

An Interview with

SCOTT GAFF

OH # 359

Conducted by Karin Matchett

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Charles Babbage Institute
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Abstract

In this interview Scott Gaff, formerly of Lamb & Company, discusses a wide variety of subjects in computer graphics history. Gaff recounts his education and work experience at the University of Minnesota, and his testing of TERAk, Evans & Sutherland PS-300, and voice recognition CAD/CAM systems. Gaff describes his brief stint in 1984-1985 at the failed Minneapolis company Mainframe Productions—which specialized in graphics for television commercials—and rendering and other technical work on Silicon Graphics (SGI) workstations and PCs running Wavefront software at Minneapolis-based animation firm Lamb & Company between 1986 and 2001.

This is an oral history conducted on July 17, 2002, with Scott Gaff at the Charles Babbage Institute in Minneapolis, MN. This oral history is conducted for the CBI Software History Project.

[Tape 1, Side A]

Matchett: It's July 17, 2002. This is Karin Matchett here with Scott Gaff. Scott can I have your verbal permission to tape the interview?

Gaff: Yes.

Matchett: Thank you. Let's start with your educational background beginning at whatever point you'd like to begin, college or before, and how you got into computer graphics.

Gaff: Just to go back a little bit into high school and pre-high school, I was always interested in drawing. I wound up taking all the drafting that I could as a high school student, and never was very good at it! What I always used to say back then is, "I'm not a good artist." I had a relative who could paint and things like that, and I just wasn't skilled at drawing. I gravitated toward drafting because there were mechanical things to help you make the pictures look nicer. In 1973, when I was a senior in high school, I first heard about people actually using computers to go the next step forward where you're actually

making lines without a T-square and things like that. But we had no access to any of that back then. In 1974 Macintoshes, PC's—none of that stuff existed. It was all very expensive equipment at that time, and when I came to the University of Minnesota as, eventually, a mechanical engineering student (and I wound up spending ten years taking classes at the University of Minnesota). It was regular traditional drafting, and I more or less tested out of the engineering drafting class because I already knew how to do all that stuff. Interestingly, I wound up teaching that class many years later. The high-end computer graphics that were used for CAD/CAM really were too expensive, even for a large university to have any access to. I drifted away from that and had nothing to do with computers except for the classes that I was required to take, until I was later in my engineering education as an undergraduate and got a job with Art Erdman doing some fly wheel studies. The people in the designing group in the mechanical engineering department were doing some fun stuff with computer graphics. Professor Don Reilly was one of the people doing that. A fellow named Frank Kelso, who's still an adjunct at the University, was a good friend of mine and was doing a CAD/CAM system that ran on a PDP-1103. It was called a TERA-K.

Matchett: What year was that?

Gaff: Well, it's hard to say. I'm guessing that it would probably be 1978, and they had a project where they were making a CAD/CAM system that would work for Minnesota v- techs who could not afford these giant computer vision systems or these interactive systems that cost a million dollars, or hundreds of thousands of dollars. They wanted to

make little workstations that they could do 3D CAD/CAM and Frank was given this task of writing this program on this dinky little machine that had 64K memory in it, which was only 32K memory because it was a 16-bit machine. He only had 20K to work with because the other 12K was used as the 1-bit frame buffer on the machine. I got involved with these guys and I said, “This is cool. I want some of this. This is neat. How do you do this?” I didn’t have the chops at the time because I hadn’t taken any classes. Up until then, I was a traditional mechanical engineer; in fact, I was studying transportation engineering—personal rapid transit, automated guided transit stuff. I approached my friend, Frank and I just sat in the room and watched him working. Well, when they started getting it done, they needed somebody to test it, so I wound up learning how to use it. My first experience with computer graphics specifically was when he said, “Okay, here, I’m going to leave you here for a while, you play with it, and when I come back you can tell me some of the things you hate about it.” “Uh, Frank,” before he’s out the door. “Um, I just pushed this button and nothing happened.” “Oh, well why’d ya push that button?” “Well, I’m looking at the menu, it’s the big one in the middle that says START.” “Oh, well I never thought of that.” That was my first experience with software development. He winds up spending three hours with me and me not being able to get to base one of the whole thing. That was my indoctrination into 3D computer graphics and I just loved it. I wound up getting sent to Arizona to the TERAK people who were going to try to sell the software. TERAK was the manufacturer of the computer. The fellow who wrote it, Frank, didn’t want to go, so I wound up going and teaching them how to use it. From that I started doing some programming on the TERAK and one of my colleagues

gave me some of the code from the engineering graphics class that I had tested out of four or five years earlier.

I sort of segued into graduate school during this time, again at the University, and Ed Anderson was my advisor for my Masters degree, which I never finished—and Don Riely later became my co-advisor as things went on. Eventually, near the end of my non-degree, the idea was that I was doing animations of personal rapid transit systems; but before I got there, I was teaching this engineering graphics recitation where they used computers. They used a very crude 3D computer package. We had a room full of these TERAks and the engineering students—these are all the IT engineering students who learn drafting and graph making and engineering, the basic first year engineering graphics class—would all have to come listen to me talk once a week and then they would be given assignments which were very crude, using this very crude 3D package that required them to type in coordinates of vertices and give very precise typed-in commands. It wasn't at all an interactive CAD package like we were developing on the same machine for the vo-techs. It was dumbed down so that they would have to learn some of the math involved in what was going on. It was a fascinating experience. I was eventually given the code for that, started playing around with that and started making little animations of what looked like toy trains, of guide ways with little vehicles whipping around them going in and out of online stations and things.

That was a fun time at the University in that 3D computer graphics was just starting to take off in the mainstream. We got an Evans & Sutherland PS-300, which was a vector

refresh machine. If you're not familiar with it, it's a fun machine that allows you to input data and then manipulate it in real time and, at the time, no one had any tools that did that. It was beautiful. It's called a calligraphic vector refresh machine, and it drew lines; it didn't do rasters. Beautiful drawings, it was like moving pen plots in a way. I started doing 3D animations of automated guide way transit, personal rapid transit, and wound up getting a Vax. The thing that sort of catapulted me out of the University was a fellow named Dick Mueller—and this would have been in 1983 or 1982, somewhere in there—was working at CDC, Control Data Corporation, and he sponsored a little research project on a very early prototype of a voice recognition system—it was a box about the size of a PC with a microphone attached to it. It was in a PC box, and you taught it words and it knew how to respond. If you said a word that it knew, it would respond with a number. We took that box and I hooked it up to a TERA-K and then to a graphics computer terminal—and ran a CDC product called, oh, I can't remember the name of it. It was based on Synthavision, which is a constructed solid geometry modeler, and Control Data was reselling it. They had some name they put on it. It was the company Magi had created this thing called Synthavision, a constructive solid geometry modeler. You take a sphere and you subtract a cone from it. If you want to make a bead, you take a sphere and subtract a cylinder from it—and it was a fun kind of thing that people were working with at the time. I built this system where you'd say, "center" and you'd read in a number, and you built things by just talking. We did a paper on it and we were actually able to make pictures and objects. It was a CAD package. We were actually able to make pictures. It was very slow because the speech recognition stuff was not very good. While

I was working for him, he started talking about this other project where he's helping Control Data go into partnership with a local film company.

Matchett: Can I ask you a question? When you were leaving the U, leaving the personal rapid transit work that you'd been doing and going to voice recognition, was that the end of your personal rapid transit work for that time, and did you leave out of any dissatisfaction with what was going on there and were more attracted to voice recognition? What caused that? What made you make that choice?

Gaff: Skipping ahead, just because I'm known for being long winded, a lot of things were going on parallel at one time. I was teaching at the time, or, I was TA-ing at the time, I was instructing at the time and mostly classes I was just teaching by myself. I was near the end, while I was doing the voice recognition work, and I was employed most of that time with Ed Anderson. I was working as a consulting engineer for a group called Anderson/McDonald. That was for a couple years before the voice recognition stuff. I worked as a research assistant for the University taking care of the computer graphics labs, helping install new equipment, getting new equipment in, helping grad students learn how to use new equipment and that kind of stuff. That was one of the things I was doing at the time. Like a new Vax came in and we all had to hook things up to it. Meanwhile, I'm helping write the patents for a company called Taxi 2000 which is, the patents are partially owned by the University and this was J. Edward Anderson and so that was going on. I never stopped doing anything. I was just doing way too many things. The computer graphics and the personal rapid transit stuff were combined at one point in

that what I was doing was my personal research towards my Masters degree, was using high-end computer graphics tools to visualize these personal rapid transit systems networks. The idea of my thesis was probably going to be on designing, synthesizing and analyzing networks using these fancy 3D tools and I was just pretty much playing. I just loved the equipment. The thing I loved telling people years later is that as a mechanical engineer, you're supposed to use these high-end 3D computer graphics tools to help you make things. Well, I got to where I liked making the pictures more than I liked making the things that I was making the pictures of. That's the stage I was in in my life when Don Reilly approached me and said, "we've got this Control Data project and you're kind of the guy to do it because it's sticking junk together and it's using this 3D stuff and you're the guy here that knows how to do that." That's how I wound up doing that. I'm still sort of at the University. I'm still thinking maybe I'm going to finish my degree. I had just finished recently, now that you mention it, working as a research assistant for the personal rapid transit people because I believe they had actually spun off this company. I went to Ed and said, "Well is there a place for me to come?" He said, "Yeah, when you finish your degree." So I said, "Okay," and went and did some more computer graphics instead.

So that's the position I was in when Dick Mueller came along. I did this project for Dick Mueller, presented this paper at some conference in Chicago. I said to Frank Kelso, "Frank, you know so much more about this than I do. You're a few years ahead of me in doing this and I didn't think I was catching up very fast, so you have to do this." Well, as the years went by I sort of caught up to him and Mueller said, "well, we're putting this

little company together in Minneapolis that's going to do commercials and maybe movies." And I said, "Hey, I'm your man. I'm the guy." They bought a PS-300 and they started a company.

Matchett: What year was this?

Gaff: I wound up leaving the University and I started work for Mainframe Productions on January 1st, 1984. I started being involved in December, but they started paying me January 1st, 1984. When we start getting toward this end of my life I have better control of the dates. It was a very interesting idea. There was a live-action fellow in town named Fred Badiyan. "Live action" means he takes movies of people—mainly for TV commercials—but he takes some film of somebody and turns it into a TV commercial. The words "live action" is in reference to making synthetic imagery instead of filming human beings or plants and animals doing things. He had a small company in town doing mostly what we call industrial pieces. He wasn't making very many TV commercials, I later found out, because I had started learning the business. I think actually he worked for the University of Minnesota sometimes, doing mainly instructional videos. You show it maybe to sell something in person or to show a sales person how to do something. He actually did some work for the State of Minnesota for tourism, probably things that were showing in the kiosks at state parks and things like that. He was sort of on the low end of that service, but he was very good. He was a good entrepreneur, and he did work for Control Data, and came in contact with the people such as Dick Mueller.

Now the 1984 SIGGRAPH conference was in Minneapolis and Dick Mueller was one of the co-chairs. Dick had an interesting sort of job: I think he was sort of ‘Guy Without Portfolio’ at CDC. He was a professional smart guy and had gotten mainly into computer graphics and advanced 3D computer graphics and as I said, Control Data was dabbling in these CAD/CAM things, and he had the idea that you could use Control Data hardware to make TV commercials. They would sort of seed Badiyan to set up a little company to make TV commercials and he’d say, “Look what we did with this nice Control Data equipment. Why don’t you buy some Control Data equipment and you can do it too.” I believe that was the idea. As I went on and got to know these people better, it was maybe a little cloudier than that, but that was the idea. Dick Mueller was pressing to do that, and Fred Badiyan was the person who was going to run the company.

Badiyan also owned at that time what’s known as a post-production house, which is a video editing house. Normally what you do when you make a TV commercial or an instructional video, is you go and shoot some film. Also TV commercials, even at this point in the year 2002, are pretty much shot on film. Most TV shows are shot on film. You then have a problem that you have to transfer that onto videotape, which turns out to be a little harder than it sounds. Then you go and edit it; you go and cut out all the stuff you don’t want. You put in the laugh track, and put on titles, and maybe add some animation if you’re doing a TV commercial and, for example, you want to have the animation of the person’s side of their stomach showing all the bad things and the good stuff going into it, and then they cut to the person smiling. Well, that’s done in the post-production house. An animation company would have made the animation, somebody

went out and shot all the film, and then the post-production house transfers the film onto video and cuts it up and puts it together and puts it on lots of video tapes and sends it out to the TV stations. That's a simplistic way of looking at what happens. Fred Badiyan originally had Badiyan Productions, which was this film house. He then started Tele-Edit, which was a video post-production house, and it was kind of neat because that way he got to use one for cheap. They became one of the better postproduction houses in town. He was good at managing money and bought cool gear and got a fairly good reputation and they did cool work. They did okay work. Well, this was going to be sort of the third arm of his empire, was going to be this animation studio.

Animations were fairly lucrative at the time in that nobody knew how to do them, and so it was like this black magic. When people thought of animation in town, especially at that time in 1984, they thought of the group such as Reel Works, or Bajus Jones where you have talented artists like Don Bajus or Mike Jones or Tom Larson sitting there drawing pictures one at a time—the Disney style. That's what we refer to as hand-drawn character animation. Some people had come into town and brought in another kind of animation—which will come up later in the story—which is known as graphic animation. Which is, you take a picture of something that somebody didn't necessarily draw by hand—it's a photograph of something, or it's a graphic, or some type that's been set—and then you make that move. You make it look like it's rushing toward you or that it stands and it twirls and goes out. Or you have pictures come on one at a time. Ken Burns is a big fan of that. If you think of the Civil War or the Brooklyn Bridge stuff where a picture fades in or kind of comes in from one side; but it's sort of choreographed in a graphic style that

entertains you even though they're still photographs. Well, that's another kind of animation that was just gaining popularity at that time. While on top of that, computer animation was just in its infancy at that time—computer animation as a broadcast advertising tool.

Some of the pioneers at that time were Cranston Csuri Productions, PDI, Pacific Data Images, a little later on Digital Effects in New York, Digital Productions, and Fred and CDC were trying to get into that sort of business. They were looking for somebody to help them and from talking to me, Dick Mueller said, “Well, I found this kid at the U and he's doing this stuff, and we'll get you the latest cheap mainframe from CDC which is still \$700,000. They got a Cyber 825, I believe it was an 825. There was 825 and an 845 and an 8-something else-5 and we had the -25 which was the lowest end one. I later found out they were all the exact same computer, but there were little wires, jumpers in them that made the one I had go slower. In fact, I got the tech drunk once and he told me, “I could go in with a pair of wire snippers and snip two wires and your computer would go four times faster.” “Well, why don't you do that?” “Well, it's a marketing thing. You pay less for this one. You know, we wanna have a line, fast, faster, fastest, but we don't want to have three production lines to do it.” So it's a fairly common thing. It's like the floppy disks that people used to sell. Used to have single sided, double sided, high density, and low density. Well, they're all made on the same line. There's only one floppy disk making thing, and what they used to say they did was they tested them. The ones that had one bad side, well—they became single sided ones. Ones that weren't quite as good, became single density, and the ones that were really good became hard density.

But this was 3M, and they're damn good at making them. They're really nice on both sides. I had a friend who used to take his floppy disks, and with a hole punch, punch a hole on the second side of the floppy disk that would turn a single sided into a double sided. Anyway, the same thing happened with computers.

Matchett: Presumably, the cost of production of the lower end one is the determining factor, because you're not going to sell a computer for less than what you need to recoup it. So then why even have a higher end?

Gaff: People would pay more money for one that went four times faster. What they were doing was making fast computers and then purposely slowing them down because there was market for lower end computers. There's a marketing term for it, I don't know what the term is, but there's a market for the low end ones, but there's also a market for the high end ones. Well, the high-end guys aren't going to pay the same price as the low end guys so you have to offer them something.

Matchett: Did he snip those wires?

Gaff: Oh, no. He would have lost his job in a second.

Matchett: And you didn't know which wires?

Gaff: Oh, no I didn't. This was 1984. What we used to call the Mac Minus just came out. That was the Mac, the second Macintosh; Mac 512 had just come out that year. I wound up buying one of the first one. They're real PC's. IBM had not come out yet. The Mini Vax came out, I think, that year. The 825 was probably six feet long, six feet tall and maybe three and a half feet wide. It was full of boards that I think were 16 inches on a side and weighed 20 pounds and it was full of just dozens of those boards. The serial I/O for it was the size of a very large refrigerator. I think three different live-action firms, including Fred, I think he filmed it a couple different times—came in to film in there because it was the classic looking computer room in 1984. It was a white room, overly lit, we had a glass window looking into it, it was a raised floor, this big—pardon me for swearing—baby-shit yellow equipment in it, which is the color of the CDC stuff; this huge circular console that you ran everything in, which was a throw back to, you know, what Sutherland used to work on. It was old radar screens, it was a vector refresh thing, which was the funny thing and I had never seen one before. It was just letters, it was just characters. That's where you sat and told the computer what to do. This sort of is a console for running the operating system, if you wish. It was running NOS, the Nasty Operating System. It was a just terrible machine. It turned out to be totally inappropriate for doing 3D graphics. I was wonderfully naïve at the time, so I just came in thinking these guys knew what they were doing. I was really the only employee. Eventually there was a salesman-type who had helped put the company together, and me. We were about the only people there and eventually we had a secretary, I think.

Matchett: What was the name of the company?

Gaff: This was called Mainframe productions. There was some confusion because six or seven years later, there's a famous company in Vancouver that's called Mainframe Productions which makes Saturday morning cartoons. But Fred got it first. We ran the company into the ground, and the name became available again.

So, it was pretty much me in this big room. They bought a PS-300, which was again, a real-time terminal, if you wish. They called them the Display Processors back then. There was this development thing going on at the time, especially with Evans and Sutherland, which made the PS-300 and is named after Ivan Sutherland. Their first computer, the PS-2, was actually just a set of boards that went into a Vax. I think it was Sutherland who described it as this circle of how computer graphics hardware worked. The PS-2 was sort of an option that you put a plug in to a computer and used the processor of the computer for doing some of the work that was involved. Well, people started saying, "Well, I'll make a special purpose chip that does some of the work that we're using the CPU in the computer for." Well, the circle rotated some there and so the computer, the Display Processor left the computer. It became a terminal. It could stand on itself. You could—and I ended up doing a lot of this—program it on its own, because it had its own CPU and it had its own ability to do things. Well, as computers get faster then, as general CPU's get faster, people say, "You know, we could do a lot of that just—" Well, computer graphics hardware, we sort of drift back into there. It kind of comes in and goes out, and goes in and come out. We're to where we are today with these graphics boards and somebody goes out and you stick it in your computer. We've gone there again. We'll

eventually wind up talking about silicone graphics in a little while, but they had a PS-300 and then they had a RamTech, I think it was called a 6211, which is a raster display, a raster frame buffer. That was a box the size of a very large filing cabinet, and a very large monitor.

And as soon as I got there, I started asking questions. I'm working there now, and I was saying, "okay!" rubbing my hands together. "We're going to go do this. Great. Now, what software were we going to use again?" Well, we're going to use Movie BYU, which was out of Brigham Young University, and you could get the code for very inexpensively. And I said, "Great, so that's running on this computer." Well, no it isn't. "Oh, okay. So, I'm going to compile it and get it going." That was one of my first tasks, to get Movie BYU running. Well, I immediately started running into some problems, one of which was, how do I look at my pictures? Well, okay, we've got this RamTech color display machine. Great. How do I send images to that? Well, here's the book, plunk. Well, I immediately say, okay, I can understand how to program this thing. It's very simple, I send in some codes, and that's how I draw a picture on it. How do I actually talk to it? Well, it turns out it wasn't plugged in to the computer at all. They said, "well, you need a special interface for that." Great, when's that showing up? "Well, you know, it hasn't been built yet." I said, "Well, what do you mean it hasn't been built yet?" "Well, we're going to use this thing that's coming from the CAD lab at Purdue." "You mean there isn't any other thing we can use?" "No, no, no. They're going to come up with this." "Well, all right." I started working on it and I said, "Well, when I took the job, you showed me some pictures. One of the pictures was of some really cool ray traced stuff."

It wasn't Movie BYU. I'm learning how to use Movie BYU as a polygon renderer, a simple scan-line polygon renderer. They had some cool solid geometry ray tracing stuff. The owner had showed me a Polaroid that had been made at Purdue, it turned out—of a thing that looked like a contact capsule that was all chrome. It was very pretty, and at that time, highly reflective images were very cool state of the art. And I said, "Okay, what about that program? Where's that program and do we have a copy?" "Well, we're going to get that." "But we don't have it yet?" "Yeah, not yet." "Oh, okay. And now what about, how do I get the PS-300 to talk to this thing?" "Well, I don't—" And I said, "You know they're doing it at Purdue."

Well, it turns out CDC was giving Purdue a lot of money. One of Dick Mueller's jobs was to interface with them and to help extract what they were learning to be used by Control Data and to serve as a liaison. Every time I asked him, he said, "Well, they're doing this at Purdue." I said, "Okay, we talked about how there's this animation package, a package that we're going to use to design the animation that will run on the PS-300 that we can go in and key frame things and do things." He said, "Yes, they've got this wonderful thing at Purdue." Well, weekly I was talking on the phone or in person with Fred Badiyan saying, "well, I can't do this and I can't do this and I can't do this and I can't do this." And he was saying, "Well, when can we start making commercials? When can you do some tests? I want to make a demo reel. I want to start bringing advertising agencies in here." And I said, "You know, Fred, I don't know a lot about this." My naïveté was my best thing at that time in that "I just don't think we can, Fred." I was feeling a little inadequate because these people who own companies were saying that we

could do this. Well, I finally found out they didn't really know what they were doing. Mueller talked to Fred and said, "Well, you know what we have to do is send him to Purdue to go visit." So I went down to Purdue, and I'm trying to remember the name of the fellow who ran the lab down there. Mike Bailey, and he wound up being out at San Diego running the computer graphics. Wonderful guy. He was the head of the Purdue computer lab, and there were a bunch of new guys down there, one of their names was Joe Cynos, and the other one's name was Steve something. These are guys who had written lots of cool papers. They were really neat guys and they were so friendly. All of a sudden I had somebody to talk to. Remember, this whole time, I was sitting in two windowless rooms. There was a window in the room that the computers were in. It was up against the alley. That room was just totally noisy. I was sitting with this dull roar next to this room that I was in on the other side of this glass window all by myself, you know, learning just gobs of stuff, which was wonderful, but also banging my head flat because I couldn't do anything. I went down to Purdue and it was like a breath of fresh air. All of a sudden I don't have to explain my terminology, the jargon all works. These guys knew what was going on. They knew more than I did. I could learn something from them, and I could exchange ideas. A couple of times in my career this has happened, it's just been wonderful. I was really enjoying it.

So, the first thing I said was "Great. How are you guys handling the memory problem with Movie BYU?" And they said, "What do you mean?" "Well, I've got Movie BYU running, and I tried to put 8,000 polygons in it. I can't put more than 8,000 polygons in it." Eight thousand polygons is a fairly small amount. Today, people are using millions of

polygons. You know, in Lamb & Company's heyday, we're using tens and tens; you know hundreds of thousands of polygons. I couldn't get more than 8,000. I had this huge mainframe computer. You know, it's got a gig of memory. No, not a gig, it had—oh, that was the thing, it had a megabyte of memory. Holy cow! That was a huge amount. Well, no actually, I think it had six Megs of memory. I can't remember. Unfortunately, there were 64-bit words and you could not program in bytes. So, all of a sudden, it was like 1/8 of however many megabytes. I think it was eight megabytes, but you only had a megabyte that you could use. Still, back then, that was when 512 Mac came out. That was a huge amount of memory. No one had ever used that much memory before and I'm saying, well, Movie BYU's been around for a while. I've seen pictures that it's made on other computers by other people. They definitely had more than 8,000 polygons. The guy said, "Well, you're running up against the memory limit." "Well, what do you mean?" It turns out there was a 20-bit memory address in NOS the operating system. If you do the math, you can't get a lot of memory with 20 bits. I could only use a small fraction of my one-megabyte of memory at a time—just a very little tiny section of it.

It was a time-shared computer. You could have dozens of people running at a time. It was a non-virtual memory operating system, which meant you had to have everything in core. NOS is what we used at the U. I was the perfect guy for Mainframe because I'd used NOS at the U, I was fluent in programming the PS-300, was one of the only people in the engineering school that had done any kind of color stuff at the time. Very crude stuff, but at least I understood the theory of what was going on, shading, lighting models and stuff like that. And I'm like, "Good grief. Why are we using NOS?" Well, at the same time,

these guys are saying, “Well, you know what we use? We use our 845 down at Purdue now.” These are the Purdue guys talking. “We use that now and then, but you know what’s really great for making pictures is this Vax. And what’s really great is this Mini Vax because it’s only about this big, and it’s really cheap and you can run Unix on it”—which I had never heard of before. I had never heard of Unix before, but it’s all set up to be virtual memory. It’s got several virtual memory operating systems run on it. VMS, for instance, (what wound up happening is that I had to have some guys who worked for CDC come in as consultants and write me a pretend virtual memory. That was the only way I could make anything that looked like anything. So, that was how that got solved). Anyway, I’m still talking to the Purdue guys. I’m still down visiting them, my one visit there. It was just heaven. I said, “Okay so, that’s my memory problem.” At the time we had no idea how to get around it. They had written their own virtual memory thing. That’s how they got around it. But then we used the Vax. I said, “Well, cool. What I really want to get my hands on is this cool ray tracer.” And they said, “Oh, you’re going to love that. It’s great, except that it’s written in Pascal.” “Okay, well I only have Fortran on this, my 825.” “Yeah, we’ve got this weird Pascal compiler. See, you need to have a couple things before we can, you need to have this other software.” Essentially what it boils down to, it’s going to be really hard for me to run it on my computer.

Matchett: You’re going to have to move to Purdue.

Gaff: I’m going to have to move to Purdue is pretty much what they’re saying. And I thought, oh, okay. Well, what about the ray tracer? If I go through all these things to get

this Pascal compiler and I compile this ray tracer, yeah, yeah, that image right there. They showed me the same image of this nice chrome contact capsule. “How long did it take you to enter that?” “That picture there? That took about a weekend.” (Pause) “Yeah, but I want to make 30 frames per second. So you’re telling me, if I want to make 900 pictures for a 30 second commercial, it’s going to take me 900 weekends?” He said, “Oh yeah, you can never use that for this.” We’re saying, “Aw, hell. Okay, show me this animation package you guys have.” Well, here it’s a graduate student project; it’s a Masters project of so-and-so, a really nice guy. So I said, “Great.” I sat down and, “Well, first I want you to understand this isn’t really the animation package. It’s more of a-” and I can’t even remember what he called it, but he said, “think of it as a shell around a shell around a shell around a shell—” He went on with this thing and it turns out pretty much that (a) it isn’t done, and (b) it’s not really going to do what I want to do. He has done some animations on it, but in a very sort of odd sort of way, and it was not what at that time was thought of as animation packages, something you sit in front of and you bring up a 3D picture of what you’re doing and moving things around. And so there! You know, three strikes and I’m out. Oh, they keep going. “Well, what about this interface for the RGB display machine? The RamTech.” They were putting the interface together. “Well, you know, Steve doesn’t quite have that done yet. We’ve got one, we’ve got the prototype, but he wants to change it before you—”

So I wound up coming back really disheartened, still unable to do anything, without a real solution for doing anything, and I start chipping away, and wound up having a couple of wonderful guys who were actually pioneers at CDC who had the title of Senior

Engineer or Senior Scientist or something like that. They're slightly arrogant guys, but as I got to know them, they were really neat, neat guys. One of them still worked at CDC and the other one had left and become a consultant. The two of them came in one night and hooked up my RamTech. It was really neat, but I was essentially hiring the guy who had left Control Data to do it because he was a consultant and somebody knew about him and hired him. The story I heard is he went to his—oh, his friend's name was Dave. He was a well-known guy at Control Data, he was the Senior Scientist guy, and he went to him and said, "Explain this computer graphics stuff to me." It was supposed to be over a beer. He just said, "Well, they do this and they do this and they do this and they do this." Then the consultant guy said, "Okay, I got it. I can handle how smart they are. I can handle this." These were guys who had worked for Norris and worked on the first Cybers there were, the first computers there were. They just knew in and out exactly what to do. They came in and took the machine apart and hooked up some stuff. They had like this one piece, a fancy cable or something, and they did some hooking up and stuck it together and they said, "Well, there you go." And I said, "What do you mean there I go?" "Well, it's working." I said, "Well, what do you mean it's working?" They got kind of mad at me. They said, "God, do we have to hold your hand on this?" "What the hell are you going to do? You know, I'm not doing all this stuff!" I'm going, "But, but, but, but—what had you done?" "Well, we built you an interface." And I said, "Okay, can I have a command, a function I can call that will send a byte to this machine?" "Oh, yeah we can do that." I was sick. I remember I had the flu and I was at home, it's like the only time I'm gone, I'm the only person that works there. I get a phone call in the middle of the night. These guys are working at night. They said, "We're in here, we're getting your

computer ready, you better get the hell down here. I've got Dave down here. He's working for free, man." I'm crying, I'm so miserable. I'm like "Okay, guys." They just said, "Oh, we can give you a byte to do this, yeah sure." You know, and they just in the night, being cranky and making my life miserable, fixed all that. All of a sudden, I'm now able to draw color pictures.

And again, through this sort of fun group, and again it was my first experience with like, when you're working with a big company, with supposedly a bunch of smart people, there are really two or three guys that know how to do things. You have to find those guys. I wound up getting fairly friendly with these two guys, and they did some more work for me and helped me do some stuff and turned me on to a couple of younger guys that worked at CDC. One of them had written a little animation package. He was writing code for CDC at the time, CAD code, and was very arrogant, hated mechanical engineers. CDC was hiring mechanical engineers and computer code writers at the time to write CAD code. The computer code writers, the computer scientists, couldn't engineer their way out of a paper bag. The computer scientists hated the code that the engineers wrote, and they disliked each other. It was just great. A couple more arrogant guys came in and start telling me how to do stuff, and I thought, "Well, they must know what they're doing because I'm young and I haven't done this before. Of course, it turns out they were just full of themselves.

Matchett: Is this still during the early part of your time at Mainframe?

Gaff: Mainframe Productions lasted 14 months, and this is probably the first six months. It's just me trying to somehow get this equipment going. It was dawning on me that doing this with a CDC machine was not the right thing to do. Because I found out that supposedly CDC was helping Fred Badiyan pay for this. But he was paying this lease on it. This CE guy that I got to know showed up every Tuesday and got paid. He showed up at about 6:00 in the morning and when I got there at 9:00, he'd been there for three hours every Tuesday to work on the computer. He'd vacuum out things, and he would check things, and he'd run a diagnostic. I think this is how IBM worked at the time, when you bought a mainframe from somebody. You had to have this contract, and they made the money on the contract. They were spending a huge amount of money on this computer that was totally inappropriate. Of course, they didn't want to listen to a 24 year old kid tell them that. They were spending money on these consultants, and finally got this going and finally got this going and they didn't believe me when I came and told them that this thing wasn't working. I had to write them letters saying this is why none of this is working. We're going to have to do this before we can do any of this. There was a stream of different people that they hired to work with me as producers, or salesmen and that kind of stuff.

At one point, after I was able to actually make some color pictures, but I still didn't have an animation package or a modeler. They'd bought a 3D Polhemus digitizer, which we had something like serial number 3. It looked like a small wet bar that was, oh, 16 inches square on the top, and you had this stylus that looked like it had a thyroid condition. You waved the stylus anywhere you wanted in the air above the top of the wet bar, in a circle

of about a yard in diameter, and it would tell you where the end of the stylus was. You could get that out one end, and it also told you what position the stylus was pointing in. And of course, it turned out this was developed for the government for putting on helmets for guys to aim helicopter guns with or something like that. This was their peace dividend on that machine. I wrote a real sort of crude thing that allowed me to do some modeling with that.

So I was just getting there, and Mainframe went out and hired an experienced animator. A guy who was a free lancer in town named Ron Pitts. That was one of the best things that happened. Because all of a sudden, I was finding out that the Control Data guys didn't know anything about animation or anything. They barely understood how to use their computers to try to do computer graphics. Though I've learned the people who did know how to do that finally. I was finding out that Fred Badiyan didn't make a lot of TV commercials, and he hadn't really done any animation before. Ron Pitts comes along, and he has. I thought, "This is great." All of a sudden I've got somebody to ask questions to.

Matchett: He was local?

Gaff: He was a local guy. I had never met him. He had been free-lancing mainly for a company that had been called Lamb & Company through Larry Lamb. He started telling me who else in town did animation. There was Reel Works, which is a character animation company. Bajus Jones, which was the 500-pound gorilla character animation in town, and they also did graphic animation. In fact, Larry had worked with them for a

while and then spun off his own company. Now, he would have a company where he was doing almost solely graphic animation. Then I found out from Fred that he wanted to compete with those companies. Fred was hoping to be able to compete with those companies and undercut them, because computers were going to make graphics cheap. One guy and a computer. Supposedly, I was going to make cooler things than these wonderful artists who every one of those companies is named after. They wound up becoming people that I got to know. I didn't end up getting to know Reel Works, Tom Larson that well, but I know the people who run his company now really well. They all became friends of mine and I found out that they're artists. Fred and Mueller and the other people at Mainframe were missing out on the artist part of it. Pitts was the first artist that I've met, and he started telling me how they did stuff now, without the computer. I thought, "Well, that's cool. No wonder that stuff looks so good. I can never do that with the stuff that they've given me right now. I'm not going to be able to do that very well." Ron only lasted maybe two months. He would come in in the morning and say, "Well how are we doing today?" I'd be programming my little head off. And I'd say, "Well, I've got the renderer kind of working," and I would show him. The renderer made synthetic images. I'd say, "And if it's okay right now, I'd like to just really quickly go over a little bit of sort of the technical terms I'm talking about. Is that okay?"

[End of Tape 1, Side A]

[Tape 1, Side B]

Gaff: In traditional 3D high-end computer animation—early unfortunately ambiguous terms—the kind that’s used for making fancy TV commercials, if you wish. There are some processes that are almost always done. One of them is called “modeling,” and this is analogous to CAD/CAM. You sit and, usually using an interactive tool on a computer, generate data that describes the surface of objects. What you’re doing is you’re creating your props and your actors, if you wish. Those are called modeling tools and the process is normally known as modeling and the people who do it are called modelers. Often it’s a part of the process that can be separated off and some times you can actually go out and buy a model. Oh, I’ve got a car in this animation. You can actually go out and buy a database of a car that somebody has already generated. Unfortunately, it’s not usually the car that you want. They’re very expensive. After you’ve defined the geometry, and it’s often a group of polygons that have been defined by their vertices that are describing the surface of an object, then you have to go and say, that’s geometrically where the surface of the object is, but what are the properties of that surface? Does it have texture? When we say texture, we often refer to what we call texture maps. Texture is used in the broader sense of the word in that it’s not just how something feels, but it’s also how something looks. The graphic of the American flag is a texture, if you wish. But some of it’s bumpiness and roughness and that kind of thing. But you define the texture and the color, how it reflects light, and that’s all done often with another tool. Those people are often called color-and-lighters, who do that kind of work.

And then there are the animators. The animators are the big wigs when it’s done either for a movie, or a TV commercial or anything. There are artists involved in all the

processes, but they're the primary artists. Usually the head animator's also the director of a piece. They're the people that take the models and determine how they're going to move; how they're articulated and move relative to themselves and move in your scene; and they decide where the camera's going to be; and they decide what the timing is or how you use the timing of what you're planning on doing. If we get into that later, we'll talk a little bit more about it, but that's the animation stage. The last stage supposedly doesn't involve any human beings. It's done purely by the computer, and that's called the rendering. You take the models, you animate them with animation software, and then you color and light them and you put all that together and tell the computer, okay, go make me a picture. It creates a rendering, which is one frame of a digital raster image of what you described. What that image is going to look like has usually been determined in the end by the animator. He's drawn in the model and the color and lighting stuff that's been done, and decided how it's going to move and then you make a separate image usually every 30th of a second or 24th of a second.

And then the rendering process is time consuming, but doesn't involve somebody sitting in front of the computer the whole time. In fact, it's usually done by a non-graphic computer, a computer that doesn't have a screen on it. A quote unquote "dumb server" sitting in the corner often does it. One of the cool things about when Silicon Graphics computers came out was that we used to refer to them as having a left-brain and a right-brain. They were a nice high speed Unix computer, which was perfect for rendering and doing any kind of analytical things. Unix is great. I love Unix. The other side was a special purpose graphics display processor, which could do real time interactive stuff.

When you think of a fancy computer card in your PC's of this year 2002, that's pretty much what several of the boards did that were in early SGI's. Those were known as display processors. All that was done essentially on a chip now, but back then that was a cool thing. The cool thing about SGI's was that you had a workstation that somebody could work on, and then you push the button and it would also do the rendering. It was all in one package.

And often times what happens is the rendering happens at night. Everybody works on their SGI during the day and they go home and the computers all render at night in a little sort of scary network that's talking to each other, working without you as you're sleeping like elves. Unfortunately, the real thing that happens is that usually somebody has to stay up all night and watch it, if you're on a deadline. Ron Pitts came to work with me. Every day he came in and I'm working on mainly Movie BYU, which is essentially a renderer, which is why I brought the term up. You pretty much typed numbers into it. There was a data base that it knew how to read, but we didn't have any interactive tools that made that database, so I would have to make a database pretty much by typing or writing a program that would make just a bunch of characters that would describe an object. Again, I had no interactive tools to do this with where I could see the object as I was going along. I would draw an object on graph paper and type the numbers in. That's how I did my modeling. My color and lighting were done by guess and miss again. Now this is all typing, and my animation was done a similar way. I would make a list of coordinates that I wanted my objects to go in. This is how crude things were when I was doing this for Mainframe. Well, I was working on the renderer, which was the hard thing. That's what made the

pictures. That's what you actually give the client, that picture. I was working on that and I was getting back to where I was actually able to make pictures, and Ron came in everyday and he wanted to animate. "Well, you can't animate while I'm doing this, leave me alone." So he would sit and practice typing everyday on a VT-100 and then usually every Monday he'd say, "Now why can't—?" He'd been thinking all weekend, and often having called me on the phone a couple times during the week. "Now why can't we do anything?" The two of us sit down for an hour and a half and he essentially writes a letter to the owner, Fred Badiyan about why we can't do anything. We need this and we need that.

Matchett: What was he hired to do?

Gaff: He was hired as an animator. When we were going to go into production, and an advertising agency would come in and say, "make this for me," he was the one who was going to decide how things were going to move and what color things were going to be. Sometimes they're referred to as a taste fairy. He was going to be the person who was going to take his magic wand and say, this is what looks the nicest and this is what we're going to do. You have to have somebody. He was the animation director.

Matchett: The fact that he came in and said, "let's animate" everyday was his job?

Gaff: That was his job. He didn't have anything to do because we couldn't animate yet.

Matchett: It was a similar situation to when you came on.

Gaff: Oh yeah. He couldn't animate yet. We were still great friends, and we became really good friends and in our conversations, he pried open. I started understanding (a) why you need an animator, and (b) sort of how the business worked. And he started describing. And one of the main things that often happens in animation is that you mix with live-action. You mix with live-action and he—why we weren't anywhere near that. I had no way of bringing any images in and that was way off in the future. He sort of said we have to find a way to make some animation software, and we have to figure out how to solve some of these other problems that I'd gone to Purdue and found out that Purdue wasn't going to fix. He served a very good purpose of pushing that along. He didn't have anything else to do. He's a wonderful kind of organizer sometimes. He wound up leaving because Larry Lamb offered him a job.

Matchett: This is still 1984-1985?

Gaff: This is still 1984. Larry Lamb offered him a job. Yeah it's kind of bogged down, but we're going through some good history here. At this time, nobody was doing computer animation in town except for a group called EMCOM run by a guy called Dick Diercks who had bought a Bosch 4000. Bosch makes video gear and EMCOM was a post-house. He bought this Bosh 4000. They were pretty much in the same situation I was, but they had this turnkey machine that could do all what you could do. They were actually making some pictures, but that didn't really actually happen until I was able to

make pictures too, in late 1984. This was all in the beginning of 1984 because the summer of 1984 was coming along and that's when SIGGRAPH was coming. Fred wanted to give tours of Mainframe Productions and all this stuff. I thought, "God, we're not really doing a whole lot."

But by that time I was able to do some things. We wound up doing some jobs. I did a job for Craig Senard, who was a local sort of producer/director in town. It was a flask. It was for a local company that sells industrial cleaning supplies, I think. I can't remember the name of the company, but it was a flask and their logo and it rotated. One of the problems I had was, "How am I going to get this to videotape?" You know, I was trying to solve my problems as they came along, but I could only look so far ahead and I finally said, "Look, I can make this thing, I can make a bunch of these pictures, oh, now I have to record them." What we wound up doing is—this was one of the only real raster jobs that we did. I'll try to describe what I mean by that in a second. We put the RamTech in a dark room. We had a little room that was supposed to be the boss's office—there was no boss—so I had the RamTech, the monitor in this room, and then I had a little terminal that I could tell the computer to do things. We rented a Mitchell camera, a 35mm camera, and that's one of the things I found out was that Fred did—Fred Badiyan, who shot film didn't have a 35mm camera. He shot on 16mm because he didn't do TV commercials. He did these industrials. We had to rent a camera and had the camera pointed at the monitor, and I remember this would have been late, I think it was one of my only raster jobs, and this was in very early 1985 in that I was watching the Super Bowl. I was doing this over a weekend because I'm running out of time. What happened was, unlike how we do

everything today, Movie BYU would draw to the frame buffer. It didn't know how to make a raster file. It didn't know to make a bunch of files that you would then record somehow—what we think of as a jpeg now that you would download off the web. It would—as it was rendering—draw the picture into the frame buffer. The memory and hard disks were so small at that time that I couldn't keep these pictures around. But I had this frame buffer, which I could store it in, which was also the thing that let me look at it. It would draw, the computer would beep, I would see that it was there and I would push a button and that would take the shot, and then start the next one. Then I would sit, and it took maybe 15 minutes per picture, and I'm making maybe 250 of these or something like that. For ten seconds or whatever that was, maybe eight seconds, and I was watching the Super Bowl on our monitor that's attached to our video tape deck—which was a three quarter inch video tape deck.

And while I was watching the Super Bowl, this commercial comes on, which was the famous Brilliance commercial made by Bob Abel, made by the people, a couple- Roy Hall was involved in it, and I think Bill Kovacs was involved in it. It's called "Sexy Robot," is what a lot of people called it. It was this chrome colored robot that was selling cans for the American Can Company. It was the most amazing computer graphics thing that anyone had ever seen, and it played during the Super Bowl. I was watching it on this snowy screen, just barely able to make it out, and this was the only time it ever got play. I was sitting there making the dumbest looking animation anybody ever made, which was my opinion at the time, watching the coolest animation on this TV. And it was like, oh good grief. This was like a month and a half before Mainframe went out of business. So,

going back a ways, I wound up doing a bunch of work at Mainframe, not on raster jobs. The technology I described a little bit, that's the traditional sort of computer graphics done for, you know, that's how R2-D2 is made in the latest Star Wars Episode II and stuff. That was the traditional computer graphics.

Well, I got approached by Bajus Jones to do some work. We had a fellow named Jim Rafferty who used to work at Bajus Jones, which was one of the big animation companies in town. Well, they approached us and said, "We want to do this techno-looking thing, and we've been working with a group called Digital Effects in New York, but we think maybe you can help us do this. And you're probably cheaper, so we'll see it." It was a farm. It was all wire frame, which is just line drawings, but that computer-looking griddy sort of line drawing. *Griddy*, with a "D", looking line drawing stuff of a corn planter going down the line and planting corn. The people I got to meet for that were Mark Marriutto and Dave Brandt. One of them was a freelancer, and one of them was an employee of Bajus Jones. They came in and they said, "Hey this stuff is cool, you can do this and this." They brought me some storyboards and I didn't have an animation, "animator" quote unquote at that time. It was just me. A producer and me. Jim Rafferty, and me who served as a sales and money guy.

Matchett: And Ron Pitts?

Gaff: Ron Pitts left. He left after two months and went to work for—little did I know that him and Mark Marriutto were like best friends and are now very close friends of mine.

This was the first time I ever worked with Mark and I'm still working with Mark, which is sort of fun. He was my director and it was great. They had some equipment to shoot some stuff on and we shot this wire frame stuff. What we did was shot black and white film with these lines on it, and they would take it back and work on it under their animation camera and make some of it color and glow and do some fun things. Well, we wound up doing three jobs together and it was a lot of fun. I finally got a snapshot into what real animation was like, as opposed to just me trying to crank out this stuff. We made some money, and that was kind of cool. Three other things that happened at that time came up again later in my history. One of them is that WCCO had a new graphics project done, a new opening to their 10:00 news. It was this whole row of '4's, it was like a field of '4's going on into the distance forever, and it rotated up and kind of came by you and flew by you and one of the '4's stayed on and then the words would write on. It was really cool and sexy and 3D and neat looking. I came in and Fred called and then the guys at CDC all called that morning and said (and actually we had some visitor who was a potential client visiting us—it was a consultant who was trying to help us get off the ground), "I just saw this thing last night for the first time on Channel 4, who did that?" We said, "We don't know." He went picked up the phone and called Channel 4 and said, "Who did it?" Hangs up, and he said, "Larry Lamb." Lamb & Company did that.

They wound up having Larry come and visit. One of the things they did was they asked Larry, "How much did you get paid for doing that job?" He told them. I'm not sure how much it was, but apparently the vice president was there—who was our liaison at CDC who was responsible for CDC being involved in Mainframe—and his jaw dropped. He

said, “What do you mean?” That he did it for that little. Apparently, they had priced out Mainframe, saying “Well, if we can make so much per job and do so many jobs per year—” Well, Larry had just done something that we could never do for apparently about a third of the money that they were planning on being able to charge for it. That was when the bricks started coming down. Mainframe was in trouble because there was somebody out there making better stuff, who was actually making it right then, wasn’t using a computer to do it per se, was doing it under a camera and hence, saving a lot of money—his overhead was a lot lower than ours was. Actually, the other story I heard was that some advertising agency people had told Larry Lamb that Fred Badiyan—and this is all hearsay, I mean, I don’t know if it actually happened—had told Larry Lamb that Fred Badiyan had said, “I’m going to build this animation thing that will be so cool that will put Larry Lamb out of business, because we’ll be so cheap that you’ll want to use us instead. It’ll be new and clean and cool.” Larry heard this from a couple of people and Larry didn’t like that, which I can understand. Larry had an ‘in’ at CDC. His ex-hockey coach—Larry used to play hockey at Grand Forks—was some vice president, and he said, “What’s going on? Why’s this guy that you’re giving money to going around and saying he’s going to put me out of business?” That got him an interview with the vice president who was in charge of us. The story is that Larry went in and started yelling at him, threw in his demo reel and said, “Why aren’t you helping me instead of helping Fred Badiyan?”—or something to that effect. After watching the demo reel, the vice president from CDC said, “Well, how much did you get for that one? How much did you get for that one?” Here’s a demo reel, which Mainframe has none of, because we’ve only done

two or three jobs, and this guy's getting paid much less than what we would have to make to make the company work.

And that's what killed Mainframe. It was just a little too far ahead of its time, and they worked under some assumptions and some restrictions, mainly the hardware we were using, that were inappropriate. Mainframe wound up dying in February of 1985. I lost my job two days before I was going to go on my first paid vacation of my life, and the killer is I was working a job that I'd been told by the company, "Well, as soon as this job is done, tell me. Because the equipment is moving out and you're on the street." My boss was telling me this, Fred was telling me this. I was working for Bajus Jones. I was working for Mark Marriutto, doing another corn planting sort of thing. It was for an herbicide or something. It's more planting of corn. We finished it and said, "Okay, thanks." I'd been up for two nights and so I came back another day later and I was sitting there watching them haul the equipment out, and packing up all my stuff, and the phone rings. It was the producer from Bajus Jones and they said, "Well, the clients have some changes they want to make, and we'll pay you so much to do the changes." "You know, you're going to have to talk to Fred about that." But I sat there and thought, and I said, "Well, you know, I don't need this computer." Our big Mainframe.

I did this all on this PS-300, which I had mentioned before, really kind of programmed itself. It really was an entity unto itself. It needed a computer to talk to. You know, most of the work I needed to do, I probably could have just done with my Mac attached to it. It really just needed a hard drive to store things on. I said, "You know what? We have an

account at the University,”—where we’d been trying to do some research with the film recorders and things—“I can just take a tape over to the University and run my program that I was running on my computer at the University and do it over a modem. ‘Cuz I’m really smart.” Nobody had ever done any of this stuff before. Years later, I figured out I was the only person that ever did any of this kind of stuff. I told them I could do this. I could actually do it. Fred rubbed his hands together, because it was a little more money that would come in. I set up all the stuff at Fred’s studio, did this job, and wound up finishing at 3:00 in the morning and the next day went to the Grand Caymans for my first vacation of my life. But it was just crazy. That was my introduction to how crazy animation is. They took the two crazy things where people don’t get a lot of sleep, and they have to think on their feet a lot, and they stuck them together. Computers and animation. They went and stuck those two things together. In the early days, it was just hell. It still is, in a way, because you’re always trying to do something new. You were always trying to do that in animation, and you were always trying to do that in computers, and they slammed the two of them together to make this double hell sort of business. Anyway, I was on the street, and Bajus Jones actually made an offer. They said, “If you had some of that equipment, we would give you space and you could come and work for us and we’ll sell you. You’ll get a job, sort of like what you were doing for Fred, without Fred.” I said, “You know, I don’t really want to do that—”

Matchett: They weren’t going to provide the equipment?

Gaff: No, I was going to have to come up with the equipment and I actually approached Fred. "You've got this equipment," I said, "I'll buy it. What can I do to buy it from you?" Fred said, "I'll tell you what. You and I will be partners and I'll get half of all the money you make for providing the equipment." Our producer at the time, who was an actual animation producer, Jim Rafferty, took me to lunch after that and said, "If you take that offer, I'm going to beat you to death." (Laughs) He said, "Get a loan, buy the gear and then do it yourself." And I'm just burnt to a crisp. My analogy that I've always used for Mainframe Production was a plane plummeting out of the sky from 70,000 feet, and I was the only person in the damn thing. It hurt when I hit the ground, and I was ready for rest. But you know, I learned what all the switches in the cockpit did before I hit the ground. I now knew how the animation business worked. I knew the seedy side of how this kind of stuff worked, and so I was ready to do some of this kind of stuff. I was trying to figure out what I was going to do.

I came back to the University, and picked up work on my Masters degree, and I got hired as an RA and as a TA and started putting Movie BYU on some of the computers they had. One of the things I immediately did was to say, who has a Silicon Graphics machine in town? I mean, in the University? Because I had seen the first SGI machine, I had seen demos of it when I was working for Fred at the end. It had just first come out, it was just first for sale. And I said, "This is cool." This is a left-brain right-brain kind of thing. I want one of these. This is the perfect thing to do animation on. Sure enough, they thought the same thing. And I said, "I want one of these. Who's got one on campus?" I found the one guy who had one on campus who, by the way, was underground in the civil

engineering building down seven stories from grade. A guy named Mike Mixel had one. He was this forward thinking, interesting fellow who was working for the Underground Space Center with a good friend of mine, Lester Shen. He had one of these computers because he was a forward thinking guy. It was the only one on campus. I immediately got to know him, got a key to the room, and started learning how to program it. I put Movie BYU on it and started learning how to program GL and learned Unix. I had to teach myself Unix with those stupid manuals. They're terrible. Meanwhile, I did the exact same thing on the Apollo and learned that I didn't want to do it on that, which is another color display. In the year and a half that I'd been gone, they went from having no color stuff or no sophisticated computers to having some cool ones, and so I helped on that. Then the Supercomputer Institute was formed and they bought seven SGI's and scattered them around campus. One was in the architecture department, so I immediately ingratiated myself to Lee Anderson who ran the graphics lab at the department, and that's where I finished putting Movie BYU on and making it so it sort of worked so I could actually do some rendering. They're a wonderful group that was doing wonderful stuff, and it was very much like hanging out with the animators and the architects. Good architects have great design sense and are essentially artists, and I loved working with those guys. I didn't get paid to work with them or anything. I just came in every morning and played with the computer and learned how to use it. Well, the Supercomputer Institute—oh, I wanted to tell one more little anecdote.

SIGGRAPH had happened in the summer of 1984 while I was at Fred Badiyan's place working for Mainframe Productions. I went to a lot of classes and stuff. I went to one

class, which was offered by Bill Kovacs, and it was about when he was able doing some animating. It was a panel or something. He gave a talk on animating a commercial that was some nice commercial. This was prior to the “Brilliance” thing being done. This was still cruder stuff like I was doing. At the time, the main companies doing things at that time were Bob Abel, Digital Effects in New York, Cranston Csuri Productions in Ohio which was based out of OSU, and then, while I was working at Mainframe, this company called Digital Productions started up. They bought a Cray and they were going to do all their stuff on a Cray because there was this rendering process, and the faster you could do the rendering, the faster you make the pictures, was what everybody thought. They bought a Cray to do that. I think they paid six million dollars for it and the story was they were all of six million dollars in debt. That’s where they were when they went out of business a couple years later. Well, the interesting thing is they—Digital Productions—had some partners. PDI was one of the people who were around back then. RamTech was one of their investors. RamTech decided to liquidate their investment. Well, they sold it to Control Data. Control Data, in 1985, I think was in a funny position. Of the few Crays that existed in the world, they owned three of them. Or they owned companies that owned three of their competitor. One of them was Digital Productions. They became a board member of Digital Productions. The guy who oversaw Mainframe wound up overseeing Digital Productions, which they did not like at all.

So during SIGGRAPH, we had a strange meeting with the two guys who founded Digital Productions. One of them was John Whitney Jr. and it wasn’t him, it was Gary Demos, was the other founder. Gary Demos came and had one of the most uncomfortable

meetings I ever sat in, with Fred Badiyan, the guy from CDC, and then we sat and talked about how we could work together. Demos and Whitney were true pioneers in computer graphics, they worked on *Tron* and John Whitney, Jr.'s father is a famous animator. (They wanted nothing to do with us. And Demos wanted to go have a beer.) Their first feature-length motion picture that had any computer animation in it had just come out, which was *Last Starfighter*. It had just come out that week, and they were all nervous because it was tanking. The rule of thumb for anything that had computer graphics special effects in it for the first several years was it was going to tank. *Last Starfighter* did terrible and Digital Pictures [sic] suffered the problem that a bunch of the first companies did.

So that was one of the weird things that happened was I had that meeting with those guys. The other weird thing was I was sitting in the meeting where one of the other guys who was working with Bob Abel, Bill Kovacs, was giving a talk. Bill Kovacs said, "Well, I don't work at Abel anymore. I just started with a couple of friends of mine a new company called Wavefront. We're based in Santa Barbara and we're going to sell software for doing animation." He was one of the programmers at Abel. While I was sitting there, I see this guy that I had just met two weeks ago, named Larry Lamb. I walked up to him—

Matchett: —Where were you physically? Was this Minneapolis again?

Gaff: I was sitting in Minneapolis at the 1984 SIGGRAPH at the convention center. As we were getting up, I saw him and these two guys that I hadn't met yet go up to talk to Bill Kovacs. This was a fortuitous time and the three of them went up and said, "We want to hire you to write us a piece of software that will allow us to do interactive animation that will drive our animation camera stand." An animation camera stand is like a multi-axis milling machine in that it's a camera that can move up and down, a table that can move back and forth and rotate. You stick stuff on it and then you take pictures as things are moving one at a time and then it gives it the appearance that whatever you're taking the picture of is flying by you or exploding. They were doing amazing things with split scan technology and things like that. What they wanted to do was something that they could preview what they were going to do. It was very difficult to do. What I was describing that I was doing modeling, they were doing for the camera. You couldn't see it until you got it developed and they were doing multi-pass stuff. The same way that the original *Star Wars* was done with pass after pass after pass with mattes was the kind of stuff they were doing. They approached and said we want this package. That day, essentially, they commissioned the first piece of software that Wavefront Technologies wrote, which was called "Preview" which was their animation package, which we spent 10 or 12 years using to feed several people's children, uh, to make animations with. We were serial number one. Lamb & Company was Wavefront's first customer. I was watching it happen when I was working at Mainframe when I was halfway through my tenure at Mainframe.

Shooting back forward again, I'm now no longer working at Mainframe, I'm working at the University. I would get phone calls all the time from my friend, Ron Pitts, who was working for Larry Lamb, who now had this Wavefront software running on an IMI 500, which is another vector refresh calligraphic machine. Very similar to the PS-300 except that it was actually running on a Unix box. It actually had a Unix computer that was running this thing. It was actually kind of like an SGI in that it was graphics and Unix all together, but it only did vectors, it only did wire frame, black and white wire frame. They were really just using it to animate. They had a model of their camera in it essentially—what their camera sees. They could only move the camera in the computer graphics software in the same way that the real camera moved. They were designing the camera moves. They digitized an outline of the artwork that they were going to put under the camera, they put it into the IMI, they encoded it into the IMI, and then they used the interactive graphics of the IMI to visualize what the camera was going to see when the animation was done. This was a huge boon to them in that they didn't have to guess what was happening, to very cleverly design what was going to happen and tell the computer to do it, very painstakingly do it, send the film away for a day, film comes back, they take a look at it and say, "Oh, that didn't work," and then do it again.

Matchett: That's much cheaper.

Gaff: That's much cheaper, well, yes. Cheaper, but very quickly, they were getting to be able to design moves, and it was giving them flexibility they never had before.

Unleashing creativity. Unfortunately this stuff never really is whole lot cheaper which is one of the underlying things.

Everybody thought it was going to be cheaper, and it never was. John Lasseter's got the great expression of that talking about making *Toy Story*. He says, "People think that it's easier to do animations with computers." He says, "It isn't. It's just as hard to make good animation with computers"—which is very important. He says, "Think of computers as really, really expensive pencils. We're doing everything that we used to do just with these funny-looking pencils." Anyway, so I was starting to get calls from Ron Pitts saying, "Well, we've got this idea that we're going to do this job. I've got this board and I want to do this." He started getting advice from me and it was fun because I was talking to Ron again, and I was giving him advice. And he'd say, "Well, we're going to maybe make this spider and how would we make it move? And how would we do this?" And I'd say, "You know, Ron, this is a lot of fun. When do you start paying me for giving you this advice?" "What do you mean?" "Well, didn't you used to be a freelancer?" It was like, "Well, I don't think anybody got paid." He quit calling after that. About that time it suddenly dawned on me that maybe they needed me there. I called Ron up and said, "Is there any way I could talk to Larry to see if he wants to hire me?" I'd only met him once very briefly, so I went to Lamb & Company and I said—this is while I'm at the University. I'm working for the University, but I'm sort of looking for a job—I went to Lamb & Company and I said, "Hey, I'm Mr. Computer Graphics Midwest. I'm the only person that's made any money really, doing TV commercials that people have seen, pretty much in the Midwest. You need to hire me because you're using computers now to

make commercials.” Larry was very cagey with me. He said, “Well, yeah. Maybe we could use you. Why don’t you write me a proposal about how I can use you.” I thought, “Yeah right, you need me. What’s going on here? Screw this proposal thing. I’ll go back to the University because they like me.” So I went back. Screw it. Little did I know that at that point—Lamb & Company had started about 1980, so they’re about five years into their tenure, their existence—they were having the worst quarter of their career. A couple of people who wound up becoming friends of mine had been laid off. There’s no way he could hire anybody, but he wasn’t about to tell me that. That’s pretty much why we didn’t get into a discussion of anything.

We fast-forward a few months—I’m at the University. A guy from the Supercomputer Institute came down one day while I was in front of Lee Anderson’s SGI playing, and said, “We have to move this.” I said, “Oh, I’ll give you a hand. Where are you moving it to?” “Well, we’re having this summer institute”—this would have been summer of 1985—“And we’re having a bunch of people come in, this NSF funded thing. They’re going to come and learn about using interactive graphics with supercomputers. And we’re going to put all of these computers in a room, it’s going to be this classroom, and it’s going to be this kind of neat thing.” I said, “Here, I’ll help you.” I wound up helping them move the computers and one of them was Scott Bertelson and the other one was Tom Jacobson, who were well-known guys at the University of Minnesota for bringing in certain new technology. One of the things they were going to do was hook them all together with this neat thing called Ethernet, which nobody was using at the time. It turns out that Bertelson and Jacobson and a bunch of other guys at the University had been sort

of covertly stringing Ethernet, a thick net Ethernet cable in the steam tunnels of the University and actually putting in the first network, and sort of trying to circumvent Plant Services and trying all that kind of stuff. There were stories of guys with physics degrees with rock climbing ropes hanging down. If you've ever heard about the steam tunnels and the University, they're kind of spooky. I got to see some of them at another job that I had earlier in my undergraduate years.

I met these two guys and all of a sudden I was in a room with seven SGI's, all the same, that all belonged to the Supercomputer Institute, that had all been brought in from around campus for this summer institute which was going to be a month of a bunch of scientists coming and learning how to use supercomputers and learning how to use graphics. I started helping them put them together, like, "Oh, here let me screw that in for you." I was starting to work with these two guys, and it was late at night and we were done and they were all working with each other and they were all talking to each other, which was really cool, I'd never seen that. And I said, "Oh, this is really neat." And they said, "Well, the institute starts on Monday, and we need to have somebody technical around all the time. I'm going to be around on Monday and Tuesday and Tom's going to be around on Thursday and Friday. Do you want to work on Wednesday?" And I said, "Uh, I don't work for you guys." "Oh, do you want to?" "Well, sure." So I wound up working for them and it was just a hoot. They were really neat guys, and they were doing all of this neat stuff and I learned all about networking. This was back—for anybody who's a nerd—this was back before the Internet existed. They were just wiring together campus at that time. Anyway, the summer institute went through and that was great.

I was still working for these guys and all this equipment was still down in this room in the Space Sciences Building, and I got a phone call from Larry Lamb. He says, “We’re buying this SGI, have you ever worked on an SGI?” I said, “Well, I’m sitting in front of seven of them right now that I’m sort of in charge of.” “Can I come and talk to you?” “Sure.” He and Paul Churchill and Dale Hughes, who were the two technical heads and who were the people I had seen talking to Bill Kovacs a little more than a year before, came down and talked to me. I had met them when I’d interviewed with Larry. They’re really neat guys. Again, they were long time friends of mine and still are. They came down and I was sitting there (If I’d had a pipe. I’d been told by one of the consultants from Mainframe, “Whenever a client comes in, you should pull out your pipe.”) saying, “Yeah, do you want to see some stuff?” I started showing them animations and rendered images, and their eyes popped out. “Ooh.” They pretty much hired me on the spot. One of the better things that happened in my life at that time was the Supercomputer Institute was like, “What, you’re leaving?” Made me this counter offer. “We’ll help you finish your degree and give you a real job instead of this piddly thing that we’ve been paying you so far. You can do this, and you can actually do research and maybe get some grants and stuff.” I was faced with this thing where I was thinking I could finally get my degree, maybe, and this might be a career in a government institution which maybe you know a little about, which is maybe an okay thing. On the other hand, I remember staying up late a lot when I did animation, and what few clients I had dealt with, I learned that they change their minds and they make you do things over again which involves you staying up more nights. They always want things done before they really should be done. They’re

always late coming too you and it's a lot of aggravation and I'd met a couple of people in this business and some of them I wasn't necessarily happy with. I can still talk to Fred Badiyan just fine, but we were not necessarily the happiest with each other when we parted company. And I was thinking, "Maybe cushy government job, maybe going back to animation hell." I kept saying, "But I seem to remember me enjoying something about the animation business." I went with Larry Lamb. I turned down the Supercomputer Institute, which was very generous to me, and I always appreciated.

Matchett: Would this have been late summer of 1985?

Gaff: This is actually the winter of 1985. Larry had come and seen me in front of all the SGI's in the late fall, and what was happening is that Wavefront had come out with their first rendering software. Their first piece of software is just drawn lines on a screen animation package. The other important thing they were doing was they were coming out with rendering software. They were switching over to SGI. When they originally started using the IMI, the SGI couldn't draw lines fast enough. It was a 1028 by 768 screen and it was just kind of pokey, and the lines weren't very good, and everybody who had been doing animation at that point had been working on vector refresh machines where the lines were just beautifully clean, crisp and because they were calligraphic. They were switching over to the SGI, so they really needed somebody who had done some rendering—which they had never done any and there weren't that many people who had, and I had. They wanted somebody who knew how to use an SGI, which I had learned how to do. I essentially started working for them in December 1, 1986. This is where I

met Bill Kovacs for the first time in December of 1985. Great guy. He showed up to start showing them the rendering stuff. The guys I was working with just didn't have a clue, but I wound up meeting Paul Churchill and Dale Hughes who were the first two employees at Lamb & Company. They were the cameraman and the technical directors—just two of the greatest guys I've ever known.

I later found out that one of the reasons that Larry was able to hire me was because he had a whole bunch of irons in the fire. One is that they had SGI's and they had rendering. I think he thought that we'd figure out how to use those eventually, so we didn't really need Gaff to do that, but he'd been negotiating with Wavefront about how Wavefront was really interested in the fact that there were supercomputers in Minnesota, because one of the killer things is doing rendering. It took so long to render the images. That's the part where you don't sit in front of the graphics computer; the computer just sits by itself making the final picture. They were troubled by how long that took on the SGI's and on the IMI's or any smaller computer that they could find. They were using Edges at the time, which is a Unix computer. They got this new Cray 2, which I'd been working on that actually made some pictures. I'd put Movie BYU on the Cray 2. We were thinking about this Cray 2, which was this cool, fast vector machine. That would be this neat thing, and the idea is that Lamb & Company would get this connection to the University—at that time was a 56KB line to the University—and we'd rent time on the Cray 2. Well, the University thought that was really cool because the Supercomputer Institute had this commercial arm where they were trying to sell time. Wavefront thought that'd be really cool, so that was one of the things I was hired to do.

Paul Churchill and Dale Hughes both worked at Bajus Jones. One of the things I found out in my next several years was that anybody in animation in Minneapolis at one point had worked at Bajus Jones. Sometimes they worked directly for them, sometimes as a consultant for them, which is how Larry had worked. They had repped Larry. Larry actually hadn't been an employee of them, but Paul and Dale used to work at Bajus Jones and do Larry's stuff. Bajus Jones would go out and sell a job saying, well, we're going to do it this way, Larry's going to be the director and then we'll shoot it on our camera. They used their equipment to do it. Larry didn't have any equipment at the time. Larry Lamb had gone to Pratt. He was trained as a graphic designer, and he had worked at Zeppelin. One of his heroes was Bob Abel, who was a pioneer in this graphic animation style, this non-hand drawn character kind of idea. That was this cool graphic design that glowed and flowed around and ran around and stuff, and he had brought that to Minneapolis. Larry had been the pioneer in Minneapolis of that kind of style. The place he had first practiced that had been in the Bajus Jones offices sort of as a freelancer. He figured out, you know if I had my own camera, I could just do this myself. He started his own company.

Dale and Paul had worked on Larry's jobs, so they'd also done years and years of character animation jobs, which if you talk to a character animation cameraman, it's complicated and it's nerve wracking and it's always done at 3:00 in the morning and it's just hell and it's always done at the last minute. We used to say they treat you like the Federal Express guy who's waiting out in your lobby for you to finish the package and

hand it to him—but you’re not the Federal Express guy, you actually work with them and they’re all drinking beer while you’re in this dark room flipping cells. When the two of them came to Lamb & Company they said, “Well, one of the cool things is, we’re the first employees and we’re being treated very well and we’re not going to be treated like that anymore. None of this 2:00 AM in the morning stuff. When they come and say do this and it’s too hard, we’re going to say, no.” Well, one of the impressions I got, and I never heard this verbatim from Larry, and I’d kind of just heard it a little from other people, is one of the reasons they hired me in computer graphics was to get the guild that had been put together by the cameraman, where essentially the designers and directors were coming and saying, “we’re going to do it this way,” and the cameramen were saying, “no, we can’t do that. You have to figure out some other way of doing it.” That produced a little tension or frustration. Well, I was the guild breaker. I was coming in to split this up, and there were a couple of issues. One is that I wanted to get paid a certain amount, which turned out to be exactly the same amount as these two guys who were the founders of the company were getting paid. There were some negotiations about that and Larry, verbatim, warned me that maybe these guys reacted poorly toward me because I think he thought that they were going to see through the thing and I was the guild-breaker. We were like really best friends from the first second. I came in and thought, “Oh this is going to be cool.” They had non-stop questions about computer graphics, like, “How do you do this? How do you do this? How do you do rendering?” I found out that these guys were two of the cleverest, sneakiest guys I’d ever met. Sneaky in that they could pull out of a piece of film stuff screaming and kicking and that the film does not want to give. Animation cameramen are just the cleverest guys in the world.

So we spent half of the very first day there in the computer room saying, “Well, show me what you got and what are you getting?” I hadn’t seen any of this stuff, and I was saying, “Okay I know what’s going on here. You have manuals for this. I’m going to be able to figure this out. Yeah, yeah, yeah.” I would make a picture and they’d say “Oh, cool.”

This was really neat. They were trying to show me stuff that they already knew how to use really well—which was the animation software, which they’d been using for a year because they had the animation software long before there was any capability of color and lighting. Like I said, these guys didn’t really know what color and lighting was yet. Well, we started the other part of the day, underneath the camera. “How does this work?” It was a mechanical engineer’s dream. It was all servomotors like a milling machine, and it was just amazing. It had these twin Mickey Mouse ears on it where you bypass things and I thought “Oh my God! That’s how you do it? That’s so cool. What’s an aerial head? What’s this and what’s that? And how’s this controlled? Oh my God! It’s run by a PDP-11, it’s just like a—” We all said, in later years, that Larry’s heart probably would have sunk. He would have said, “Oh, damn it.”

They welcomed me into the guild. Sure enough, eight months later, when Larry brought me the first computer graphics job, he said, “How are you going to do this?” I said, “Oh, we can’t do that!” He’s never told me that he’s done this, but can I just imagine that he went home and said, “Oh, here we go again.” But he pretty much said, whatever the computer animation guy had said, who was running the company, “Well, we got it.” So we figured out how to do it. I think the first 3D job that we did at Lamb was for Dewey

Stevens Wine Cooler. It was for an advertising agency in Kansas City, and it wasn't for broadcast, it was going to be shown—it was industrial, like we talked about—it was shown to a bunch of salesmen. It was coming out of the label of the beer and we had never done any of that stuff. We had to figure out how to do it, and we had been doing some tests. The way we used to get things on the film at that time was we would stick one of the monitors under the camera in a frame we built for it and shoot the camera off the screen.

When I first started there, they were just about to get their second computer. We had two SGI's. The entire studio was run with 210 megabytes of hard disk space which, to buy one of those three disks would have been more than my salary, probably. We had 16 megabytes of memory, I think, on both of the machines. We tried to run one of them with eight for a while, but it was just too hard, and so we didn't have nearly enough room to store a 20 second animation. That was 20 megabytes. We had three 72-megabyte hard drives, and they got used up really quickly. When we were doing the Dewey Stevens job, we were rendering many frames and they took forever to draw, they took forever to render. Take a picture of it, expose a frame, and then start drawing the next one. We were recording on one of the machines, and the other two machines were starting to render. The disk space was filling up and filling up. On one of the machines while we were rendering, were also writing these old QC (I think they were called) cartridge tapes. They had the piece of aluminum on the back and those only hold 70 megabytes. We were trying to back up on tape while we were recording. We hadn't shot the whole animation. We couldn't store it all on our disk space. We had no idea what it looked like moving

because we could see wire frame, these 3D line drawings moving when we were designing the animations, but we couldn't see what we call flipbook now or what you would call a QuickTime movie or a Media Player movie. We couldn't see those kinds of things back then. This was 1986. This was three or four of us guys running around in this weird ballet at 3:00 in the morning. Just insane. It was really cool, and it was really a pain.

One of the guys who worked at Lamb & Company the entire time, who I got to know then and is still a really close friend and we still work together—is Jim Russell. He was one of the young guys, and I later found out that he was older than all the rest of us because he was so good looking and looked very young. He was quote unquote “assistant cameraman,” who was becoming essentially the main cameraman because the two ex-cameramen, the technical directors, were becoming computer guys. So we were all becoming computer guys. Jim already was one of the best people running the computer too. I wound up working with this wonderful group of people. We added computers and started doing jobs and finally getting jobs and when we would do job, I was sometimes referred to as Dr. No. I'm known as the pessimistic guy. I always said, “No, we can't do that. There's no way we can do that. It's not going to be the way you think it's going to be.” It always kind of worked out in the end, sort of like *Shakespeare in Love*. We never quite figured out how, but we figured it out. It was just a wonderful team. There were some freelancers working. Steve Brandt—who I worked with Mark Marriutto at Bajus Jones—was freelancing there also. He was one of these drifters, and he would work with us some times. People like Pat Carney—who was one of the first people I ever met who

was doing desktop publishing, and did some really cool stuff—was working there and there was a producer and her assistant, or two producers. There were three of us technical guys. There were two assistants, young Doug. Doug the first. We went through a lot of Doug's. We added these cool interns. Paul Churchill's wife, Bonita Wall, was a lens media instructor at MCAD, Minneapolis College of Art and Design, and we'd get her good guys, the ones who knew how to use a camera and could work in the dark room.

When I first got there, we were still doing a bunch of our stuff under the camera, not using the computer too much. Then we were just starting to do 3D stuff, and everybody was kind of learning both, except me. I was just doing computer stuff. The camera stuff was of course what I loved because that was new to me. It was just neat, it was magic, it was fun. I went back to this decision I had to make to not work at the Supercomputer Institute and to go to Lamb & Company. I was worried that, you know, it was going to kill me, it was going to crush me. I was there the first day, maybe—and it's a good story at least—and I was sitting there still thinking, God this is going to be hard and all this stuff I have to learn and these guys are fun (but they're good friends so I can say they're all weird) but there was this energy going through this place and it was really fun. What used to happen was that every afternoon if you were really busy, the film would show up. You'd send the film at the end of the day, or in the middle of the night to the film lab to Delden Labs in town, which is still in existence. This was this 35mm color film, and they could process it. When Lamb & Company first started, there wasn't a good processing place, but they were one of the reasons Delden was in business. And so, we'd get the film. You would put the film on a thing called a KEM, which was similar to a Moviola.

It's a thing that you could sit and look at. It would play the film so you could see it. It was not a movie projector. It was a sort of a TV set for looking at film, if you want to think of it that way, but it was not video. It was projected onto a screen that you looked at, kind of like a monitor. The film would show up, and everybody would gather around the KEM, and we'd play the animations over and over again, at same time as the soundtrack, which was on a strip that looked like a film that was MagTrack. We'd look at it, and just the electricity that would go through, the creative process: "we made this," and the "what are we going to do?" and the thinking, and the working with a team of just wonderfully creative, intelligent people. It was Ron Pitts, and Dale and Paul, and Larry, and it was just great. Like an old man, I remember my youth as being really cool. It was also late nights and cranky people and recalcitrant clients, and people complaining about money and how much they were getting paid, and why don't we have this new equipment, and that kind of stuff. We started adding people, and we started adding equipment. One of the first great people to go work there who's still in town here was still an up and coming guy was one of Bonita Wahl's interns, a fellow named Doug Pfeiffer, who's now the owner of Creative Images in town. He started as an intern, and I remember teaching him how to edit things on the computer and he wound up becoming a director and wound up going to AFI for a while and then coming back and being a senior director, and then leaving and wound up doing live-action. He's also a writer. He, two years ago, won the McKnight screenwriting award.

[End of Tape 1, Side B]

Gaff: We wound up getting more machines, and more people. One of the interesting things that happened and oh, I can't put my finger on exactly what year this was then, but it was probably 1987. All hell broke loose in the business. Digital Pictures more or less went out of business and was absorbed by a group called Omnibus. Omnibus also absorbed Abel and they became known as DOA—Digital Omnibus Abel. They also were “Dead On Arrival” because they very soon after that went out of business. Digital Effects in New York had gone out of business by this time, and we got the word that Cranston Csuri was going out of business.

Matchett: They were where?

Gaff: In Ohio. These were all pioneers that were going on. Pretty much of the people who had been going on in 1984 when I first got started. One of the things that I left out was that I used to sit and look at their videotapes all the time thinking, “Oh my God, how could I ever do that stuff?”—they all went out of business. Cranston Csuri was sort of the last one to go out of business. The only one left was PDI who's still alive. They're the people who made *Ants* and *Shrek*. The main funny thing about Lamb & Company where they're kind of historic is we were some of the first people who bought animation software from somebody and made it work. Then there were a bunch of people running around that made national stuff, Cranston Csuri, Digital Productions, Abel, all those people wrote their own software. It was proprietary in-house software. Like I said, we bought one of the first: Abel was actually selling some software, and guys who wrote the Abel software had started a company called Wavefront. They were really the only people

selling software at the time and we were Wavefront's first customer. We commissioned the first piece of software. We were really the first people who made viable computer animation with off-the-shelf software. The really cool thing is that we were people who were already making animations. Cranston Csuri, PDI, Digital Effects, Digital Production, well, not so much Digital Production, but those other three companies were essentially a bunch of computer guys that said, "Hey, we can make animations." It wasn't until Bob Abel got into it that somebody who knew what they were doing, and had some taste, and knew what an animation was, started using computers as a tool. He still had to go out and hire a bunch of programmers and do it from scratch. We were the first people who said, 'You know, let's go buy another tool, just like we bought a camera.' We used this tool, and we were able to make it work. We were able to put ourselves up in the top ten people who were making commercials—in Minnesota with store-bought software. It was a really good group of people with Larry's leadership and foresight. He was a pioneer in Minnesota of the kind of style of animation that lent itself to computers.

When Cranston Csuri went out of business it was sort of interesting. When Digital Omnibus went out of business—they went out business first—we got a phone call. The call said, "I looked you up in the Gold Book in California,"—which is a directory—"Um, yeah, I've got years of experience up here and I'm looking for a job." Because they put 50 people on the street when they went out of business. We said, "Hi, great. Do you know that we're in Minnesota?" "But you have a California phone number." "Well, yeah, it's our office. We've got a phone and it just rings in Minnesota." "Oh. So I'd have to move to Minnesota?" "Yeah." "Uh, no thanks." Well, it turns out people living in Ohio

don't mind moving to Minnesota! So we got this great group of people. Marcia Dietrich who was a programmer, Dave Novak, who's still in town, Doug Kingsbury, a wonderful animator, and these are guys who were pioneers or animators at Cranston Csuri, and they came along and then we were able to buy a bunch of their equipment from Cranston Csuri. We bought a Polyhemus and some other things from them, and all their software. It turns out they had rendering, they had all the software, and some of their software was interesting, but there was animation and rendering and modeling software that was too hard to use. It was sort of old hat. The new stuff was better, but they had all these little things that you couldn't buy. This was the thing that makes a string of polygons doing this, and this makes particles. There were all these little software packages that were just wonderful to use, and Marcia wound up adapting them for us and we wound up using them. That was this big boost we got. We also got a bunch of experienced CG guys who all learned Wavefront instantly and blended right in with us and all of a sudden we became bigger and stronger and neater, and we did a bunch of great jobs.

Matchett: What period was this?

Gaff: I believe we hired them in 1987. Dave Novak was really smart in that he saw the writing on the wall. He had already given his resignation, and come and gotten a job with us, and when the axe dropped, he said, "Hey, I'm going to Minnesota, you guys want to come with me?" A couple of people did. Doug Kingsbury and Marcia did, and it was just great. It was a really good team, and we were on the order of about ten people then. Around then, in 1988, Mark Marriutto came on board. He had been drifting around at

Bajus Jones and he'd been my director when I'd worked for Mainframe working for Bajus Jones. He came on board and really upped the quality of directorial ability. Then we started hiring a bunch of people out of Texas A&M and we grew and grew and grew. One of the things we were known for is that we did the first animated morning TV show. It was all CG animation called *The Incredible Crash Dummies*. We did it in conjunction with Tyco who built the crash dummies, and with Nelvana Films. Just prior to that, we hired some more Ohio guys. We refer to them as the Ohio Mafia. They're ex-Cranston Csuri people. Scott Dyer, John Duncan, and Jeff Faust came on board. Scott Dyer is now vice president of Nelvana. He wound up leaving with Ron Pitts and a couple of other guys and starting Wind Light, which was a large animation company in Minneapolis for awhile who was in partnership with Nelvana and was later absorbed by Nelvana. Dave Novak was also part of that team, and they brought in some wonderful people into town, and did some neat stuff, and essentially created "Rolie Polie Olie," which is an Emmy Award winning thing. They wound up moving to Toronto and they tried to go on having an animation arm here and making TV commercials, and they wound up having to go out of business. Just closing their doors. But those guys came on. Jake Parker came to work for us as a Flame operator. We were Wavefront's first customer, as I mentioned, and we were also Discrete Logic's first paying customer for using Flame. We used Flame in making the Incredible Crash Dummies and that was one of the very fun things I got to do, to know the guys at Discrete Logic and watch Flame grow to what it is, to Inferno, and all the Discrete products.

And also one of the things we started doing at that point was—Dale Hughes had unfortunately left and we brought in another programmer-sort-of-technical person, Jeff Thingvold—and we started doing motion capture. Lamb & Company was known as a pioneer in actually using motion capture. We used motion capture a little bit in *Crash Dummies*, using a Polyhemus set-up, but did a bunch of initial stuff, that was in our second studio. We wound up moving to our third studio where we built a whole big motion capture stage up on the 19th floor of what was then called the IBM Building. We did a seminal thing called “Bobalou the Beast Boy” using a wonderful actor in town, Kevin Kling, to do the motion capture, motion capturing him doing one of his one man pieces, and doing a wonderful piece with that as a sort of proof of technology.

Matchett: At some point, would you give some of the details about how motion capture works?

Gaff: Oh, but it’s so boring! The way motion capture works is you take a figure, a human being, and you rig them up with an ability to measure different points on their body. This is done in two different ways. We would do it by putting little magnetic sensors at areas on their body, usually at their joints, and as the actor—the human—acted out what they were doing, all of the motion of those points were recorded. Another technique of doing it is to put little reflective points at the same points on the body that we put the magnetic things on, and to film them. You use photogrammetry to measure where those points were. What you get is this cloud of points that are moving around and you used cool software to turn that into a jointy figure that you then use as a starting point for animation.

I sometimes differ with my ex-boss about the role of motion capture. Motion capture was used mainly by Lamb & Company as a starting point for animation, as a rough draft, if you wish, that you would then manipulate. Some wonderful tools were created at Lamb & Company to allow you to do that. It was missing in motion capture. People were doing a lot of good work on making sensors and grabbing motion capture really quickly, but you got this data that was a little noisy and was not necessarily a form that was used by real animators. Jeff Thingvold and the company that spun off of Lamb & Company known as LambSoft created some wonderful software to manipulate that data. That's been used by a lot of game people in the country, the world. Motion capture was fun and we use it now and then, but it never really—in my opinion—hit its stride. The “Bobalou the Beast Boy” thing showed what could be done and it's used in almost every game that has a figure that has two legs in it and some that don't, and it's been used in several movies. It's used a lot. It's used wildly, widely in *Final Fantasy*. But I can sit in a room with a bunch of animators and we can tell what was motion capture and what was not motion capture—unfortunately, not because it's good. You often get the Stevie Wonder effect. There's a lot of Saturday morning cartoon stuff that's going on that uses motion capture. The people's heads seem to do what Stevie Wonder's head does which is sort of wiggle back and forth and kind of look up in the air a little bit when they're not knowing what they're doing. So is that good enough for that, for motion capture?

Matchett: Sure.

Gaff: Lamb & Company was dealt the blow when half way through the Crash Dummies a group of the people announced to the vice president—being part of the group—four of the people announced that they were leaving and starting Windlight. The company changed quite a bit then, Crash Dummies was not picked up as a TV show, but we did a whole bunch of really cool work. We moved yet again to a neat new studio and did some of this motion capture stuff we talked about, but the industry seemed to be in a decline and had been for years. A lot of people at the end of Lamb & Company said, “Oh, you know, these last two years have been terrible.” Larry said, “No, it’s been the last eight years. I’ll show you graphs. We’re going down.” It’s like my analogy with the airplane; you just notice it a little more when you get closer to the ground. We did some really cool commercials, but went through some hard times and wound up having to lay people off a little bit at a time and a little bit at a time until we got smaller. We were probably 30 people during Crash Dummies and after Crash Dummies at the height of the total number of people we had at the time, there were maybe 50 people in Minneapolis who were making nationally seen animation at one point. Today, here in 2002, there are maybe five people getting a salary to make nationally seen TV commercials in town. There are a bunch of experienced guys working freelance who are working now and then, but very few salary people when there were maybe as many as 50 people at one time, 60 maybe. Lamb & Company got smaller and smaller and smaller.

We did a lot of work in Mexico. We were really lucky early on to do some Coca Cola spots and some things for the Winter Olympics, probably when they were in Calgary. I can’t remember which ones they were. We were able to develop a relationship with some

great people in Mexico City and that kept Lamb & Company going for a long time. A lot of our traditional smaller clients just kind of dried up through, I think, economic problems. We had a bunch of people on the West Coast who did department stores that slowly went out of business. Then Broadway quit advertising as much as they used to. We lost a lot of our return clients who were always good for the filler jobs, the smaller jobs. The budgets on jobs started going down. The number of jobs started going down. Fortunately things were a little cheaper to do. The software had become much more powerful.

One anecdote I love to just say—and you’ve probably heard this from a lot of other people, not an anecdote, just an observance—when I first started we were dealing with eight megahertz machines with eight megabytes of memory and a 72-bit hard drive. If a frame took an hour to render, that was bad. If it took more than half an hour to render, that was a problem. We’d put our heads together and figure out a different way of doing it. At the end of Lamb and Company, we just didn’t use SGI’s anymore. We started using PC’s because they were so cheap and powerful, but still using what is now Alias Wavefront, using Maya to do our work. The exact same thing held. If it took about 20 minutes, you’re doing something wrong. We had to figure out a better way of doing it if it took more than half an hour. We never did anything if it took more than an hour. Well, we’re using bigger hertz machines now as opposed to eight megahertz machines, and we’re using a gig of memory as opposed to eight megabytes of memory, and we’re using at least 40 gig hard drives instead of these 720 megabyte hard drives, I mean 72 megabyte hard drives. We still have this hour rule. So, we’re doing something 200 times

faster, 200 times harder. We're doing 200 times cooler, 200 times more complex or something. That's the history of what we did. It was real sad to see Lamb have to close their doors, but it just petered out and Larry just wasn't able to make it. He's back essentially where he was twenty years ago, which means he's working as a freelancer. He doesn't have the staff to do it, but he knows where he can find the people to do it. Larry did a wonderful job with a wonderful animation company in Mexico. Again, it's what we were talking about with the technology. It's a circle that's come around. We'll see what happens. Several people like myself are working freelance now and scraping by. The big change is that the money both in production and in employees seems to be in content now. Content, in this business, means non-TV commercials. It means (we used to call it long-format) movies and TV shows, TV specials, TV series, direct to video, little moviettes, short movies and things like that. I've never heard of anybody getting rich doing animation for TV commercials, production. People did it because they loved it. The fun thing about the group that I worked with was that, most of the people, and they're still here now, worked with us because they liked being in Minnesota and they liked doing animation. It's a really neat crew. Any questions?

Matchett: This has been great. Is there anything else that you wanted to follow up on, anything that you wanted to add? We can pick it up again.

Gaff: Oh, if we're running out of time, like we think we are, we should probably stop.

Matchett: We can follow up in the future.

Gaff: Sure.

Matchett: Great. Thank you, Scott.

[End of Tape 2, Side A]