on in early 1980s, if you went into the theater, the sound was arguably worse than what you would get if you were just listening to your stereo at home. Because those systems were using new technology and advancing and trying to improve with things like Dolby. But so, George was very unhappy with the state of audio and also projection going on in theaters. So, they set up this project in order to improve theater sound and projection. And that ended up being called THX, which was a bit of a pun. The guy who headed it up was Tom Holman, and one of the key pieces of

[5] The Sound Project was headed up by James. A. “Andy” Moorer.

equipment was a crossover circuit, which I don't know anything about, but so it was Tom Holman's crossover THX. But of course, one of George's very first films was THX-1138.

Spicer: <laughs>

Blanchard: Which was the name of it.

Spicer: Right! Wow! Wheels within wheels!

Blanchard: Yes! <laughs>

Spicer: That's fun, I like that!

Blanchard: So, they essentially went out and designed sound systems for theaters and also set up standards for projection, you know, like, "How bright does the image have to be on the screen?" and that sort of thing. And actually, they would go out and certify theaters and say they were THX-compliant.

Spicer: Okay, there's a great scene in "The Simpson's," by the way, where Grandpa Simpson is watching a movie and the THX thing comes on, you know, the slow audio build-up, and it gets louder and louder and louder. Finally, everyone's glasses in the theater shatter… and Grandpa Simpson says, "Turn it up! I can't hear it!"

Blanchard: Yeah.

Spicer: Little moment.

Blanchard: Yeah, that sound by the way was generated by the sound group in the Computer Division. That was a digitally created sound there.

Spicer: Oh, definitely, very much so! The dynamic range is unbelievable. It really gives the speakers a workout, I'm sure, in the theater. How about EditDroid now? That seems very significant actually. At least technically. I don't know how it did in the market, but it seems like a real important milestone.

Blanchard: Yeah, so that was one of the three main projects. And it was headed up by Ralph Guggenheim. Again, a lot of this stuff is, they're starting to use technology that's just not quite there, but they're trying to say, "Okay, I can see a year from now the technology's going to be there and then we can really make this work." So, at that time there were video disks that were just coming out as the precursors to DVDs. And our even compact disks were still not very much available. But he realized, you know, they decided the best way to go forward is to use that technology. They could record the film onto a disk, or multiple disks and then in real time switch between the different tracks on the different disks in order to play back and edit.

So, that was the basic concept was to do that. But the technology wasn't quite there yet. Certainly, video disk technology was just very much starting out and not quite there. So, Ralph spent a lot of time for a year or so also doing a lot of research into what sort of video systems would be needed in order to support that. Also, at this time they were trying to figure out what sort of hardware, computer hardware to use. There was a computer out of Carnegie Mellon or Pittsburgh called the Perq. That's what he started to use to begin with. Didn't work out all that well, and right about a year or so into that project, Stanford University Network Systems came out, SUN! <laughs> So, that was the origin of SUN, you know, kind of built with the idea of UNIX being run on it. And so, we became kind of one of the very first users of SUN computers. In fact, I believe one of our guys ported UNIX to it. He was the one that actually put UNIX onto a SUN for the first time.

Spicer: Wow.

Blanchard: So, anyway, they changed over and started using a SUN. Which was nice, because it had a nice Bitmap display so you could do an interesting user interface, and that was, I think one of the things that was really needed to be done. So, after I kind of wrapped up my asset management system, Ralph asked me to come on and start working with the edit system. And particular, well, since I had all this database stuff, you know, I was kind of in charge of building a new schema on top of DBMS that was related to editing. So, it would store, keep track of all of the film and then the cuts so that we could, you know, play them back properly. So, that was one part of my task, and the other was to do the graphical user interface. So, I was kind of in charge of what to display to the editors. And I had no editing experience whatsoever. I mean, I knew nothing about this stuff. But there was some really good, nice editors who would hold my hand and tell me, "Okay, here's what's that." And at one point it was, you know, I'm already forgetting what the technical terms are, but there's a term for where you cut the sound before you cut the picture, you know, in time the sound changes before the picture changes and it's like a split edit or something like that. And I didn't quite under-- you know, they used the technical term, and I didn't quite understand what that was. And I said, "Well, what does that mean?" And the editor actually took out a piece of paper and then drew kind of, "Well, here's the picture going by and here's the sound going by, and the cut's here on one, and the cut's here on the other." And that was my aha! moment of saying that's how you're going to-- how it's best to display-- the edited-- the graphical user interface. So, that was a timeline, and it was ended up being, when I ended up implementing it, it was the first time a timeline had ever been implemented. Another one of my being in the right place at the right time. I think people had talked about that before, but nobody had the displays that could actually support it.

Spicer: I think that is an absolutely wonderful story. And tell us-- I alluded to this before about the way that you go from right to left versus left to right, yeah.

Blanchard: So, again, we were trying to model things after what people were comfortable with. This also brings up another story at the time, how I was trying to do this interface, it was thought that, "I should go hang out with George for a while just to see how he works in the edit studio when he's editing." And so, it was arranged, I was allowed to go in and sit there and watch George cut "Return of the Jedi."

Spicer: Oh, my gosh!

Blanchard: You know, and I'm sitting in the room, his assistant is there, you know, running into the other room and getting out pieces of film and bringing them back and fetching them and he's cutting them and going back and forth. Now it turns out that it's really boring to watch, because all the interesting stuff is going on in George's head, and it's not-- you know, you can't really see that thought process. And George is a kind of quiet guy. He's not saying, "Well, I'm going to do this and I'm going to do that," and things like that. He's just kind of-- he's sitting there working away. And about a few hours into it, I'm realizing, "I am bored out of my skull sitting here! I am watching George Lucas cut "Return of the Jedi," people would give body parts to be here, and I'm bored!" <laughs> It's like, "Get me out of here!" So, I only spent one day with George. But anyway, and he was editing on a flatbed editing table, so you would have reels of film that kind of went through a little thing that would project onto a screen. And in that setup, the film went from-- time went right to left rather than from left to right. And so, EditDroid, the first iteration of it, our timeline went-- time flowed from the right to the left, rather than what everybody else does. And a year or so later, we decided, "Well, we can switch it back." <laughs> To do so it'll make a little more--

Spicer: Wow, was there any reason you switched back? Did anyone push that, or--

Blanchard: You know, I don't think that I was even there when they did that. At some point someone--

Spicer: Okay.

Blanchard: But you know-- of course it's pretty much centric on our writing systems in the West. If we'd been in China we probably would have-- or if it had been in Hebrew, it would have been going the other direction, it would have made sense, too, so.

Spicer: Well, tell us about the state of computer graphics outside of Lucasfilm, which of course, is a very unique sort of hothouse of the best and the brightest and the most advanced technology. What was happening in the outside world or with other uses of computer graphics?

Blanchard: Yeah, let's see. At that time, the only other big computer graphics company I can remember was Triple I, Image International something or other, I don't know what all the I's were for[6]. And they had a Cray computer, supercomputer at the time, and that was what they were doing, their graphics that they're work with.

Spicer: Wow.

Blanchard: And there was a few, you know, in research places, in colleges and universities were doing some stuff. But it really wasn't, you know, there wasn’t a lot of commercial stuff going on at the time. One of the-- now, so as I said, one of the projects was the film scanning in and out and doing compositing. That was kind of the graphics group in the division. And this was kind of Ed and Alvy's stealth operation in order to do computer graphics. Because George really wasn't interested in computer graphics, he was most interested in not having to cut and tape pieces of film together anymore.

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[6] Information International, Inc.

Spicer: Right.

Blanchard: But they were trying to advance the state of computer graphics, knowing eventually that when the hardware gets there, there would be a good chance they could make a film, a feature film. So, anyway, that's going on. Oh, one of the big problems at the time was emulating motion blur. Now, I don't know if you remember going back and looking at stop-motion films, like Ray Harryhausen's stuff…

Spicer: Oh, yes.

Blanchard: If you look at it, it has a weird feel to it. It's kind of a static sort of image. And that's because each frame is perfectly in focus and clear. And in fact, in a real camera what happens is the aperture opens for some period of time, and the scene continues to move. So, if you look at each individual frame, there's a little bit of blurring there. Well, it turns out that you really need that for our eyes to make that look smooth.

Spicer: How fascinating!

Blanchard: And the other thing I didn't know about at the time, movie projectors actually display each frame twice. And so, they're going at 24-frames-per-second, but if they just did 24-frames-per-second, that's a slow enough frequency that our eyes and brain will actually perceive that. You'll actually see that frequency. So, they get over that by flicking it twice, so it's sort of like you're getting images now at 48 frames per second, and your eye then doesn't see that. But the problem is if you do a real sharp image that's here, but you're going to show it twice before it shows up here, your eye is tracking this object and you'll end up seeing two things going by. So, another artifact of not having motion blur is that you can get these weird artifacts. So, anyway, the graphics group knew that was one of the problems they really needed to solve was how to make images blurry. <laughs> which was-- <laughs>

Spicer: Yeah, you'd think that was the last thing you'd want to do, right? <laughter>

Blanchard: Yeah. And in fact, when they finally did figure out a great technique for doing it, I can remember seeing a newspaper article saying, "Lucasfilm figures out how to make blurry movies-- blurry images!" <laughs> That was a big breakthrough. But yeah, there were several different competing ideas for how to do the motion blur technique and finally stochastic sampling is what finally won out. So, what that means is if you want images, you know, a still image, you're going to go essentially looking through geometry and do a sample at each pixel. And you just do this all in a row. And that'll give you a nice sharp image. You also can get some aliasing, but that's-- we don't need to get involve with that stuff. But the technique was instead of having an object that's moving, for each pixel you actually dither the time that you're looking at. So, the geometry for a particular image essentially is moving, because you end up sampling it at different times, and that creates the blur, and it turns out to work really well. They also realized that other effects could happen and that is that you could use the same technique to do depth of field. So, this same technique also opened up the ability to make images that looked like they were done with a real camera. And that was kind of the big breakthrough that that group came up with.

Spicer: Now was there a point at which-- well, I mean, I guess we're still there, but at which point did the uncanny valley in filmmaking became less horrible?

Blanchard: Yeah, people-- at that time we weren't even considering doing humans, really?

Spicer: Okay.

Blanchard: That group got a few little effects jobs thrown at them from ILM. One of them was for "Young Sherlock Holmes," the Stained-Glass Man scene where in the movie there's a stained glass with a knight in it, and it-- the knight jumps out of the window, but he's just pieces of glass walking down through the church. So, he's not trying to look like a real human, it's trying to look like pieces of glass kind of in a stylized human form. Yeah, staying away from trying to do humans. So, and I should probably bring John Lassiter into the story about now, because he's also starting to be around the group.

Spicer: Right, and I guess my last question draws the distinction between animation and computer graphics, and digital filmmaking as a third category perhaps.

Blanchard: Yeah.You know, later on, you know, as we got into Pixar, they definitely tried to stylize stuff. We're not trying to make it so that you think that's a real human. And then that kind of avoids that whole uncanny valley problem.

Spicer: Right.

Blanchard: So, in animation, it's usually, it's stylized enough that it's not a problem, but--

Spicer: It's interesting because in computer graphics, I had several computer graphics people tell me that, "Photorealism is the Holy Grail," right, but in some ways I wonder if it really is? Do you have any thoughts on that?

Blanchard: Well, it depends on what you're trying to do. As I recall one of the mantras was that photorealism wasn't the goal, but that was a benchmark. That if you could do that, then you had the technology to do whatever. So, it was more of a benchmark rather than, you know, a computationally algorithmic benchmark to get to.

Spicer: Right, that makes sense.

Blanchard: Yeah, and at this time, you know, computers were nowhere near the power they are today, and so it still wasn't practical for the hardware to make a feature-length film. And of high enough resolution that you could get away with it.

Spicer: So, are you basically workstation based at this time?

Blanchard: Yes.

Blanchard: SUN or Unix workstations, those kind of things?

Blanchard: Yeah, at that time we were using VAXes, you know, so we still had some DEC equipment.

Spicer: Wow.

Blanchard: Both Suns and DEC stuff was what we were working on.

Spicer: What you said earlier about the people behind some of these innovations projecting the technology out ahead a year or two and how these would make these innovations even better, reminds me of when Microsoft Windows first came out. Bill Gates led this vision of wanting to the make the PC your multimedia center, so it would have audio and video applications but that were quite poor at that in the first few years. And it makes me think, I guess he just saw a few years further down and thought, 'in three years we'll have sound cards that are better and video cards that are better and so on and this ecosystem that I'm envisioning will actually make sense.' Until then, it's kind of slow, but when you're on the bleeding edge, I guess that's what happens.

Blanchard: Yeah. Along those lines, I can remember at the time, at this Lucasfilm era is when the Mac came out, the Macintosh, and also the IBM PC came out and the folks at Lucasfilm computer division kind of pooh-poohed them. It's like, these are toy computers. This isn't going to ever do anything very interesting, but that changed. So the graphics group was trying to do all the foundation work for being able to make animated films, features. What's happening in the regular animation world at this time? Walt Disney was in a very deep slump as far as the films that it was making, and all the animators there were getting really old and there weren't any new guys coming along. And so...

Spicer: Sorry. What year is this, approximately?

Blanchard: Early '80s.

Spicer: Okay, sorry to interrupt. Thank you.

Blanchard: Yeah, early '80s, and so they, realizing that they needed a new generation of animators, Disney funded CalArts to train the next generation and out of that group came a lot of really fabulous filmmakers. One of the guys that was there was a guy named John Lasseter, who made some really great student films, and how was hired by Disney to work for them as an animator. John knew about computer graphics and so he wanted to try to start to work with computer animation and did a short, as I recall, that involved some computer animation. Did not go over well with the old crew at Disney, and so when his project was done, they just let him go.

Alvy and Ed somehow knew of John Lasseter, I think probably from his student film days that he'd put out, and so when Disney fired him, they contacted John and hired him on at Lucasfilm. Now, George was not at all interested in doing animated films of any kind, and so it was a little problematic to hire an animator. So John's title was user interface designer and his official job was to evaluate and do these

user interfaces and help improve them. So that was what John's official position was. What he actually was doing was starting to make short films in the backroom and the first one that came out was "The Adventures of André and Wally B. " I think the second one was "Luxo Jr."

Spicer: Right.

Blanchard: "Luxo Jr." was a real breakthrough because up until then, a lot of these films, they had a lot of interesting technical content and people would go at SIGGRAPH [ACM Special Interest Group on Computer Graphics] and they'd say, "How did you do that?" and "What was this technique?" and nobody was actually looking at the films and enjoying them as film.

Spicer: As stories.

Blanchard: As stories.

Spicer: Yeah, right.

Blanchard: What "Luxo Jr." for those of you haven't seen it, it's the Luxo table lamp that is now Pixar's logo, but it's an adult lamp and an infant or child lamp playing with a ball back and forth and there's a little story there and it's really kind of cute. But it was the first time that people looked at it and said, "That's a story," and John tells how after one of the screenings at SIGGRAPH he saw Jim Blinn, who was one of the pioneers in computer graphics, heading for John. John was going, "Oh God, he's going to ask what the technique was. 'What was the algorithm you used?' and 'How did you do this and that?'" And Jim's question was, "Was that a father lamp or a mama lamp?"[7] And so the whole thing was he just bought into the story and didn't really care about the technology and that was a real breakthrough moment, I think, for the group.

Spicer: For the whole company, perhaps. They realized really it's about the story, not the technology. I'm sure they knew that anyway, but this drove it home.

Blanchard: Let's see, and then I think the one after that was "Tin Toy,"[8] which now we're getting into the uncanny valley again. This is the one with the baby.

Spicer: Oh yes.

Blanchard: At that time, it was the closest we'd come to trying to do a human character and it was pretty uncanny, I think, but that was...

[7] According to the original script, it's a father lamp.
[8] "Red's Dream" was made between "Luxo Jr." and "Tin Toy".

Spicer: The classic one with the uncanny valley is that one, the Christmas story with the train and Tom Hanks. [Ed – The Polar Express]. It was the exemplar of creepy faces. You've really got to try hard to make Tom Hanks look creepy, but somehow they managed.

Blanchard: So where are we here? Tin Toy.

Spicer: Oh yeah.

Blanchard: Yeah, we're getting along. We're able to emulate a lot of the analog stuff using digital techniques. EditDroid is coming along; it's being commercialized; and the soundboard as well. It was getting to the time where we needed new projects. We pretty much can see the end of the road for those three projects. So at about that time, George and his wife divorce, and so George, all the sudden, in order to keep control of Lucasfilm, essentially needs to raise half the value of Lucasfilm in cash.

Spicer: Because he had to pay the other half to his ex-wife.

Blanchard: Yeah, to his ex-wife. Yeah.

Spicer: Right. Okay.

Blanchard: We were finishing up our project, so the decision was that Lucasfilm was going to sell the Computer Division. It actually ended up getting split into two parts, one of which did EditDroid and the sound system called SoundDroid, and then the graphics group was going to go out and try to do some computer graphics stuff. One of the other things that happened with the computer group was the design of the Pixar Image Computer. This is where the name Pixar originally comes in. In order to do compositing of multiple frames and layers, you needed to have a computer that really understood frame buffers and could deal with them very quickly and combine them properly, and so they designed some special-purpose equipment called the Pixar Image Computer. And so the idea was that the computer division would go off and try to sell that as a product.

Spicer: What would you call that in generic terms? Is it like an image processor, or...?

Blanchard: It is, yeah. It's essentially a programmable computer, but yeah, it was an image processor.

Spicer: Okay, because I noticed some customers were dealing with x-rays and...

Blanchard: Yeah. One of the main things about it was it could deal with the three[9] channels simultaneously so it was a single-instruction, multiple-data architecture computer. It could do a lot of different image processing tasks since it was programmable, so the decision to sell the company was made and then we had to go find a buyer and so a long process ensued there. Early on, Steve Jobs was still head of Apple, he hadn't been kicked out yet, and he came by to look at us and see, well, does this

[9] Four channels, actually.

make sense for Apple to get involved with this. I can remember, and I'd heard stories about Steve Jobs and was curious, what's this guy like, and so I knew this meeting was going to happen, that he was going to show up, it turns out, with Alan Kay. So I said, "Hey, mind if I sit in on the meeting? I'd just like to see what this guy is like." So they said, "Come on in." So I ended up sitting in on the meeting where Steve first met Ed and it was interesting because, Steve, I could see he sat down in the room and he immediately was scanning the room to see who's important, who isn't important. He looked at me, not important. <laughs>

Spicer: Oh, nice.

Blanchard: Well, he didn't say it out loud. <laughs>.

Spicer: Such a warm fellow.

Blanchard: Yeah. Well, we can talk about Steve's life arc.

Spicer: Yes.

Blanchard: He was definitely at one of the lower points at that time of his life. Anyway, so he looked at it and he was very impressed with the technology because we were doing color graphics at the time and he was still just doing black-and-white, grayscale stuff and so he thought this would be a good group to introduce color to Apple. We had heard all the bad stories about “bad Steve” and were a little wary of working for him -- that combined with not necessarily wanting to be buried into the big Apple corporation. Ed turned him down, essentially. He said he was going buy us and bring us into Apple and we said no. Going on, we talked to lots of people. General Motors was interested in being able to display car designs because part of their design process is that they have to build a mockup of what their design is and take it into a special room with all this lighting so that they can evaluate exactly what it looks like. And they thought, well, maybe could use this technology to replace that.

Spicer: So it's the image computer that is the main attraction for these potential suitors?

Blanchard: Yeah, that's what we're selling.

Spicer: Okay.

Blanchard: Yeah, it was kind of weird in that since it really was an image processing piece of equipment. We managed to port our rendering software onto it so we could actually have it generate images, too. So they could have used that.

Spicer: That's RenderMan?

Blanchard: Yes.

Spicer: Let me know when you talk about that, when the right time to talk about RenderMan is because that's a major...

Blanchard: Yeah.

Spicer: Thank you.

Blanchard: Yeah, that's more after we finally did become Pixar is what we probably should talk about there.

Spicer: Okay, great. Yeah.

Blanchard: So there was General Motors. There was the medical imaging, so Phillips, that was one place where we actually sold some stuff eventually. We didn't sell it until after we had spun off, but we were starting to talk to them and kind of understand how they could use it for medical imaging. Prepress was another area where you could lay out color graphics and stuff like that. So we had prepress companies come in, which is another interesting story. All through this time while we're looking for suitors, a lot of George's friends would come in to see what all this new technology was about, and so we were giving demos to lots of people. I gave a lot of the demos because I did a lot of work with our trade shows and things like that and putting together the demos for that, but there was one day where I think in the morning I was to give a demo to one of the oldest, straightest printing companies in the world. It was a British printing company. They print about half of the world's currencies and they're really proper and old and hairy and in the afternoon I was giving a demo to Jerry Garcia and Mickey Hart from the Grateful Dead.

Spicer: That's great.

Blanchard: I just remember getting up that morning and saying, "What the hell do I wear to work today?" <laughs> So the answer was, I took a change of clothes and I...

Spicer: Oh, okay. That's...

Blanchard: ...wore a suit in the morning and T-shirt in the afternoon.

Spicer: That sounds like the right approach. That's funny. So these Hollywood types, I guess, and the beautiful people would come into your-- any other interesting interactions with or people that you saw, actors or...?

Blanchard: Yeah. Who did "Rambo?"

Spicer: Oh, Sylvester Stallone.

Blanchard: Sylvester Stallone. Yeah, he came through one day and that was particularly interesting to see him. This was someone-- I think this is earlier on, more when we were still working on EditDroid and he was very interested in seeing editing and stuff like that. But he shows up with a beautiful blonde on both arms, and we sat down and we gave him the demo of the editing system and he was really kind of contemptuous. He was all, "I'm the big shot," blah, blah, blah and not very warm, and then George walked into the room and started talking to him and all the sudden the whole dynamic changed. He became completely subservient to George and it was just a funny little exchange to see his personality.

Spicer: Yes, see people's true colors.

Blanchard: Yeah. Yeah, there were a lot of different stars who came through.

Spicer: Did you have the feeling this was more PR, or were any of these people-- were they just kicking the tires, or was anyone actually going to buy anything?

Blanchard: Well, a lot of this was just George showing off his technology.

Spicer: Okay.

Blanchard: But that was happening at the same time as we were trying to find real suitors to buy it, so we gave lots of demos and went out and tried to get people convinced about it. So that went on for about a year, that whole process.

Spicer: Can I ask how you demonstrated the Pixar computer, or did you? Or, did you show slides, or...?

Blanchard: No, no. Especially at trade shows, we'd have real equipment there and would show things. One of the things it could do was it could do compositing in real time, so we could do some really fancy-- well, of course these days, you wouldn't think it's very fancy, but we could do some really interesting real-time graphics that nobody else was able to do at the time, which also reminds me, another thing about John Lasseter. This is when I really “got” John as to what he was all about. One of our trade shows, we had done a very photorealistic image of a road, and it was called, "Road to Point Reyes."

Spicer: I know that well, famous image.

Blanchard: Yeah, famous image, and the idea at the trade show was that we'd show this beautiful image that we could display, which a lot of people couldn't even display yet.

Spicer: Yeah.

Blanchard: But then, we could show how that we could actually generate an image and then also be able to overlay subsequent frames quickly enough that we could actually get an animation. So my idea was, at the time, one of our shorts had a unicycle in it, and so the demo was going to be, okay, you can render this image of the unicycle, and we'd do that in real time. You actually see the image of a single unicycle

and then I said, "And if you do multiple frames, then you can get an animation," and I wanted then just to have the unicycle turn around and go down the road, Point Reyes, and around the hill in the back. So I approached John and I said, "Could you do that animation for me? All you need to do is turn the unicycle around and have it go down the road." Of course, John's an animator. That wasn't good enough. He had the unicycle turn around and have an attitude and how he managed to have that unicycle do an attitude and it went down the road and it was like...

Spicer: That's awesome.

Blanchard: ...oh, I get it. And so that's the one time in my life that I directed John Lasseter.

Spicer: Oh, that's wonderful. Tell us a bit more about him and also Brad Bird, if you can. They're the storytellers.

Blanchard: Yeah. Well, Brad Bird doesn't show up until well into the Pixar days.

Spicer: Okay.

Blanchard: But he's another CalArts alumnus, so yeah, some good guys there. So in that year of us trying to sell the company, Steve Jobs had been kicked out of Apple and was figuring out what to do next and he came back and approached us a second time. Either he was being nice or we were getting more desperate, but this time we said, "Yes." So he...

Spicer: Sorry. What year was that?

Blanchard: You're going to have to check me on this. This is mid-'80s[10].

Spicer: Okay. I guess we could look it up but mid-'80s. Okay.

Blanchard: Yeah. I'm terrible at years, names, and things. So yeah, so he pulled out his checkbook and wrote a check to Lucasfilm to fund this new company called Pixar. At that time, we had a product that we could sell through Phillips for doing medical imaging and then also we sold ones and twos of the Image Computer to people doing research and stuff like that.

Spicer: At this stage, was Steve Jobs interested in what was Ed's motivation, which was to make movies using computers?

Blanchard: I think so. He certainly came to be, and I can't remember. I think he was really more interested in the technology at that time. He thought this was really cool technology, rather than he was dreaming to be a filmmaker.

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[10] 1986

Spicer: Okay, yeah. It's a bit of leap, in his case, but not in Ed's case, though.

Blanchard: No.

Spicer: Sounds like that was his overriding vision, really.

Blanchard: Absolutely. From the Utah days onward, that's always been Ed's goal. So we spun off trying to sell Image Computer. It never made money. Steve kept having to write more and more checks but he kept writing them and we were all going to go, one morning, he's just going to wake up and look in the mirror and say, "What the hell am I doing? I'm not going to get any money out of this, and this is just not happening." But he stuck through for quite a few years just funding it, trying to get the Image Computer to work, and then by now, early on in Pixar was when RenderMan happened, so that's our photorealistic rendering software that takes a geometric description of a scene and creates a very realistic looking image of it. That's another little pun. It was originally called Renders Everything You Ever Saw, which the acronym is Reyes and so the "Road to Point Reyes" was also a pun on that.

Spicer: Oh, nice. Can I just ask what kind of person would use this software? What kind of professional would use RenderMan?

Blanchard: Well, at the time, special effects were starting to be done digitally, and there was a lot of flying logos. I don't know if you remember that era on television...

Spicer: Oh, yeah, totally.

Blanchard: ...where you take your logo, extrude it, and then have it fly through space and tumble and so it's flying.

Spicer: Also, don't forget the era of chrome balls on chessboards.

Blanchard: Yeah, all that stuff. So yeah, a lot of people doing those commercials, and that's another thing. When Pixar started out, there was a small group that was doing commercials for hire so using RenderMan and Ralph Guggenheim headed up that group and they did quite a few commercials that ended up on TV at the time.

Spicer: But did RenderMan render humans or just objects?

Blanchard: Well, if you could describe the geometry of a human, yeah, it would, but...

Spicer: Okay, but it wasn't really...

Blanchard: ...it's a generic...

Spicer: ...optimized for that, so to speak?

Blanchard: No, no. Well, it was optimized. One of the optimizations was to be able to do some very convincing surfaces and one of the things about it was there was actually a shading language so you could program what the texture on a surface was or if it has bump maps but it gave a lot of flexibility in what objects would look like. Obviously, optimized for scalability because people were trying to guess, well, how many polygons do you have to render in order to have it look like a realistic scene.

Spicer: Exactly.

Blanchard: It's a huge number and so there was a lot of thought going into, well, how to make this algorithm scalable and those were the issues that were going on there.

Spicer: So the typical person using RenderMan would be an animator, then, or something else?

Blanchard: No, more technical, I think, than that.

Spicer: Oh, really?

Blanchard: Yeah, yeah, because it's...

Spicer: Not so much an artistic, creative type but a...

Blanchard: No.

Spicer: Okay.

Blanchard: The idea was, in fact, RenderMan itself is an interface specification. It's kind of conceived like PostScript was a specification for how computers can talk to laser printers.

Spicer: Okay.

Blanchard: RenderMan itself is a specification of how some design program can talk to a renderer, and so that's what RenderMan is. It's a specification. The software, our renderer, was called Photorealistic RenderMan, so it was our version of the thing that's on the backend but the RenderMan interface itself was essentially open-sourced. Anyone could use it. In fact, we encouraged that because we wanted that flexibility, being able to plug stuff in on either side of that interface.

Spicer: Right. It also kept people using it.

Blanchard: Yeah, so you needed to be pretty technical to use it, although, let's see, I don't remember exactly. There obviously was an animation system that we had developed first at Lucasfilm and then as Pixar. Obviously, John Lasseter's not a technical guy, but he was able to use that and animators as they were hired on were able to use-- that's right. I'm trying to remember the name of it. It had some silly

name[11], but anyway, yeah, we did have an animation system that was only used inhouse and so if other people were using RenderMan, they had their own animation system to drive it.

Spicer: Right, and on the human side, when you're bringing people along to use these tools, Pixar must have had an internal educational function, right, to train people how to use these tools?

Blanchard: Yeah, yeah. Once Pixar finally got on its feet, we actually had a division called Pixar University, which was just for that, but that was quite a bit later. I think this was more one-on-one sort of thing and you got hired, somebody sat down with you and showed you the ropes and how to do it.

Spicer: Okay. What's the headcount these days now that Pixar is an official company?

Blanchard: I think it was around 40 people when we left Lucasfilm and...

Spicer: Wow, still very small.

Blanchard: Yeah, yeah.

Spicer: And I believe people that were not in the computer graphics part of Lucasfilm got let go. Is that...?

Blanchard: No, there was another company spun off called the DroidWorks and they were specifically supporting EditDroid and SoundDroid.

Spicer: Okay.

Blanchard: Somewhere in there, there was a games division that was started up. That was late in the tenure there, and they, I believe, stayed with Lucasfilm and did some games that were sold.

Spicer: Okay.

Blanchard: But yeah, nobody-- I don't know. It wasn't an explicit layoff. It was, "Until later." <laughs>

Spicer: One of the great answers you gave in an earlier interview when asked, "How did Pixar become an animation company?" is you said, "Everything else just kind of fell away."

Blanchard: <laughs> That's essentially it.

Spicer: Could you elaborate on that a bit for us? How Pixar became an animation company?

Blanchard: Yeah, you know, we had this group that was doing ads, computer graphic ads. And it was a very small group of people, it was half a dozen people maybe doing that. And then the main focus early

[11] Menv, which stood for modeling environment.

on was to do the Pixar Image Computer and at some point, it was clear that that wasn't working. And so, I believe that got sold to somebody else, and I don't remember all the details. But that technology, so that fell away. And we were still, in the software side, were doing photorealistic RenderMan. You know, we were selling that for other people to use, and licensing it. Trying to build some products on top of it ourselves. One of them was Typestry, which was a system that you could buy commercially that would you do your flying logos with RenderMan! <laughs> So, that was a product we tried to sell. At one point, we had a really ill-conceived product called Showplace, which was essentially, I think it's supposed to be equivalent to a page layout program for graphics. So, you would have canned models that you could place in a scene and take pictures of. I actually was the manager of that group for a while. But then it was, you know, that stuff wasn't paying the bills.

Spicer: Sorry, the typical customer would have been like TV stations, or networks doing their own logos?

Blanchard: There were actually, no, more third-party companies that networks and TV stations would hire to do an ad for them.

Spicer: Got it.

Blanchard: R/Greenberg was one of them. You know, ad agencies and people like that.

Spicer: Right, okay.

Blanchard: They were the primary customer. So, this wasn't going all that well. And so, about-- oh, there was one very successful thing that happened here, also using the image computer, and that was a system that we built-- designed and built for Disney called CAPS.

Spicer: Oh, right!

Blanchard: Computer Aided something System.

Spicer: Production System? [Ed. — Computer Animation Production System].

Blanchard: Production, probably something like that. But up until then, the cels, the individual frames of an animation, were drawn on acetate, and in a black outline, and people people would go in and paint the colors inside the black lines by hand. They would then all be sandwiched together, put under an animation camera stand, and photographed. And that was the process. So, they need to do the painting and the compositing. And it turns out these are things the Pixar Image Computer can do very well. And so, we hired a few people to kind of work with Disney and do the system, which did scanning and painting and compositing.

So, at that point, it actually improved things by a tremendous amount as far as animation was concerned. If you think about it, when you combine those cels, they’re clear, like one on top of it clear, so you can see some of the color that's underneath, on the other-- it might be like two characters. One character would

be on one level, and another character there. But there was a limit to the number that you could stack, because the film is not perfectly transparent: for example, they would have a character who had a particular color of shirt. Well, there would be like four different versions of that color depending on which layer you were on. So, if you're on the top one, it's probably duller, and then that second one had to be brighter, so it matched on the top. Well, once you digitize the stuff and paint them and do it electronically, that limitation goes away. So, you can have infinitely deep stacks of animation. So, that helped a lot. Plus just the tedium involved in hand-painting all those cels. So, that was a successful product that we sold to Disney.

Spicer: That actually makes me think that there's-- like clearly there must have been an edge detection algorithm in the Pixar Image Computer or something.

Blanchard: Oh, yeah.

Spicer: Did it have its own language, or its own set of commands?

Blanchard: Yeah, it was programmable, and it-- essentially had its own language, but it was programmable.

Spicer: Right, yeah. That makes sense.

Blanchard: I think we might have ported C to it, but if you really wanted to get to speed, you had to be a little closer to the hardware to really make it work well. So that was how, you know, once again, Disney kind of shows up on Pixar's radar. And about the time that a lot of this stuff was falling away, Disney came to Pixar and said, "We want you to do a film." And the original idea was Ed responding, "Well, we could do a half-hour special." And Disney said, "Look, if you can do a half-hour, you can do a 90-minute feature. So, why don't you try doing that?"

Spicer: Which is completely untrue, I'm sure, right? It's probably a thousand times more difficult! <laughter> But anyway.

Blanchard: Anyway, yeah. So, that was-- so Disney came to Pixar and said that. All this other stuff wasn't working out very well. And so, this is when the company bi-furcated, essentially. The whole group that was doing software stuff, you know, Typestry and the Showplace and all of that kind of was-- in that case was laid off. We tried to regroup and start another company, but that didn't happen, and were laid off. And meanwhile, the group that had been doing the commercials work, started ramping up to be able to do this film for Disney. People were given the opportunity to join on. I could have joined the graphics group, but by then I was kind of burned out. Time to take a rest. And so, at that point, I left Pixar again. Or left this group again and was at Pixar then. So, Pixar remained and worked on what would become "Toy Story." And that took them quite a few years, and I don't know all the details, because I wasn't there. Just kind of saw it from afar, but that was when they finally--

Spicer: Yeah. This is, I think, 1991 when you left the company?

Blanchard: Yes, that sounds right, yeah.

Spicer: Right.

Blanchard: And then what, "Toy Story" came in '95? Something like that. So, it was like four years that they were doing that. I went off to work for a company up here in Santa Rosa, Island Graphics, and they were mainly doing prepress work, and had a big contract with Japanese printing company, Dainippon Press. And so most of work there was dealing with color issues. As you know, if you look at a color on a computer screen, and then just print that out on a printer without thinking about it very hard, you'll get a completely different color. And so, it was a difficult problem in order to be able to say, "Okay, what I'm seeing on the screen is what I'm going to get on the paper." And so, I did a lot of work on that sort of thing.

Spicer: That's a really gnarly problem. I remember, I forget what terminal manufacturer it was, but it actually came with a colorimeter? You'd put it on the screen and calibrate it.

Blanchard: That was Rob Cook's company. And I don't know what's the name of that company[12]? In fact, after a while at Island Graphics, I left there and just became a consultant, and I worked for that company for a while.

Spicer: Oh, neat!

Blanchard: And also, for Brøderbund and some stuff for Pixar. So, I was kind of independent contractor for a while.

Spicer: So, without getting too much into the hairy details, how do you match what's on the screen with what's, you know, the printed output?

Blanchard: Yeah, I ended up doing the same thing for Pixar just before I went back to work for them, but I-- this point I was a consultant. You essentially, again, it's almost a brute force method. There's a very precise color coordinate system called CIE coordinates, that really define a color. And so, what you essentially do is you look at the full gamut of colors that can go on a screen, and you record what the CIE coordinates are for each of those. So, you kind of have a standard for-- I know what that color is now. And you essentially do the same thing for paper. You know, you print out all the stuff that-- all the colors you can on the printer, figure out what those are, and then you just do the match and say, "Oh, on a screen, I get this CIE--,"

Spicer: The expert transformation matrix--

Blanchard: Yeah.

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[12] Lightsource

Spicer: -- takes place, and things are mapped onto--

Blanchard: Yeah, "I know I want this standard in CIE coordinates. I know I can look up on a table, and it'll get me to that over here." Now it's a little more gnarly than that, because the actual gamuts on the screen are different than the gamuts on film. So, for instance, there are some greens that you cannot show on a TV-- on a CRT, but you can get on film. And so, you kind of have to think, "Well, how do I deal with that?" And so, there are a lot of subtle issues in how that all works.

Spicer: Right, and now you work in that area for Pixar, I think that was called the Chameleon Project?

Blanchard: Yes, yeah.

Spicer: So, it's pretty obvious to see what their application would have been, and it's important they have fidelity on the screen, and--

Blanchard: And the interesting thing about that is they didn't have that software when they did "Toy Story." And their cameraperson, Sharon Calahan, had the amazing ability to be able to look on the screen, see that color and know what it's going to end up on film. So, she was doing that transformation in her head. So, she would adjust on the screen so she would get the color that she wanted on film.

Spicer: Oh, wow.

Blanchard: This obviously was not a tenable thing for to train people to do that. That was a pretty--

Spicer: Doesn't scale very well.

Blanchard: No, does not scale very well at all. So, while they were working on "A Bug's Life." I came in and put together a system that they could use to actually have it happen automatically and get the right colors in.

Spicer: Are there any instances like little Easter eggs where someone would look at that early film and go, "Oh, the color's wrong there!" Probably you're the only one.

Blanchard: Yes, Sharon probably could.

Spicer: Yeah, right. Is anything else you want to say about color matching? I think we have--

Blanchard: I think that's pretty much, yeah, what we-- any work there.

Spicer: And you mentioned "Bug's Life" so I think that's the next major project they had there.

Blanchard: Yeah, "Bug's Life" was-- actually when I-- so, I-- what was it, in '98, I went back to Pixar. This is after I'd done the color stuff just before then. This was when-- I think that was the year that "Bug's Life" came out. I went back just after "Bug's Life" came out. So--

Spicer: Oh, okay.

Blanchard: So, they'd spent quite a few years doing that. At the same time that they were doing "Bug's Life" they also were doing "Toy Story 2." And the original idea of "Toy Story 2" was it was going to be kind of a cheap knock-off. You know, it wasn't kind of considered a-- I think they might have even been doing it as a-- I don't know if it was going to be TV or not, but it wasn't, you know, it was sort of like all of a sudden now we had the A Team and the B Team. And at some point--

Spicer: Uh oh.

Blanchard: Ed said, "This is not good for our company to do that." So, after a "A Bug's Life" came out, they corrected that. Turned "Toy Story 2" into a full-scale feature animation. And put John in charge of it, because you know, this poor guy, though. I mean, he'd just done two films in a row, and now they're going to, "Here, and this has to be done in a year!" is the other thing that was sort of like a madhouse.

Spicer: Oh, my gosh! What drives those aggressive timelines, by the way? Because you mentioned in an earlier interview, they're much stricter than they used to be. I guess there are more moving parts now?

Blanchard: Oh, yeah. And well, with any feature, there's a deadline that you just can't not meet. Because there's all the merchandise that goes on. There's all the advertising, the promotion. I mean, there are just so many different long processes that all have to converge at the same point in time. And so, you just don't miss those deadlines.

Spicer: Right. Two questions: One is what was the work-- the culture like? And related to that, how much overtime did people have to work to get the job done? Did they have to work like demons to get these movies out?

Blanchard: Yeah, which one was it? I think it was "Toy Story 2," there was a-- I mean, because it had the shortest-- they revamped the whole movie like a year before it was supposed to come out, and changed a lot of the stuff, so that was the one that was like really the hardest to get done. A lot of overtime was done, to the point that there were a lot of people injured with repetitive stress stuff. And I believe our workman's comp insurance rates were starting to go through the roof, and so not only a monetary thing, but also from a human level, we can't do this. And so, it was after that film that they became very strict about you don't do overtime unless you get approval for it. And you have to, you know, there has to be a good reason. So, they really started to look into that quite a bit to reign that in.

Spicer: Right, and not as you say, not just for financial reasons, but for humanitarian reasons.

Blanchard: Yeah, yeah.

Spicer: Can you tell us about the Xenon Project?

Blanchard: Oh, okay! That was-- okay, so when I came back to Pixar, so this would have been in '98, at the time it was still, you know, there's an issue of how do you look at your animation in real-time? Or get a feel for it playing back? And at that time, they were using some sort of video equipment that Silicon Graphics was selling. And essentially you could send a sequential video frame onto this box, and then it would play back the film in real-time. And it was a really flaky device. I'm trying to-- I can't even remember what the name of it was now.

Spicer: Was it called something Central, like Movie Central?

Blanchard: Uhhh, that doesn't sound--

Spicer: It's not a video server?

Blanchard: It's sort of, but it certainly didn't have that capacity to, you know, it couldn't store a lot of video, but that was the general idea, you could send individual frames and it would play them back. So, when I came on, they wanted to have a newer version of that, you know, something that's a playback device for their animation. And that was what Xenon was. And so, interestingly enough, we ended up using a Windows box as the computer that drove it. So, that the heart of the Xenons were Windows boxes. I can remember it being kind of unusual. I was responsible for Steve Jobs writing out this huge purchase order for a bunch of Windows boxes <laughs>, instead of Macintoshes. But he was always very good about that, he says, "Use Macs if they make sense; if they don't make sense, don't use them, use something else." So, at that time, you know, we were all using SUN boxes, I think, and there were a few Macs around, but they were not really in the production pipeline at all. So, yeah, the Xenon essentially allowed us to ship frames over onto that box and play them back. The interesting thing about it was that we could then start playing around with how they got played back. So, it wasn't just a straight, "Okay, play it back at speed." We could also then start doing things like, "Well, we'll give the animators the option that as they're looking at it to say, "Oh, well, I want this part of it to be a little slower or a little faster."" So, you could go in there and interactively play around with the timing, which was the first time we were able to do that. There was also using that thing called an ‘exposure sheet.’ Again, be able to play with the timing. So, you know, we'd almost do key frames and then really play around with the timing and that. So, that did open up some new things that they weren't able to do before. But it also just did playback.

Spicer: How many of Pixar's tools were developed in-house?

Blanchard: Oh, almost all. You know, it was all proprietary. And very little of it went out. The only-- you know, RenderMan was sold, but our animation system was never sold outside, it was always in-house.

Spicer: Yeah, that's your Golden Goose.

Blanchard: Yeah.

Spicer: <laughs> Well, that's wonderful. And for the rest of your career, you work in the Tools Group at Pixar. What kind of changes did you see over the course of either this second Pixar incarnation or from the beginning to now?

Blanchard: One of the things I noticed, I was in the tools group and I was doing a lot of support for the animators, so I was working on that animation system. And had a lot of interaction with them. And when I first went back, I really felt that, you know, we were kind of all working together, and I knew them all, and I could wander off, and go into dailies and that was all great fun. As time went on, and we were trying to get a production every year, and then three every two years, you know, [so] the group grew to the point where by the end of that term, the interface between tools and animation were kind of formalized. You know, we had certain people that kind of watched out for that. And it wasn't quite as chummy, but then you know, the company now had over a thousand people in it, too, so…

Spicer: Ah. What was the period when they really spun up in terms of headcount? Was that for "Bug's Life" or--

Blanchard: Uhhh--

Spicer: "Toy Story" maybe?

Blanchard: No, well, no, it would have been sometime after "Bug's Life" and "Toy Story 2" because they realized that doing a movie every few years wasn't going to make it, and they really needed to be able to first-- you know, the goal is to do a movie a year. And so, they were really starting to-- and you know, because these films take about three of four years from inception to finished film. So, if you're doing a movie a year, that means you've got to have like three or four movies in production at the same time, and so that brings the headcount up quite [a lot]… of course, and you need different people for different phases of that process, but it really does-- need to ramp up for that.

Spicer: The process, how would you describe it comparing it to those cel animators at NYIT? And you know, the differences-- I mean, they still use animators, I think, for some animations, like "The Simpson's" is an example.

Blanchard: Oh, yeah, yeah, yeah.

Spicer: Yeah? Speak to that.

Blanchard: Well, you know, the pro-- other than the animation, the process is very similar in that the original scripting and storyboarding and that whole pre-production phase is very much the way Disney did it for ages. So the process is you start out with-- you have a script written. And then people start doing storyboards, which look very much like Sunday comics panels, kind of telling the story from ‘this happens and then this happens and then this happens.’ They will then record that on film and timing-- you know, hold those frames for the appropriate amount of time, and do scratch recordings of the voices and music, and you can actually then go into-- before any animator has done any animation, you can go in and

actually see what the film is going to look like. And they do a lot of work in that stage, because the animation is very expensive. So, if you're going to make changes, you want to make changes back in the storyboard phase. And those techniques are pretty much as they've always been. It's just once you start to get into the animation phases that it becomes computer graphics.

Spicer: Well, I think we're-- is there anything else? Questions that I haven't asked you today that you'd like to leave any thoughts, parting thoughts about your career or the industry? You know, this amazing ride that you've been on?

Blanchard: Yeah, it's going to be interesting to see what happens when COVID is behind us. Because right now, Pixar has not-- they've all been working from home since last March.

Spicer: Wow.

Blanchard: I-- well, and there's some systems people and that around, but I'd be curious to see if the gang gets back together again, and all go to the same campus on a daily basis, which will be interesting to see how that work out.

Spicer: Interesting. What are you feelings about the necessity of people being there in terms of just not feeling isolated either, but just having a collegial atmosphere with--

Blanchard: Yeah, and that's another interesting thing about Steve. When we-- oh, back in the early 2000s, we moved-- we built the campus in Emeryville. And Steve was very much involved in designing the main building. And one of the things that he insisted on, a design idea, was there's a huge atrium in the middle, where the café is there, the mailboxes are there, the restrooms are there. And the concept was you needed to get people out of their office and running into each other in the atrium. And having serendipitous conversations and that's going to be changed somehow. People are going to-- people are not in the physical-- same physical place.

Spicer: Yeah, I thought actually that most of the work they do would be dependent on some fairly high-powered hardware or specialized equipment? But maybe not?

Blanchard: They can access it remotely.

Spicer: Oh, okay.

Blanchard: Yeah, there are a lot of computers that are in the building that they're using, but they can do it remotely.

Spicer: Yeah, and I mean, like a good fast computer is-- home computer is good enough nowadays to--?

Blanchard: Yeah.

Spicer: -- for them to do their work, I guess?

Blanchard: Yeah. That was another interesting thing, I don't know if I'm going to get the numbers right, but one of the things about computing power is how long it takes to render a single frame of one of our movies. And I think for "Toy Story" each frame was on average-- I'm probably going to get this wrong, but it was on average like four or five hours to do a single frame.

Spicer: Oh, my gosh!

Blanchard: And in the subsequent years, the power of the hardware has gone up, you know, exponentially! It's like a hundred-thousand times probably more powerful now than it was back in "Toy Story" day. And today, it takes about five hours to do a frame. It turns out that it's not how long-- the limiting factor is turnaround. How much time can you allow the frame to last, because you're going to need to see that frame, you know, like at most the next day. So, all this extra computing power has not been used to speed up the rendering, but to make the rendering more complex. So, the elements that are in one frame now is just-- has gone up with the power of the computers. So, it's just-- it's kind of fascinating, but it's, you know, all of this increase, but it hasn't changed how long it takes to do a frame. <laughs>

Spicer: Right, and you were saying that's because the scene complexity--

Blanchard: The scene complexity is now just--

Spicer: -- has gone through the roof, there's so many elements, and--

Blanchard: Yeah.

Spicer: Yeah. Cool! Well, thanks again Malcolm for your time, This has been great.

END OF THE INTERVIEW