SMITHSONIAN INSTITUTION

LEMELSON CENTER FOR THE STUDY OF INVENTION AND INNOVATION

Stephen Piner

Transcript of an interview
conducted by

Christopher Weaver

at

National Museum of American History
Washington, D.C., USA

on

29 November 2018

with subsequent additions and corrections

Preferred citation:
Stephen Piner, "Interview with Stephen Piner," conducted by Christopher Weaver, November 29, 2018, Video Game Pioneers Oral History Collection, Archives Center, National Museum of American History, Smithsonian Institution, Washington, DC.

Acknowledgement:
The Smithsonian's Lemelson Center for the Study of Invention and Innovation gratefully acknowledges financial support from the Entertainment Software Association and Coastal Bridge Advisors for this oral history project.

Abstract

Steve Piner begins the oral history by discussing his early family life, education, and origin of his interest in computers. He follows recounting his time at MIT, recalling the members of the Tech Model Railroad Club and his work with the TX-0 and PDP-1 computers, including his *Expensive Typewriter* program. Piner discusses the development process of *Spacewar!* and the contributions of various team members to the project. He concludes recounting his post-MIT career and final reflections on *Spacewar!*'s impact.

About the Interviewer

Christopher Weaver is a Distinguished Research Scholar at the Smithsonian's Lemelson Center for the Study of Invention and Innovation, Distinguished Professor of Computational Media at Wesleyan University and Director of Interactive Simulation for MIT's AIM Photonics Academy. He has contributed to over twenty-five books and publications and holds patents in telecommunications, software methods, device security, and 3D graphics. The former Director of Technology Forecasting for ABC and Chief Engineer to the Subcommittee on Communications for the US Congress, he also founded the video game company Bethesda Softworks. Weaver is co-director of the Videogame Pioneers Initiative at the National Museum of American History, recording oral histories and developing new applications for interactive media and public education.

About the Editor

Justin S. Barber provided transcript audit-editing, emendations, and supplementary footnotes to this oral history as part of his broader work into video game history and digital museology.

Table of Contents

29 November 2018

Video Game Pioneers Oral History Collection

Interviewee:	Stephen Piner
Interviewer:	Christopher Weaver
Date:	29 November 2018
Location:	National Museum of American History, Washington, D.C., USA

Weaver: Good morning, Mr. Piner. Would you please state your name, for the record, and the date?

Piner: Stephen Piner. It's November 29th, 2018.

Weaver: Very good. Mr. Piner, you said you were born in Muncie, Indiana.

Piner: Yes.

Weaver: Would you tell me something about your family, what brothers and sisters you had, and what your order was there?

Piner: I had one brother, older, and one sister, younger. My parents were self-employed. They owned a floor-covering business in Muncie. I guess that pretty much covers it.

Weaver: When did you first develop an interest in science or math as a child?

Piner: I was very young, probably five years old, and my mother said I used to like to take things apart and see how they worked but was not so good at putting them back together.

Weaver: When did you learn something about computers or have any exposure to them?

Piner: Probably my first awareness of a computer was, I think, the presidential election of 1954 when the UNIVAC [Universal Automated Computer] was the big thing predicting the election of our next president. I was fascinated by computers at that time.

Weaver: Did you do anything about that fascination prior to going away to school?

Piner: Somewhere in between then and when I went to school, I acquired a mechanical contraption that claimed to be a computer that was basically a bunch of switches and wheels. I played around with that. I learned a little bit about computer logic at that time.

Weaver: Did you have any real exposures to computer before you went to college?

Piner: No.

Weaver: And where did you go to college?

Piner: I went to MIT [Massachusetts Institute of Technology] in the freshman year of 1958. That was my first real introduction to a real computer. That was the TX-0 [Transistorized Experimental Computer Zero].

Weaver: Why did you go to MIT?

Piner: Because I wanted to be a physicist.

Weaver: When you were at MIT as a freshman, other than your classes, were you exposed to any kind of groups where you felt you wanted to join that group?

Piner: Yes, I joined the Rocket Research Society in my freshman year and was actively trying to build little rocket engines. We had a test facility in the basement of—I don't remember which building it was, but it was a big armor-plated room that we could close off. It vented into the Great Court. Sometimes when we'd run a rocket engine that was fueled by hydrazine and red fuming nitric acid, it would belch great clouds of orange smoke into the Great Court and attracted a lot of attention.

Weaver: Was there another group at MIT, such as the Model Railroad Club, that attracted you?

Piner: After I became disenchanted with rocket research, I joined the Model Railroad Club. That was probably about 1959, late 1959. That's when the computers became accessible to me.

Weaver: Was that your reason for joining the Model Railroad Club?

Piner: No, I had an interest in model railroading as a child. [I] had a few pieces of equipment that I drug along with me.

Weaver: Was there anything in the Model Railroad Club other than obviously the trains themselves that would be of interest to you, having a background in science and interest in computers?

Piner: Oh, yes. The Model Railroad Club was run by a very large mechanical computer, relays and telephone switches and all sorts of thing. I got involved in doing some of the maintenance work under the layout and keeping that system functioning.

Weaver: So, going back for a moment, if it was 1959, is it correct that you were not a freshman; you were a sophomore?

Piner: I would have been a sophomore at that point, yeah.

Weaver: Okay. Were there other members of that class with whom you became close within the Model Railroad Club?

Piner: No, there weren't. I never really got very close with any of my classmates, other than those that might have lived in the dorm with me.

Weaver: Were there people who were what we would consider early hackers who were also members of the Model Railroad Club who you knew?

Piner: Oh, yeah. Well, I didn't know them before I joined the Model Railroad Club, but I certainly knew them as hackers after. That was kind of our avocation besides model trains, was hacking.

Weaver: Would Alan Kotok have been one of those hackers?

Piner: I don't think I knew him.

Weaver: What about Peter Samson?

Piner: Oh, yes. Peter was probably the premier hacker.

Weaver: Did you know Dave Gross?

Piner: Yes, I did. Knew him in college, but after college, I actually even lived with him for a while. We lived together.

Weaver: And what about Bob [Robert] Wagner?

Piner: Yes, remember Bob very well.

Weaver: And the last one, William Mann?

Piner: That one, I don't believe I knew him.

Weaver: Would you say that these were the people who formed the core of the hacking scene at TMRC [Tech Model Railroad Club]?

Piner: Yeah. There were a few others, but that was the hardcore, yeah.

Weaver: Were you close as a group, as a hacker group, or was this much more loose in terms of circles within the group?

Piner: I think it was a pretty loose circle.

Weaver: What was the relationship of this group of people who we just mentioned to the "Tix Oh", the TX-0 computer at MIT?

Piner: Well, the Model Railroad Club, our faculty sponsor was Jack Dennis. Jack Dennis was in charge of the TX-0 computer. Through him, the Model Railroad Club had pretty much open access to the TX-0, and after that, to the PDP-1 [Programmed Data Processor One] when it was put in place.

Weaver: Just for the record, would you mind describing what the TX-0 was?

Piner: It was a big bunch of transistors. It was pretty large. It was pretty limited in power. In those days, of course, 4,000 bytes of memory was a lot of memory. The TX-0 started out as a pretty minimal computer, but over the years, it did develop more. They increased the memory. They added external storage. But it was a test bed, a test bed for the core memory that they were developing for the TX-0 computer at Lincoln Laboratories.

Weaver: You mentioned Professor Dennis. What was his relationship to the TX-0?

Piner: I'm not sure his exact relationship, but he was basically the portal for the club to the computer.

Weaver: Was he also the portal to the club for the PDP-1 computer?

Piner: Yes. They were in adjoining rooms. Both were managed by the same group of people, and he was responsible for that group.

Weaver: Do you remember where the computers were located?

Piner: Building 20, I think.[1]

Weaver: Do you remember that it was the RLE, Research Laboratory of Electronics?

Piner: Yes.

Weaver: What do you remember about the earliest days of the PDP and MIT?

Piner: The PDP-1 was delivered, I'm going to say, in 1960 or 1961. It was, at the time, a pretty impressive piece of machinery. It was much smaller physically than the TX-0 because it benefited a little bit from a more modular construction. It was about six feet high and eight feet deep and two feet wide. I think at the time it sold for about $120,000, which was pretty expensive in those days. I think today that would be about $1 million.

Weaver: When the PDP-1 was delivered to MIT, if you know, what tools were available that came with the machine?

Piner: Very limited tools at that time. It was a paper tape, punched paper-tape input device, punched paper-tape output device, and a CRT [Cathode Ray Tube] display and a Soroban electric typewriter. The programs were prepared offline on Flexowriters or Teletypes with a tape punch. Our immediate goal was to get functioning software to help us do what we wanted to do with it.

Weaver: When you talk about software to get it to do what you want it to do, how did that come about? Was that something that DEC, the manufacturer of the PDP-1, gave to MIT or was there some other story behind how the tools became available for the computer?

Piner: Well, pretty much there were some rudimentary programs. There was an assembler for assembling the programs. Of course, we were programming purely in machine language at that time. We had no compilers or high-level languages. There was an assembler and there were some minimal debugging tools and such. This group, the so-called hackers, are the ones that developed the operating

[1] According to a communication dated January 6, 2020 from Robert Saunders, "the PDP-1 was located in Building 26, room 26-260. (The TX-0 was in 26-248. TMRC was in Building 20, at 20E-216.)"

software for the PDP-1. The macro assembler, the tape editor, and a debugging program, and these were all done by this very group.

Weaver: When you say that it was done by the group, were you one of the group that did that?

Piner: Yes. I did the tape editing program. It was called *Expensive Typewriter* because it was expensive, and it did use a typewriter. It was basically a very primitive word-processing program. I like to think of it as more of a text-processing program because it didn't know what a word was at that time. It is sometimes referred to in some of the publications as the first word-processing program, but that might be a little over ambitious.

Weaver: Well, let's examine that for just a second. To the best of your recollection, were there any similar programs prior?

Piner: There was a program called *Colossal Typewriter* that had been developed at BBN, Bolt, Beranek, and Newman, but it was very primitive. It was really little more than an advanced Flexowriter, because you would tell it to read a line and then either delete the line or replace the line. The *Expensive Typewriter* had searching capabilities and could go back and forth, where the *Colossal Typewriter*, I believe, only operated in one direction. Once you were by a line, you couldn't go back and change it.

Weaver: Did you work on that alone or did anybody help you with *Expensive Typewriter*?

Piner: Initially, alone. Later, towards 1964, a young student named L. Peter Deutsch started working on it along with me. He extended it even more into the word-processing realm and did some really good enhancements to it.

Weaver: When you were a student—you said a young student named L. Peter Deutsch—do you remember when you were working on it, was Peter Deutsch the same age as you?

Piner: No, he was a couple years younger. He was a child prodigy, I think. He started at MIT at the age of sixteen or seventeen, a little bit younger than the rest of us.

Weaver: You mentioned the issue of your search capability and things like that with the *Expensive Typewriter*. Was it what you would consider today WYSIWYG, "What you see is what you get"?

Piner: No. We didn't have a graphical display. Everything was on this electric typewriter, so you had to pretty much imagine. You had to have a pretty good idea of what you were looking for before you started looking. Its main purpose was program preparation, but it later was extended a bit to be able to do papers, like term papers and stuff like that.

Weaver: The initial purpose of it was to solve your immediate problem?

Piner: Yes.

Weaver: And then it evolved into what I guess you would consider a true word processor.

Piner: Yeah. Not a WYSIWYG, but at least it was capable of doing word searches, and that was mostly done by Peter Deutsch, that extension.

Weaver: Going back for just a minute, do you remember when the PDP-1 was first delivered to MIT? Was the large graphic CRT delivered with it or did it come later?

Piner: It was part of the package, I believe. It was integral to the computer, but it was pure just point addressable. You had to program every point that was displayed.

Weaver: We're going to get into *Spacewar!* in a little while, but would you consider when you were writing *Expensive Typewriter* that this was part of what one might loosely term "hacking" activities? If so, were you students told by management that there were only certain times of day that you could sign up for it?

Piner: No, we weren't really limited. Most of us did it at night simply because we had studies during the day, classes, so a lot of it was done at midnight and 2:00 a.m.

Weaver: Do you think that was completely convenient and accidental or do you think that was something that was applauded by those people who were in control of the machine during the day when there were course activities involved?

Piner: I don't know. I think it was probably more accidental because I'm not sure there were many courses using that computer. At that time, there was no computer engineering department at MIT. There were one or two computer courses taught in the electrical engineering department. Basically, the TX-0 was used in at least one of those for some of the test problems.

Weaver: When you talk about these courses, were these courses, these early courses in electrical engineering, taught by John Mackenzie?

Piner: John Mackenzie was more involved with the larger computers, but the one course that I did take, computer course, was taught by Jack Dennis.

Weaver: And this was the same Professor Dennis who was in charge of the PDP-1?

Piner: Yes.

Weaver: During this time, did you interact with the people from the Artificial Intelligence Laboratory down the hall?

Piner: No.

Weaver: Was there a famous weekend of furious coding for the PDP-1 that you remember, and if so, were you involved in it?

Piner: I don't remember, no.

Weaver: Several TMRC programs, the Model Railroad Club programs, used the word "Expensive." Do you remember what started that trend?

Piner: I think maybe in a way it was the *Colossal Typewriter* program that I alluded to earlier. Bob Wagner, who you mentioned earlier, wrote *Expensive Desk Calculator*. I think that was the first one that got the title "Expensive". I guess he picked that out of the air because, as I said, we're talking about what would today be a million-dollar computer that was being used as a desk calculator that you could buy for a few hundred dollars.

Weaver: Would that also apply, in your mind, to what Peter Samson dubbed the *Expensive Planetarium*?

Piner: Yes.

Weaver: I know that you described your working on the *Expensive Calculator*. Were there any particular challenges that you remember that you were not expecting?

Piner: I don't think so. We were pretty innovative, I guess, at that time.

Weaver: When were you first exposed or did you hear about the idea of the *Spacewar!* hack?

Piner: I guess when it happened. We were all working together pretty much as comrades-in-arms, I guess. All of the projects that each of us was working on

were pretty much collaborated in by all of us, one extent or another. When the first *Spacewar!* came up, I was probably there watching.

Weaver: When did Steve Russell become involved in this group? Because when you say that you were all together, the original group, we talked about had additional members who [also]contributed to *Spacewar!*?

Piner: Yes.

Weaver: How did that come about, to the best of your recollection?

Piner: I can't remember exactly the sequence. I know Steve did come on a little later in the game as an active participant. I think he was perhaps behind the scenes of the original development. There was a group called the Hingham group or maybe the Hingham conspiracy. I don't know. I think they came up with the original idea of it and passed it on to Peter, who basically took the bull by the horns and did it.

Weaver: Before Peter took the bull by the horns, go backwards for just a minute. You mentioned the Hingham group, the Hingham Institute. What was that and who were those people?

Piner: Those were just really three people: Wayne and "Shag" and Steve [Russell] or "Slug."

Weaver: That would be Wayne Wiitanen?

Piner: Yes.

Weaver: And Shag was J. Martin Graetz, correct?

Piner: Yes.

Weaver: Very good. Were they the sort of initiators, as far as you remember?

Piner: That's the way I remember it. Now, it's been a long time. [Laughs.]

Weaver: Let's now pick up on what you said about Peter. Which Peter are we talking about?

Piner: Peter Samson.

Weaver: And this was the Peter Samson of *Expensive Planetarium* fame?

Piner: Yeah, yeah.

Weaver: Why would Peter Samson make a planetarium?

Piner: I guess to see if it could be done. As they say, why do people climb a mountain? Because it's there, you know. It was a challenge.

Weaver: You said that Peter, after the initial idea, sort of carried the ball.

Piner: That's my recollection, yeah.

Weaver: What was Steve Russell's contribution or participation? Or in the pecking order, where did that occur?

Piner: I'm not sure there was a pecking order. I think the people that contributed to that project, more or less, they would see a need and they would conceive the code to do it. They invented the gravity and they invented the hyperdrive and they invented the star field and all of that. I'm not sure any of that was any one person. I think it was a collaboration.

Weaver: By this time, when you talk about a collaboration, it sounds as if there was a group that was very tight that was now working closely together. Correct me if I'm wrong, it sounds as if *Spacewar!* was kind of the boiling stone, if you will, which everybody was working toward. Is that correct?

Piner: I think it might have been, yes.

Weaver: Why was that?

Piner: It was fun. [Laughs.]

Weaver: Who came up with the way that the game evolved? In other words, you mentioned features, but how did the game get fun? Did it start out as fun or was it not as fun as you originally thought?

Piner: I think it started out as fun and it got even more fun as it developed. You kind of have to think back that computers at that time were—nobody had yet thought of there being a personal computer. Computers were corporate entities. They never were even thought by some of the people who built computers at that time that they would ever become a household product, a personal computer. I think

the famous quote by Ken Olsen was, "Who would ever want one of those in their home?" And like I said, they were very expensive. They were not something that a normal person could ever expect to have in his home at that time.

And this group started looking at it and saying, "Well, there is a future in this, and this future is the personal side of using computers." This was an effort to make computers accessible to ordinary people.

Weaver: And to have some fun in the process.

Piner: And have a lot of fun in the process, yeah. Peter also did a music program, which I don't know if you ever heard about, where we would sit down and put scores for Beethoven or Mozart or whatever into the computer. It would play them on its synth lights that were hooked up to a speaker, and that was a pretty elaborate program that Peter did too.

Weaver: Again, to the best of your knowledge, had you heard about any of that on any other computer?

Piner: No.

Weaver: How would you classify something like that? In other words, if you guessed that this was the first of something, what would we call it? What would it be the first of?

Piner: Well, I think it was the first of a revolution in what a computer was. I've always thought that this group, this group of hackers, were pioneers in the personal computer industry. Much more so, in a way, than maybe Bill Gates or any of those people. They wouldn't have perhaps had the inspiration to do what they did if they didn't have the goal that these people had set for making the computer a personal item.

Weaver: As you're thinking back about this and the times and coming together in the collaboration, was the excitement the challenge?

Piner: Yeah, I think so. I know it was for me. In doing the *Expensive Typewriter*, the challenge was getting a product that was useful. More useful than sitting down at a Teletype or a Friden Flexowriter and rotating the little tape advance over the part that you wanted to clip out and then typing in the new stuff that you wanted. It was an effort to replace one instruction in a program because you had to run through the whole thing up to the point where you wanted to change the line,

space over the line you wanted to get rid of and enter the new line of code. That was a lot of work. The *Expensive Typewriter* made that easier and made it a lot more productive.

Weaver: Do you think that *Expensive Typewriter*, as part of the overall *Spacewar!* group hacking, materially benefited *Spacewar!* on some level?

Piner: Yes, I think it did, because it made it just so much faster and easier to edit your programs and make improvements to the code.

Weaver: Looking back over the collaboration and the development of *Spacewar!*, how much testing, if you called it that—or maybe you just called it playing; you can tell me—but how much testing went into it in terms of the fun-ness of the game?

Piner: I think most of the testing was fun. It was just using the program and saying, oh, if we made this change, how much more fun it would be. When they first wrote it, it didn't have gravity, and somebody said, "Well, you know, a spaceship in gravity field wouldn't behave like that, so let's make it so." So, they sat down and figured out the mathematics to make gravity happen.

Weaver: By the way, do you remember who said that?

Piner: No, I don't.

Weaver: Were there bragging rights involved?

Piner: I don't ever recall so much bragging rights. I think it was still pretty much a group thing.

Weaver: Was there competition in the group in terms of being the best at the game?

Piner: At playing it? Yeah, I think so.

Weaver: Did anything develop out of that, such as the ability to control ships, for instance, versus switches on the PDP-1?

Piner: Yes. Originally, there were five or six—I don't remember—little toggle switches on the front panel that you would use to control the spaceships. That was pretty cumbersome, especially since they were so close together that getting two hands in there to operate the switches was difficult. They built up some game control boxes with a joystick and a couple of pushbuttons. They used the joystick to control the X and the Y and the pushbutton to fire a torpedo and another

pushbutton to enter hyperspace. And they had two of those working, so two people could fight a space battle together.

Weaver: You mentioned a couple of things just now. You mentioned hyperspace. You mentioned "game controller," which I've got to imagine was a term that was not well known at the time, "game controller."

Piner: I'm not sure we called it that.

Weaver: But do you remember who made the controllers?

Piner: I don't, no.

Weaver: And what about hyperspace?

Piner: Hyperspace was an interesting feature that if you got into real trouble and needed to just get out of there, you could push this button. You would vanish from your present location and, a short time later, appear at a random location. The only caveat was that probably one time out of four, instead of reappearing, you would explode.

Weaver: Was that accidental or was that to control people to misuse it?

Piner: That was quite intentional. That was to keep people from overusing it.

Weaver: When did your group playing or creating *Spacewar!* decide that you wanted to have more of the public, people who weren't in the group, view it and decide whether or not you'd created something cool?

Piner: I don't really recall. I think we might have had it playing at some open houses, especially for freshman coming in, because they would usually have an orientation prior to the first week of classes. That's when I was first introduced to the TX-0 back in 1958, was at orientation, but it was another year and a half before I ever got to program it.

Weaver: We know now historically that *Spacewar!* became very popular, but at the time, do you remember how that went? In other words, do you remember how the popularity sort of evolved?

Piner: No. I think probably a lot of it was after I'd graduated and before it had become a real public program.

Weaver: When did you graduate?

Piner: I graduated in 1963.

Weaver: Do you have any memory of what the relationship was between the manufacturer of the PDP-1, DEC [Digital Equipment Corporation], and *Spacewar!*?

Piner: Oh, yeah. It was very, very good. DEC had given that computer to MIT, I think with the very hope of what happened, one way or the other. Although there was still some reluctance to believe that a computer would ever be a household product in the management of that company, they were looking to develop a basis of programmers to come to work for them. As a matter of fact, when I graduated, I went to work for Digital Equipment and worked there for three or four years. I think their intent was to develop some programming resources for the company, because at that time when I went to work for them, they didn't have a programming staff. They had a couple people in marketing, I think, that wrote some programs, but they didn't have a programming staff, as such.

Weaver: Just for the record, where was DEC located?

Piner: In Maynard, Massachusetts, in an old woolen mill. Up on some of the manufacturing floors, the floor was still slick from the oils from the wool manufacturing process.

Weaver: You think, looking back, that DEC got their money's worth for that donation?

Piner: I think they did. Like I said, they had a macro assembler that came out of there. They had the debugging program that came out of there. They had *Expensive Typewriter* and they had all those other things. As aside from the game, they had the tools that came out of that group.

Weaver: Was the *MIDAS Assembler* part of what was converted or repurposed from the TX-0 to the PDP-1?

Piner: Yes. I don't think we called it *MIDAS*, anyway. I think we just called it *Macro Assembler* at that point. It was pretty powerful for that time in terms of its capabilities. It had some real interesting features.

Weaver: Did you work on that as well?

Piner: A little bit. Not a whole lot. I did some of the work on that.

Weaver: Do you remember who did a lot of the work on that?

Piner: I'm going to say Robert Saunders and probably Alan Kotok were two of the biggest movers in that one that I remember.

Weaver: When you left MIT, you said you worked for DEC for a few years. What did you do after DEC?

Piner: I went to their competitor in Framingham, Massachusetts, Computer Control. I worked for them for a couple of years. Then after that, I went to a consulting firm for a while. Didn't last there very long. Worked for General Electric in a division they called Medinet that was trying to develop a medical information system somewhat before hospitals and doctors knew what a computer was, I think. General Electric kind of had this policy that if a new product idea doesn't work out within two years or so, they just can the project. We were about a week away from releasing our product, which was a program called *FileComp*, a file information retrieval system. We came in to work one morning and they said, "We've cancelled the project." We were on the verge of doing a final test run before releasing our product when they did that, so we were a little disappointed.

Then I went to work for another consulting firm for a short while. Then became involved in a startup company that we were trying to build, using the Digital Equipment LINC-8 computer, a medical information system for doctors. That kind of went down the tubes when the federal government decided to quit funding those people. Then I moved to Connecticut and joined a company called Canberra Industries and spent more than twenty-five years there.

Weaver: What did you do there?

Piner: I was programmer there. Canberra was a medical information company. They were basically funded by some of the same people that we talked about before, Ken Olsen and some of those folks. They had the same modular concept of instrumentation. They had little boxes that you would put in a rack to put together the instrument that you wanted. We also designed some nuclear assay equipment. I worked on an electron beam microprobe for Ford Motor Company, and over the years, we developed into a lot of other things. At the end, I was working at a division of the company called Packard BioSciences. They were doing a drug discovery computer program. That took me up to about 1996, I guess. I still worked at that place after 1996, but I worked as a consultant at that point.

Weaver: Except for the time that you worked on *Spacewar!*, you had no involvement in the evolving computer game industry, is that correct?

Piner: No, I didn't. No, I didn't.

Weaver: Do you ever think about that?

Piner: No, I don't think so. I was pretty satisfied with the kind of work I was doing. It was the only chance I probably ever had to use any of the physics I learned in college, which wasn't very much. I didn't have what you would call a successful career as a physicist. [laughs]

Weaver: Based upon a lot of the things you've told us, if you were talking to a young person today, somebody who's young enough to be thinking about what they want to do with their lives, with science or engineering, what kind of advice would you give them?

Piner: I would say whatever you find that you do, be sure that you enjoy doing it. I did enjoy doing what I did for over forty years. Even today, I really can't divorce myself entirely from it. I still do some websites that I take care of, and I use my computer daily in some other organizations that I'm involved in. Whatever you do, make sure you enjoy doing it or find something else.

Weaver: What do you think the relationship is between people who are innovative and inventive or creative? Thinking back, for instance, when you were young and at school and your interests, what do you think the relationship is between innovation and invention?

Piner: Hmm. That's a good question. I'm not sure I could answer that one. [laughs]

Weaver: Okay. Is there anything else about your memory of the times or *Spacewar!* that you think, from a historical perspective, would be important for people to better understand?

Piner: I think we've covered it pretty, pretty well. I can't think of anything just off the top of my head that I could add to that.

Weaver: At the time that you were having fun, could you have imagined what a burgeoning industry computer games would become?

Piner: I don't think we really, at least I, had a really good grip on that. I did see computers as becoming more prevalent and smaller and smaller and smaller.

That was even apparent in the short time that I was in school, was I could see it was just the beginning of the integrated circuits. They were just starting to be developed, so you could see almost right away that these big behemoths that had two million transistors in them would someday have only a few integrated circuits, and that it would happen. But I never foresaw them getting so small that we'd be carrying them on our waist and using them as telephones and cameras and computers all together.

Weaver: If you had to do it all over again, if you were a student in school, do you think you would have done many of the things the same way? Obviously, you went from DEC into the computer medical field. Is that your driving interest? You said you play with websites now. You continue to use your computer. Kind of having a little bit of the forethought of computers getting smaller and smaller.

Piner: I think most of the things that I did were just a process, that they happened because they happened. My move into Connecticut and the medical nuclear instrumentation field was because the company I was working for died, went under. I had an opportunity to join this company. And the fact that their target was nuclear instrumentation, nuclear medicine and all that, that was just what happened. That was just the job.

Weaver: Great. Steve, I think we got it all.

Piner: Good.

Weaver: Thank you.

Piner: I hope it wasn't too disappointing.

Weaver: No, it was great.

[End of interview]