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**Peter Samson**

Transcript of an interview  
conducted by

Christopher Weaver

at

Computer History Museum  
Mountain View, California, USA

on

9 January 2017

with subsequent additions and corrections

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## Abstract

Peter Samson relates his contributions to the development of the video game *Spacewar!* during his undergraduate studies at the Massachusetts Institute of Technology [MIT]. Samson recalls the origins of the *Spacewar!* concept, the challenges of developing programs for the PDP1 and TX-0 computers, and the collaborative open development process followed by the pioneering group. In addition, Sampson discusses his personal attempts to code music on the PDP1 computer.

## 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.

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Video Game Pioneers Oral History Collection

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Interviewee: Peter Samson

Interviewer: Christopher Weaver

Date: 9 January 2017

Location: Computer History Museum, Mountain View, California, USA

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Weaver: Peter, good afternoon. Would you please, for the record, tell us your name and the date?

Samson: I'm Peter Samson, and it's January 9<sup>th</sup>, 2017.

Weaver: Very good. Peter, you had something to do with the computer program called *Spacewar!*, did you not?

Samson: Yes.

Weaver: Can you tell me a little bit about what your contribution was? A little bit of the backstory behind the contribution and how it was made?

Samson: Well, the larger part of my contribution was the background of stars. This was a natural star map taken over and put onto the computer. So, I took the stars magnitudes down from the brightest to a magnitude of roughly four and a half. I got them out of a book of star tables. I took the right ascension and declination, converted them to octal and I had myself a star table of roughly 1,000 stars. Then I wrote the code to display them on the PDP1 [Programmed Data Processor One] screen. The code was a challenge, because I felt under the gun.

We had *Spacewar!* basically working thanks to Steve [Russell] and the major issue there was computer time<sup>1</sup>. The display is only as fast as the computer can keep throwing up dots. The spaceships and the torpedoes

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<sup>1</sup> "Computer Time" is defined as the time required for an electronic computer to complete a certain set of computational operations.

ate up most of the computer time and there was great skepticism about whether I could put up a screen full of stars in an amount of time which was small enough not to affect the play of the game.

It took some work. Beating the code down instruction by instruction to the point where I was satisfied. I gave it the name *Expensive Planetarium*, which was sort of an afterthought because several other people had been working on PDP1 programs which they gave the name of “Expensive” to. There was a text input and output program that they called *Expensive Typewriter*. Now, the fact is it did more than a typewriter, by a long shot, but it was also a whole lot more expensive. Hence the name. Another fellow working on *Expensive Desk Calculator*, which did what a desk calculator does and more. But again, vastly more expensive. Now, I did a reserve analogy on this, and I called it *Expensive Planetarium* even though it's cheaper than a planetarium to keep up the sort of system that had gotten started.

I was lucky enough that the powers that be, largely Steve but also other *Spacewar!* users, felt that it did not slow down the game significantly, and so it went in. And we have, voila, real stars.

- Weaver: And why did you do it?
- Samson: Well, because it had to be done. Steve put up random stars and this had an important purpose. It showed you basically the outline of the playing area of the screen. You could figure out where you could go off an edge and where you would come back on and this was vital. But I also have a background as a hobbyist in astronomy, looking at the real stars whenever the weather was clear. I looked at the screen and just couldn't find myself and felt very disconcerted and out of sorts. This is wrong. This has to be fixed. So, I went off and fixed it.
- Weaver: Was that something entirely random? Or is that something that came from your personality?
- Samson: Which? That I had to do something?
- Weaver: Yes. That you had to fix it.
- Samson: Well, that's the way I saw it. I think that's how a lot of things get improved.

- Weaver: Well, I don't disagree, but let's put this in context: At the time, how old were you?
- Samson: 20 years old.
- Weaver: And you were attending MIT [Massachusetts Institute of Technology]?
- Samson: Yes.
- Weaver: Which mean you had a full course load.
- Samson: Right.
- Weaver: So, you did this as part of the Model Railroad Club<sup>2</sup>?
- Samson: Parallel to it, let's say. In the sense that it was extracurricular. At the same time, not only is it making something good, but, you know, I'm learning along the way too.
- Weaver: Did anybody else take a similar position of "they saw something they didn't like, and they had to fix it?"
- Samson: I think a lot of *Spacewar!* went that way. There was an enormous amount of experimentation with different features, which were promoted by various people. Some of them were kept and some of them went out. Nearly all of them were thought, at first, to be bad ideas, and a few of them actually were good ideas.
- Weaver: Do you remember some of the features that were being considered or attempted and never made it in or were taken out because they weren't as good as people wanted?
- Samson: Oh, yes! [Laughs.] One I developed was called "the winds of space." You set up a certain parameter and everything is blown a little bit off course. Depending on where you are on the screen, the winds are stronger or weaker. You know, it sounded like just something to make a game a little harder, but it made it quite impossible. And no one wanted to see that any longer.

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<sup>2</sup> The Model Railroad Club was established at MIT in 1946 as a volunteer group that built elaborate model train sets, including complex wiring systems and scheduling protocols. Club members extended into experimental computer programming as computers became accessible to club members in the 1950s.

- Weaver: Anything else that you can think of that wasn't yours that was that was temporarily implemented and then taken out?
- Samson: Well, there were attempts. I think, with two stars. There was an attempt to show the universe from the point of view of one of the spaceships where everything was wheeling around. These were bad.
- Weaver: Would it be fair to say that this truly was a collaborative effort of a relatively small group of people?
- Samson: I think that's an important point. People, even then, were talking about programmers being loners. Doing things off by themselves. Take it or leave it. And [*Spacewar!*] was a very much a community effort. Steve [Russell] with the works. Shag [Martin] Graetz with hyperspace. Dan Edwards with gravity. Don Eastlake with the twinkling star, and so forth and so on.
- Weaver: Well, you just gave us a number of names. Can you, from memory, think of other people who contributed such as Steve Piner for instance or Bob Edwards?
- Samson: Dan Edwards. I would mention him for work on gravity. Otherwise, not offhand. Those are the names that happened to stick in my mind, but I'm sure there are others.
- Weaver: Can you give a context from the standpoint of describing the community of people who all took a personal interest in this? Why did you all come together? Was it just a group that occurred in and of itself? Was it an outgrowth of, for instance, Model Railroad Club people?
- Samson: Well, some were, and some were not. *Expensive Typewriter*, *Expensive Desk Calculator*. They were [created by] Model Railroad Club people. The system software, the macro assembler and the debugger were written by Model Railroad Club people. It was a very unusual year from the point of view of MIT admissions. This was the class of '62 and, apparently, they-they spread the net a bit wider than usual. And they got people who were creative, not, you know, buttoned down.
- Weaver: Were there other kinds of serendipitous events that you think contributed to *Spacewar!* actually getting written and done? Let me give you an example of what I'm talking about. Do you think Jack Dennis had anything to do with it getting done?



Samson: Jack Dennis.<sup>3</sup> Now there's another Model Railroad Club connection, because he was an illustrious member of the Model Railroad Club in his undergraduate years. For one thing, that suggested he had the same sort of mindset as a lot of us did. And for another, I think it gave him some sympathy with where we were coming from. I have the greatest respect for Jack Dennis' decision to let us un-sponsored individuals on his machines.

Weaver: Why do you think he did that?

Samson: Well, this goes back a bit...before the PDP1 to a machine called the TX-0 [Transistorized Experimental Computer Zero]. This was built at Lincoln Labs<sup>4</sup> as an experiment in running core memory computers with transistors. When the experiment phase of it was over, which was a big success, they moved the machine to the MIT campus and put it under Professor Dennis' charge. Lots of people who needed a semi-interactive or fully interactive computer, either for sponsored research, for thesis and so on, would get authorized to use it.

There were a few of us who heard about this interactive computer and were in no sense authorized or sponsored but, uh, kept hanging around. Jack Dennis could have said, "No, no. Go back to what you're supposed to be doing." But in fact, he said, "All right, when no one else is on the machine, maybe you can do something useful." That extended when DEC [Digital Equipment Corporation] gave MIT the PDP1. That too went under his laboratory auspices and we moved largely to that.

Weaver: Do you happen to remember when the PDP1 was delivered by DEC? How much software it had in addition to the hardware?

Samson: Right. It had an essential assembler. And we had already gotten very familiar with the assembler and debugger on the TX-0. This was interactive, symbolic... It was everything we felt it should be. That was developed in large measure by Jack Dennis and people he was supervising.

Jack Dennis and several model railroad people got together, and the conclusion was we could get time on the PDP1 if we provided system

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<sup>3</sup> Jack Dennis, was an MIT faculty member in the Department of Electrical Engineering and Computer Science starting in 1958, where he specialized in computer theory and computer systems.

<sup>4</sup> The MIT Lincoln Laboratory, located in Lexington, Massachusetts, is a United States Department of Defense research and development center chartered to apply advanced technology to problems of national security.

software. DEC system software was really, very rudimentary. We had experience on the TX-0 as something that we thought was vastly better. The challenge was to put something equivalent on the PDP1. This was done, in essence, over a long weekend. I wasn't one of the people who did the code, but I ran Cokes over from the Tech Model Railroad Club to the people who were doing it.

They did it by the very straightforward, and, nowadays, well known technique of taking the TX-0 code and converting it instruction for instruction to PDP1 code, which was possible because they were very similar machines. So, without having to invent or design anything, by the end of a long weekend had the assembler assembling itself.

- Weaver: Would you say that was sort of the cost of admission?
- Samson: I think some people viewed it that way.
- Weaver: Do you think Jack Dennis viewed it that way? Did he honor his commitment?
- Samson: Oh, he certainly honored his commitment. Actually, I would say he was already letting us on the TX-0 without such a stipulation.
- Weaver: But it nevertheless benefited him just a bit.
- Samson: Oh, yes. It was a nice step forward for the installation in general.
- Weaver: Do you think Jack Dennis remembers your group well, after all these years?
- Samson: Well, we were pretty flamboyant. I think I would have remembered us.
- Weaver: Give us a little bit of the backstory, if you would, from your memory or how *Spacewar!* came into being in the first place.
- Samson: Well, I've been hearing this every other week from Steve Russell, so I'm afraid I'm going to basically be echoing what he's been saying. Yes, space was a big thing. We had all read science fiction, space operas, as they were. The bad guys are chasing the good guys across the galaxy. On the fly, the good guys invent a new secret weapon and turn around and chase the bad guys the other way across the galaxy. Things like that. And yes, we'd seen TV shows about this. Buck Rogers was serialized in the

movies. There was Tom Corbett Space Cadet on television. You know, after Sputnik and the initial men in space, this was an extremely live topic around the country. Getting someone to simulate real space... that was what Steve proposed to us. Real spaceships, real inertia, real time lags, and, you know... On the one hand, it sounded like a great idea. And on the other hand, you know, our feeling was “Steve, you better prove it.”

Weaver: Do you remember that Steve was just raring to prove it?

Samson: Well, Steve had a life. I mean he had a paying job. He had his social friends and activities. I can't criticize him very much for not doing it. He put it in terms of excuses, but, I think he just had a lot of other things on his plate. It took, you know, pressure from all sides to eventually persuade him. It was sort of the Quaker idea of persuasion: everybody just keeps on him. Eventually, he took the time to write the basics of it. At which point, everybody realized what he had known all along: That this was a fabulous idea.

Weaver: Let's go backwards just a tiny bit in terms of, as you said so appropriately, the Quaker method of persuasion. Do you remember any stories such as that Alan Kotok decided to persuade him?

Samson: Well that's pretty well known. At least, the story is well known. I presume it's true. Yeah. Alan Kotok, another of our real dear friends had, by that time, been making some contacts at Digital Equipment, where he would later work in a work study program on his master's degree. When Steve said, “Well, I don't know how to write sine and cosine routines,” - I think Steve was a better programmer than he was letting on - Alan Kotok took this personally. He drove his brand-new Volkswagen Beetle out to Maynard<sup>5</sup>, got sine and cosine routines and drove them back. DEC didn't actually write them. They were written by Adams Associates, an early PDP1 customer, but DEC distributed them.

[Alan] gave them to Steve and said, “What's your excuse now, Steve?” Steve, about that time, decided it was enough excuses and that he should do something.

Weaver: Was there any other story? You sort of mentioned that's a very well-known story. Was there any other story that's not so well known, that-that sort of added weight? You know, “trial by stone,” as it were?

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<sup>5</sup> The Digital Equipment Corporation (DEC) had moved into Maynard in 1957.

- Samson: I don't know. It was not, at that moment, my big deal. My big deal was computer music. It was only once the basics of *Spacewar!* were running that I really got excited, as a lot of other people did.
- Weaver: Just touch on that for a minute. Even though it's not directly *Spacewar!*'s, I would argue, perhaps, that it's nevertheless vaguely related, in the sense that, how did you get good on the PDP1?
- Samson: Well, the story again goes back to the TX-0. TX-0 was an extremely limited computer. When it was shipped from Lincoln Lab to MIT, it had a total of four instructions. So, you had to learn how to make the most of small resources. Bumming programs down, both in terms of space and in terms of speed, was something you did all the time. You spent most of your time really doing that if you were into a real time program like music or like *Spacewar!*.
- Weaver: When you talk about music, didn't you have a predilection for early music?
- Samson: Oh, yes. I discovered baroque music, even before I got to MIT and found a real affinity for it.
- Weaver: Didn't Jack Dennis also have an affinity for early music?
- Samson: I presume he did. You mention that, and it rings a faint bell, but, at the moment, I don't recall any stories.
- Weaver: And so, what did you do with the PDP1 relative to music?
- Samson: I did it first on the TX-0, believe it or not. Before the PDP1 came, Jack Dennis told me, "Make this TX-0 play music." And I was able to get it to play a melody. Which given the, you know, very primitive nature of-of the computer was I think a good success. I said, "This isn't enough. I want harmony." And the PDP1...I'm sorry. [I mean] the TX-0 wasn't up to it. So, he let me add some outboard hardware to the TX-0. About a dozen so-called DEC laboratory modules, wired up. I could get with-with the aid of extra hardware, three-part harmony out of the PDP1. Then the TX-0 appeared on the scene and it has far more instructions. Much more capable order code. Without added hardware, I figured I could do four voices and that's what I did.

Weaver: I think you actually reversed them just now, didn't you? You went from TX-0 to PDP1.

Samson: Right. Sorry if I misstated that. Yes.

Weaver: In terms of going from homophony to polyphony, what were you able to do with the PDP1?

Samson: Again, experimentally, on the TX-0 with the added hardware, I could code up an awful lot of Bach music. Other people coded up lots of Baroque music, for which it's aptly suited, because it doesn't have the dynamic range, the fortes and pianos and the crescendos and decrescendos that followed the Baroque era historically. What you get out is a simple square wave, which sounds enough like an organ pipe that we're not totally displeased with the sound quality.

Weaver: Would you say this was one of the earlier, true, digital synthesizers?

Samson: Yes. The [PDP1] computer wasn't purpose built for music. Calling it a synthesizer is a bit [inaccurate]; "*Expensive Synthesizer*". I suppose that is what we'd call it today since [PDP1's] general purpose was spending most of its time doing things that weren't music synthesis. Digital synthesis of music had a long, slow beginning. It was proposed by [J. Presper] Eckert [Jr.] and [John W.] Mauchley, builders of the ENIAC<sup>6</sup>, which is how far back it really goes, to actually get music under computer controls. Even in my time, the early 1960s, some serious composers were using mainframe computers to make serious music, but this would mean running the machine for an hour, which is very hard to get on a mainframe, for a minute's worth of music. That didn't please me.

Weaver: Going back for just a minute, in terms of the collaborative process, such as it was on *Spacewar!*, you've had a lot of experience now with programming methodologies. Admittedly, many of the methodologies were subsequent to when you were working on the PDP1. Is there any methodology extant now, looking back, that you think that you, as a collective group, were following? Or was it kind of like whoever could contribute when and did what they could?

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<sup>6</sup> The ENIAC [Electronic Numerical Integrator and Computer] was one of the earliest general-purpose computers, first introduced in 1946.

Samson: Well, you know, both of those are true. I think there was no schedule or project management going on saying, “Now we need this. Now we need that. You're late. Where's the regression test, etc.” None of that with *Spacewar!*, at any rate. And what there was, I think, was agile programming in the sense, try something. See if it works. If it does, keep it. If not, fix it. Move on. Move on. Move on. Step after step. Avoiding the so-called waterfall model of design everything first and then lock the design forever. This was the whirlpool model, just keep going around, getting it better and better.

Weaver: Interesting. Anything else about *Spacewar!*, whether the development, concept, realization, etc., that you think has never been properly brought forth?

Samson: Well, a lot of things have been brought forth. I mean that this, in essence, you know, some people will say this spawned the computer game industry. There's a way in which that's true, and, of course, a way in which it's not. We had no vision of an industry. That was partly because we were naïve and partly because you could not patent or copyright [computer] code at that period. So, to see what has become of computer games, to see all the stages it's gone through from dedicated hardware to home computers to now in your telephone. It has all been sort of astonishing.

Weaver: You've sort of indirectly answered it, but what did you think, when you were working collaboratively on this, you were actually doing? And now after the fact, what do you think you actually accomplished?

Samson: Well, one point I'll make is that we did not have an ultimate goal, or at least I didn't. I was putting one foot in front of the other. We can do this. Fabulous. Does this mean we can do that? Let's try it. Step after step. Not only is every step a delight, and a gratification when it works, but you are moving things forward in a more abstract or objective sense.

Nowadays, you talk about computer game development - and I know some people who work in that field - there are vast teams of a wide array of talents. I think that's great, but it is a much more structured and much more goal-oriented process than we had.

Weaver: In terms of somebody who's had personal experience working with, at best, underpowered hardware, do you feel that something's been lost in

terms of the training, whether from external or having to learn on the job, when you have all the tools and all the memory you could ever want, you become complacent or otherwise not as sharp. You know where I'm going with this?

Samson: Yeah, I know where you're going. There will always be some people who have to go down to the bare metal. And, you know, in just quantitative terms, I'm sure that number is larger than it's ever been. But it is a smaller percentage of people programming than it has ever been, at the same time. You lose something with every step you take away from the hardware. You step back from bits to assembly language to a compiler to an operating system to something that manages memory for you to something that's built on a platform to something that's built on the platform that's on top of the platform. With every one of these steps, you lose a little bit of touch with reality. You know, I'm glad that we have the tools we do. I'm glad that people have developed the programming environments and platforms they have. It means a lot more people can get a lot more done. But at the same time, reality is a farther and farther distance from what you're doing.

Weaver: Could you foresee at the time, as best you can remember, that *Spacewar!* would become such a cult classic?

Samson: No, I don't think I did. Maybe people like Steve [Russell] and his science fiction cohort did. More than I did anyway. Certainly, had I it to do over, I would have put a lot more effort into claiming intellectual property, into publishing, into things like that. But at the time, my feeling was, "I can do this. I can do more. I can do more and more tomorrow and the next day." So, what's the problem?

Weaver: Okay, this is great. [To Matt Robertson<sup>7</sup>] Do you have any questions?

Robertson: Could you just tell us, if you were talking to somebody, a young person let's say, who has no idea what *Spacewar!* is, how would you describe what it is?

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<sup>7</sup> Matt Robertson is producing and directing the documentary component of the Video Game Pioneers Initiative and runs a New York based film production company. He earned a B.A. in Cinematic Arts at the University of Southern California.

Samson: *Spacewar!* is a game played on and mediated by a computer for two people to shoot each other in outer space.

Weaver: That's pretty pithy and good!

Robertson: And what's your sense of its role in the chronology of the video game industry or video games in general?

Samson: It was pretty much the progenitor of shoot them up games, of two-person real time games, of games with explosions and torpedoes, of games played in space, and of games played by a computer program.

Weaver: What do you think, other than the game itself, were the larger issues that were learned from this? Anything from the standpoint of influencing generations of programmers-in-training or programmers-in-desire, to human interaction with computers, to user interfaces?

Samson: That's really beyond me to say. I keep running into people who said, "Yeah, I saw *Spacewar!* on the MIT machine." Or "I played *Spacewar!* on a PDP1 at Harvard or Stanford." So, it's clear that it made an impression on a great many people. To what extent that was central to the development of the game business today, I don't know.

Weaver: That's great, Peter. Thank you so much.

[End of interview]