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Nolan Bushnell

Transcript of an interview
conducted by

Christopher Weaver

at

Aesthesia Studios
Los Angeles, California, USA

on

17 November 2017

with subsequent additions and corrections

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Abstract

Nolan Bushnell begins the oral history by discussing his early family life, education, and his initial career as an amusement park operator. He follows with his transition into video engineering at AMPEX, which leads into the co-founding of Syzygy, and eventually the video game company Atari. Bushnell's narrative describes the creative and business thought processes behind his moves which helped establish the commercial video game industry. Bushell next discusses his personal viewpoint of the rise and subsequent fall of Atari. He then describes discussed is the creation of the Pizza Time Theater restaurant chain and subsequent business ventures.

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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Interviewer:	Christopher Weaver
Date:	17 November 2017
Location:	Aesthesia Studios, Los Angeles, California, USA

Weaver: We're here today on November 17th, 2017, with Nolan Bushnell. Nolan, good morning.

Bushnell: It's great to be here.

Weaver: I'm very glad you're here. Nolan, would you please say your name for the camera?

Bushnell: Sure. I'm Nolan Bushnell, born in Clearfield, Utah, engineer, bon vivant. [Laughs.]

Weaver: Welcome.

Bushnell: Thanks.

Weaver: Nolan, you grew up in Clearfield in the 1940s and 50s. What was it like in those days, and how did it influence your later life?

Bushnell: Well, when you're in a small town in which you know most of your neighbors, where you can get on your bicycle, be gone all day, and come home for dinner, then your mother knows exactly where you've been all day because of the network. There was a party line in which you knew that if it rang twice, it was you, if it rang once, it was the Thurgoods, and if it rang three, it was the neighbor across the street. It was quiet. It was idle summers sitting on the lawn on a blanket playing games, running through the sprinklers, hanging out and having fun.

Weaver: And what role did the Mormon religion play in your life then?

Bushnell: Well, it was an ever-present part of my life because that was the community gathering spot. Not just Sundays, but there was a thing called Mutual Wednesday Nights, and attached to that was Boy Scouts. It was—I hadn't really thought about

it because it was part of my environment. You know, the fish doesn't discover water. [Laughs.]

Weaver: Your mother was a teacher and your father owned a cement company?

Bushnell: Correct.

Weaver: Looking back now, how do you feel each one of them influenced you in terms of the man that you were, became, and then are today?

Bushnell: Well, my mother was an educator and all her kids were her focus. She had two or three goals as far as the kids were concerned. We were not allowed to slur our words. Diction was important to her, you know, and she would say, "Speak, and make sure you're understood."

The other thing that she would do, and I was a little miffed at that, but she would call us in for lunch on a beautiful day when we could have been out playing, and after lunch, she would read stories to us. We'd get a book and we'd do one or two chapters every afternoon. I actually think that one of those books represented a breakpoint. It was called *101 Balloons* and it was about this fantastic inventor that invented this crazy world in which chairs popped out of the floor and he created a platform held up by all these balloons and he flew it around. I thought to myself, "Maybe I could be that guy." The fact that seventy years, sixty-five years later, I still remember it means it had to be impactful to me.

Weaver: What about your dad?

Bushnell: My dad was dyslexic and didn't read and write as an adult. He was always a little bit concerned about that and he was bound and determined that none of the rest of us were going to be that way. But he was running a successful company and he used to take me to work to read for him when I was nine, ten years old, and so we developed a very close relationship. My dad probably had as many aphorisms as he had anything else. I find myself quoting the same old saws to my kids now. A good saying is like encapsulated wisdom, and I think it is part of what builds your personality. I mean, the one that I love the most is he said, "Moderation in all things, including moderation." And I thought to myself, that's really good stuff, because it says live a moderate life, but every once in a while, go a little bit bat-shit crazy. [Laughs.]

Weaver: You were mentioning something also about your dad just before we started that I found very interesting that probably bears repeating your father telling you how to deal with people. What did he tell you?

Bushnell: He says the lowest regard you can have for any person is not hate, but apathy. So, I actually take that [to heart]. People who do me wrong, I just try to forget

them, move on. I'm not going to have a scintilla of effort in hating them or disliking them or thinking about them.

Weaver: Right. A waste of energy.

Bushnell: Yeah.

Weaver: What about the rest of your family, your siblings?

Bushnell: My older sister, most of the time I think of her as just being a pain. [Laughs.] My younger sisters were great fun and I felt that it was my job to torment them. I was pretty good at it. But then later on when we got to be teenagers and that, we got to be quite close. In fact, both my sisters worked for me at Lagoon, and I hired them on, and they were some of the best game operators that we had.

Weaver: Did you ever hire them again as you created later businesses?

Bushnell: No, because they stayed in Utah and I moved to California, so it was geographically difficult.

Weaver: Got it. So, other than your mother reading to you when you were a kid, I think you've said in the past that you were a very games-oriented family. What kind of things did you enjoy doing as a family?

Bushnell: We played a lot of games like Sorry and Monopoly and Rummy. My mother had a Pinochle club that met, I don't know, either weekly or monthly in which a bunch of her teacher friends would all come to our house or go to another house and play Pinochle. So, games were always part of the fabric of my existence.

Weaver: What about hobbies? What hobbies do you remember having as a child?

Bushnell: I went through a whole bunch of phases, and in some ways, that's also been a characteristic of my life, in which I deep dive, do it, do it, and then forget it. For example, I went through a phase where I was doing model airplanes and got really pretty good at them. Then I went into a phase of chemistry and thought that it was fun to blow things up. Then I went through a phase of rocketry. The kind of chemistry in those days if you're a ten- or twelve-year-old kid is really about making things go "swish" or things go "bang." I mean, that's kind of the main thing. Once you understand the elements of what makes things oxidize extremely rapidly, i.e., go "boom," then you start exploring other areas. If you have it all tied up and restricted, it goes "boom." If you have a hole in the bottom, it goes "swish." That was a phase that was very fun for me. I built a blockhouse so that when things went "boom," I wouldn't get hurt. [Laughs.] I mean, if I tried to do that today, I'd be known as a terrorist, you know. There were different times where when things went "boom" in my backyard, the neighbors would say, "Oh, there that Bushnell kid's doing it again. He's blowing stuff up." [Laughs.]

Weaver: Talking about "that Bushnell kid", what kind of outlets existed for you around your small town that was for a boy who ultimately became interested in electronics and technology?

Bushnell: Well, I think that I was largely ignored until I got into the electronics phase of my life, with one exception, which I believe was another breakpoint in my life. We'll call it my eight-year-old strawberry caper. The strawberry caper was my mother at dinner table said, "We've got too many strawberries. We planted too many this year, and they've all come on and we're going to have to give them away," or something.

            Next day, I went with my mother to the grocery store and noticed that they were selling strawberries in these little baskets for fifty cents, and I thought to myself, "Give them away? Heck."

            I knew that we'd kept some of these little baskets from various things, and I went to the garage, got all the baskets, picked all the strawberries, filled them up, and went door to door selling them for fifty cents. I ended up earning about eleven bucks, which in a world of allowance of fifteen cents a week, that was *massive*, massive money. I think in some ways that experience launched me to the world of entrepreneurship because it was more powerful than if I'd won the lottery, because that's a random occurrence. By seeing an opportunity, acting on it, and all of a sudden making two years' worth of allowance in a day, you can't help but somehow distort your mind, but in a good way. [Laughs.]

Weaver: How did you transition from that combination of entrepreneurship and hobbies into the electronics area? Did you have a mentor?

Bushnell: The breakpoint was Mrs. Cook's third-grade class. Mrs. Cook had a passion for science and birds and snakes and all that sort of stuff. But more than that, in the locked closet she had the magic science box. In the magic science box, there was wire and dry cells and light bulbs and prisms and just all kinds of wonderful magical things. I was assigned to take the magic box on the back table and put together the experiments on electricity and show it to the rest of the class. That was her methodology. And I was hooked. It was magical and yet logical. It was interesting. And I remember that night going around in my house, in the garage, finding every piece of wire, every old flashlight, every battery, every old light switch in the house, putting it on the card table and starting to tinker, and I never stopped.

Weaver: I am guessing you expanded your tinkering by going down to the boneyards and grabbing whatever you could?

Bushnell: Another step first. There was a ham radio operator down the street named Chet Ashby. Behind his house, he had a surplus store for electronics. He had a mail-order catalog that he published every other month or so about the stuff that he bid on in these auctions. This was after the Second World War and an awful lot

of material was being junked or gotten rid of by the military. They would do it by auctions. He would figure out what he could get from his ham community and sell it, and that was his business. He was very happy to have us kids do odd jobs for him sorting out—he'd get a big shipment in from an auction and he'd put the vacuum tubes over here and the switches over here, and sometimes there were whole chassis of stuff that we'd disassemble and turn into parts. He was the one that introduced me to the world of ham [radio] and gave me some of the magazines that were the trade rags of the ham radio things. There were two of them. One was called *QST* and the other was called *CQ*. Then he gave me this little handbook that you could get by writing into the government. It was the licensing requirements and tests. He said, "Study this up, learn how to do Morse code at five words a minute, and we'll get you an office license."

I said, "Done and done."

Then to add to that, there were these junked aircraft from the Second World War. They had no value to anything, so they were being melted down for the aluminum. There were these massive boneyards of two- and three-hundred-dollar aircraft fuselages. The wings had already been taken off, but they were just lying there out in the field. We would sneak out into that boneyard and strip out the electronics. Because nobody really wanted them, we didn't feel like it was stealing, though we had to dodge the junkyard dog. I just had miles and miles of cable that I'd taken out of airplanes and old radios, and sometimes there were even headsets and microphones. You know, it was a treasure hunt. So that added to the magic of ham radio.

Weaver: What was your call sign?

Bushnell: W7DUK.

Weaver: I mean, obviously the man down the street had gotten you interested in it, but why did it continue to attract you? I think you were—how old? Eleven?

Bushnell: I was ten.

Weaver: And so that made you the youngest ham radio operator in the area?

Bushnell: In Utah, yeah.

Weaver: Why did you like it so much?

Bushnell: I think that deep down inside I liked being a poser. You know, "fake it until you make it". Ham radio gave me an opportunity to be an adult without anybody

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[1] QST is a magazine for amateur radio enthusiasts, first published by the American Radio Relay League (ARRL) in 1915. CQ Amateur Radio (also known simply as CQ or CQ magazine, and formerly as CQ: The Radio Amateur's Journal) is a magazine for amateur radio enthusiasts first published in 1945.

else knowing. I was only judged by the quality of my thought and reason, not by the fact that I looked like a kid, and I liked that.

Weaver: What are you earliest memories of playing pinball or coin-operated things?

Bushnell: There was a pinball machine at the local malt shop. It was literally a classic malt shop in the 1950s where you got hamburgers for twenty cents and a malt for ten. I mean, when I think of those prices, it's just amazing. But there was a jukebox and two pinball machines, and they were just fun. I was not an avid pinball player because I was too stingy. I wanted all my money going to electronic parts, and so I didn't play as much as I could, but I watched a lot.

Weaver: What transpired between this time and then going into high school?

Bushnell: At about fourteen, I transferred my interest from ham radio to cars and girls. I still had my ham rig and everything, but I bought a 1931 Model A Ford and set about to fix it up and make it cool. It didn't run, so I had to teach myself how to overhaul an engine, which I did, and got it running. I paid $5 for the car. Because it was in an impound lot, I think it cost me $25 to get it out. And I had to buy a battery and some parts, and I think for 70 bucks I had my first car. In Utah, you could get a daylight driver's license at fourteen and a half, and so that was my thing. I had to get my car operating before I turned fourteen and a half. The day I turned fourteen and a half, I was there to take my driver's test. I had studied, passed it, got it, and I was set. I was very, very happy.

            That really became my focus of energy more than ham radio at that time, with the exception that at about twelve, I started Bushnell Repair. Bushnell Repair was my TV repair business. In those days, the TV sets were all tubes. I knew enough about TV circuitry and various other things that I could readily diagnose what the problem was and swap out the right tube. This was where I kind of learned how you can be devious about marketing. At that time, a house call was five bucks. That was just the norm. These were adults and people with panel trucks and all that, and they just had the look and the talk. And I decided that my house calls were going to be fifty cents, but I could really mark up the tubes that I swapped out, because I found out through Chet that a lot of the tubes that I needed I could get in war surplus. Literally, I could pay a dime or a nickel for them and sell them for what the typical repairman was selling these same tubes for like $2.80. I just matched their prices, but I really focused on supply chain. There wasn't a week go by that I didn't make 50 to 100 dollars. And for a kid at twelve years old making that kind of money, I was making more money than my dad. [Laughs.] I mean, to put it in context, when I graduated from college, the starting salary was $10,000 a year. [Laughs.]

Weaver: Having all that money and being interested in girls and having a car, did that have an effect on your schoolwork?

Bushnell: No, it actually didn't. Without sounding arrogant, school was always very easy for me. I knew from the time I was in the third grade that I didn't want to be a fireman anymore, I didn't want to be a doctor anymore. I wanted to be an electrical engineer. I mean, my path was set. I was able to have math and science and mechanical drawing. That thread continued in high school. All these things I had to learn in order to get my first ham licenses at [the age of] ten so it was a cakewalk. I understood more about electronics than my physics teacher in high school. That sounds arrogant, but it was true.

Weaver: In terms of timing, you mentioned Bushnell Repair. You also worked at a place called Barlow Furniture, right?

Bushnell: Let me put that in context. In the summers, I worked for my dad, because the repair business was almost all at night. I learned everything to know about the cement construction business. When my dad died, I closed his business down and finished his contracts. I actually bid on a couple of more contracts because I felt the business could be sold for more if I had another couple of contracts. The contracts that I bid on didn't know that my dad had died, because they'd dealt with me before. I was the guy who read and wrote and did that kind of stuff. The dining room table was where the books were kept by my mom. You know what I mean? [Laughs.] It was a team, very much the way my wife and I work today.

This is something where the Mormon upbringing affected me a little bit, because when you're the male of the household, you're considered to be the go-to guy. You are now responsible for the family. The day my dad died, I felt that I had to be financially totally independent because any money that I took from the insurance money or what have you was going to take away from my mom's ability to survive and my sisters' ability to go to college. That was another thing that was kind of in my head. Up until that time, I had been pretty flippant with money. At that point, I decided I had to build wealth, that I had to be responsible.

When I could no longer work for my dad, Barlow Furniture asked me to come and run their repair and delivery business. After school and Saturdays, that was what I did. We agreed that now that it was Barlow Furniture, we could charge $5 for a service call again, and I'd split it with him. It was a good thing. Then I got paid an hourly salary to deliver furniture as well.

Weaver: Your father died when you were fifteen, I believe.

Bushnell: Correct.

Weaver: And you went to college when you were seventeen or eighteen?

Bushnell: Correct.

Weaver: So, for the ensuing two or three years, you were basically the man of the family.

Bushnell: Correct.

Weaver: Did that influence where you went to college? You went to Utah State, didn't you, initially?

Bushnell: What caused that to happen was two things. My mother had graduated from Utah State, so there was sort of a legacy thing going on. And second, during my senior year, there was a thing called Boys State in which we had a mock government reenactment. It was done at Utah State, you stayed in the dorm for a week, and you did mock government. You elected a mayor, then you elected a governor and you did all these things. Well, my friend and I were basically rascals, sneaking out of the dorm at night and hanging out and going down to the city and just basically cruising around. When they did photographs of the [mock reenactment] cities, each one of them had, like, twenty boys in it. We were in seven of the ten. [Laughs.] Just having fun. But out of that, I was given a scholarship to Utah State, with full tuition and books, so done and done.

Weaver: In terms of the context of the time, this was now around 1961, 1962?

Bushnell: 1962. Yeah, I graduated 1961.

Weaver: Okay. So, the Vietnam War was really starting to heat up.

Bushnell: Absolutely.

Weaver: Sex, drugs, rock-n-roll. The whole sixties culture.

Bushnell: Right.

Weaver: How did that affect you at the time?

Bushnell: Well, getting a college deferment, for one thing. It was a way of staying out of the draft. The issue for me was to stay in school. I didn't rush a fraternity my first quarter, but I did the second quarter, called Winter Rush, and I pledged Pi Kappa Alpha. I moved out of the dorm, in with a bunch of other Pi Kapps in an apartment down off campus. That was where I learned how to play poker and drink beer, and this was at the same time that I left Mormonism.

Weaver: You said that early school was relatively straightforward and easy for you. What about college? How good were you as a college student?

Bushnell: I was quite good when I got my homework done. What happened with me is that I could always test well, but as I got deeper into engineering, homework became very important. Not doing the homework made it more difficult to test well. My primary reason for going from Utah State to the University of Utah was to get rid of bad habits and bad influences. Because you can start every quarter with a resolve, "I'm going to study. I'm going to not go out with the guys on

school nights. I'm not going to carouse around," and that lasts about a week, maybe two. When I decided to go to University of Utah, I determined that I was *not* going to live at the fraternity house, that I was *not* going to hang out with anybody that was not an engineering straight-A student. It was a way to both deal with the reality that I was weak when it came to partying. I was just not the strong person that I thought I should be, but I felt that by making drastic changes, I could make life changes.

Weaver: Did that work in the sense that in those early days at Utah State, you were often on academic probation?

Bushnell: Correct.

Weaver: Did this transfer to University of Utah work? In other words, were you on academic probation there?

Bushnell: It worked like a charm. I was able to take my deficit grade point and bring it back up. I didn't get great grades in college, however. I could do pretty well in fall quarter, winter quarter, but spring quarter, the amusement park was opening, and I had to take a lot of time off. A lot of times I ended up withdrawing from classes or getting straight F's in classes that I took in the spring because I just had to miss too much school. I probably shouldn't have gone to school in the spring quarter, but the draft board was constantly in my rear-view mirror.

Weaver: When you say the amusement park, was this the Lagoon?

Bushnell: Correct.

Weaver: When did your employment at Lagoon start? What did you experience at Lagoon? How did it affect you? How did it influence you?

Bushnell: I think I have to go back a little bit to the Campus Company. The Campus Company was my advertising company. It was an idea I had to make the campus blotter. It was a big sheet of paper and I sold advertising around a calendar of events in the middle. The economics were that I'd sell the advertising for about $3,000 and it cost me 500 to print, and I'd give them away free at every quarter. It started out that was what I was going to do in the summer. I was going to get it all sold and everything. Then I decided, "Nolan, you're weak and you're going to spend all the money that you make carousing around. Why don't you get a fun job?"

Understand, my mindset was that I was an entrepreneur, and the idea of going to work at an amusement park at a dollar an hour was anathema to me. That was just something that I thought, "Boy, what a sucker's job that would be." But I got past it by saying, "But I won't have to work—it'll keep me out of mischief." So, it was kind of a remediation move more than a financial planning move.

But then I got there and found out that I was good at it. I found out that if you made a quota, you got $1.25 an hour. And if you exceeded quota, you got 10 percent of everything you exceeded. All of a sudden I was averaging $2.25, which in those days, I mean, minimum wage was a buck, so it was okay for me. It was pretty good, and I was good enough—and I was a little bit older. Most of the kids that were working the booths such as Spill the Milk, Tip 'Em Over, Guess Your Weight and all that, they tended to be in late high school, early college. I was going into my sophomore year [in college]. That actually, first of all, gave me a lot of experience with dealing with people.

I also think that my debate experience in high school helped; I was a pretty hotshot debater. Learned how to speak extemporaneously, not be bashful, some would say be brash. Being a carnival barker, you learned brash in spades. So, I think that in that case—I was made assistant manager and then the following year I was made manager. All of a sudden I had 150 kids working for me. I was responsible for labor percentages and merchandise percentages and inventory control, theft control, mediation of disputes, and training.

I started thinking, "How can we make more money?" I started modifying the games to increase throughput or increase price. My boss was just—he'd just never seen anything like it. There was an Over-and-Under game where you had six balls roll down. I turned it into four balls. First week we did it, I increased revenue of that game by 28 percent. I did another one with a baseball game that we had that were basically modified coin-op games and took it to where instead of getting nine runs to win the prize, you only had to win six, same price, same payout, different time.

Guess Your Weight, before me, was one old pudgy guy that everybody thought was a character. I said, "No, let's put in hot girls." And during big days, I'd put sometimes six girls in the Guess Your Weight booth, and they'd all be going. Now because there'd be a certain amount of patter and conversation at one set of scales and then checking ID for dates and everything like that, Guess Your Weight was always probably in the middle tier of the earners. In one fell swoop, all of a sudden it was one of the top-earning games on the Midway. I mean, it stuck like that, and it was very rewarding to me.

But the most important thing was I had an arcade, the Midway Arcade, reporting to me. I understood how much each game was earning on a weekly basis. I knew how much each game cost. I started tracking for the first-time maintenance cost and downtime and did calculations of revenue per square foot. I calculated which games were the lowest earners per square foot and did the calculation of return on investment and said, "Why don't we get a better game? Let's buy something new."

My boss would always say, "Yes, increase the revenue of the arcades."

This was at the same time that I was playing games on the computer lab nights at the university. It was very easy for me to see that the games that were being played in Dr. Evans' labs, if you put a coin slot on it and put it in the amusement park, it would earn money. The costs, of course, were not in line. If you divided twenty-five cents for three minutes into a half-million-dollar computer, the math didn't work. I sort of spun that away and left it for another day.

Weaver: What did you do for fun in college? In other words, you're working a lot.

Bushnell: I'm working a lot.

Weaver: Right. Was it the carousing that you did before? Because it sounds as if you had matured. What were you doing for fun at University of Utah as opposed to Utah State?

Bushnell: I dated. I was looking for Mrs. Right. I was somewhat of a geek in that I really liked hanging out at the computer lab. I did a lot of what I'd call just hacking. In those days, it was punch cards. You had an account, so you could write a program in Fortran [Laughs.] and turn it in and they'd run it for you, no charge. That's kind of where I polished my programming skills a lot.

            The other thing was I did some spelunking. There are a lot of limestone caves up in the mountains behind the university, and that was an avocation in the summer. Of course, winter skiing, and I became an avid skier. The wonderful thing about going to school at the University of Utah in engineering is I'd set all my labs for Tuesday and Thursday mornings and wear my ski clothes to school. I could be on the slopes, skis on, in line for half-day pass, which you could buy for a buck, at 1:00 o'clock when half-day pass went on. All winter long I would ski three days a week. I would generally ski Tuesdays, Thursdays, and Sundays. I always did Sundays because the Mormons weren't there, and so the lift lines were shorter. [Laughs.]

Weaver: I heard, or I think I read, that you once turned your frat house into a living pinball machine.

Bushnell: That's correct. I actually did. It's funny. We won the house decorations twice in a row. I was house decoration chairman both times. One time, I turned it into a pinball machine. It was nothing more than a soccer ball painted silver that was rolling down ramps. It would hit a light switch that turned on a bumper that said "Go" and it went down to the other one, "Fight," "Win," "USU," "Rah, rah, sis, boom, bah," and that was the whole idea and then it would repeat. It won first place.

            The following year, I did a high striker with a great big thing, and the puck would go up and it would light up "Go," "Fight," "Win." That was kind of the thing that you tried to do. Then when it hit the top, "USU, ha, ha, ha," what have you.

Weaver: And you used your frat brothers as bumpers and things like that?

Bushnell: Absolutely.

Weaver: I see. Okay.

Bushnell: My worst escapade, the biggest failure, was when I was social chairman for the yard party. The idea was you would go down and buy a bolt of cloth of weird ugly fabric, something that could not be duplicated. Then you would give all your fraternity brothers exactly one yard, and you and your date were required to make your beach outfit out of that yard, so there wasn't a lot of material there. To make it really authentic, I decided we'd get a couple truckloads of sand and cover the chapter room floor with about three inches of sand, beach umbrellas, and what have you. The Beach Boys were really important at that time, and so we thought that it'd be a great thing to have a summer vacation in the middle of Utah State winters, which were regularly ten below zero. The whole idea of having that, everything's wonderful until we started dancing. The sand, I didn't understand enough about sand, which was strange because I'd been in the cement business, but you can get washed sand and unwashed sand. I got unwashed sand because it was cheaper, but it was dusty, and all of a sudden there was dust, all that. And we had a couple kegs, so people started putting beer on the thing to take the dust down. It turned into a muddy nightmare. The whole fraternity house was just a disaster from then. Thank God for pledges, or we'd have never got it clean. It reminded me of the old Walrus and the Carpenter. "If seven maids with seven mops swept it for half a year, do you ever think they could ever get it clear?"

            "I doubt it," said the Walrus, and he shed a bitter tear. [Laughs.]

Weaver: You stayed in college until 1968?

Bushnell: Yeah, '68.

Weaver: So that was a seven-year college stint.

Bushnell: Correct.

Weaver: I'm assuming that your reasons were work and play.

Bushnell: Work and play. But it was more than that. I had changed majors several times. When I was having trouble in engineering, I decided, well, all the guys that were drinking beer with me and carousing around, they were in easier things. They were either in business or what have you. I did a couple of quarters in business. I really loved economics and I did a lot of that. I even did a quarter in mathematics, because I was always really good at math. I think I was in non-engineering majors for probably four quarters, almost a full year and a half. But when I look back on it, in my business life, what I learned in those other

dalliances, I think, ended up being important. It's like my engineering degree gave me the key, but the business courses, like patent law, business law, and accounting [were crucial]. I had two accounting classes. I knew how to do the books so my other businesses, I actually had a proper set of books. I didn't do just shoebox accounting. Maybe my beer drinking driving me to these other things was a blessing, in the final analysis.

Weaver: Well, it's interesting, because this was also when you were at Lagoon, right?

Bushnell: Correct.

Weaver: You had an opportunity to have sort of a work-study?

Bushnell: No question about it. In fact, I've often said that my experience at Lagoon was my MBA, I mean in hard knocks. I mean, my boss was tough but fair. He loved me because he valued outcomes. It was actually interesting. When I graduated, I had another breakpoint that came very, very close to going the other way. I had job offers all over the nation for a lot of money to stay in the game business. Marriott was just opening up their park in Chicago. I think that my job offer from Ampex was $875 a month, and I had a job offer from Marriott for $1,200 a month. I was married at the time, I had a daughter, and that extra money seemed really important. But I had this feeling that I always had that pedigree of amusement park behind me that was somewhat evergreen, whereas a new electrical engineering degree, I felt it had a half-life because technology was starting to move very quickly.

Weaver: Let's go backwards for a second in terms of the engineering degree. After you sort of changed your major and then came back to electrical engineering. Your final degree, if I remember correctly, was in computer design?

Bushnell: It was computer design major, but my real passion at the time was speech recognition. My bachelor's thesis was on speech recognition and I did some work on that.

Weaver: Go into that for just a little bit, because in the later 1960s, speech recognition, to say that it was in its infancy would be an understatement.

Bushnell: Would be an understatement. In fact, I can say this with great humility. The approach I was making was so wrong. [Laughs.] I mean, it was absolutely wrong. I mean, it could distinguish between a fart and a whistle, and that's about it. [Laughs.]

Weaver: Was there anybody even there at the time who understood what your thesis would have been? In other words, how did you even get interested, for instance, in synthetic speech or speech parsers at a time when the technology was nonexistent?

Bushnell: It was one of those things that I was really just fascinated by. As you can tell, I kind of deep dive on things. I get interested in something and then I get bored by it and then I deep dive in something else. It was one of my deep dives at about the time you had to decide what your thesis was going to be.

Weaver: You were more of a hardware engineer than a software engineer in terms of your areas of concentration?

Bushnell: My formal training was definitely biased heavily towards hardware, though I knew my way around Fortran pretty well, but I wouldn't ever say that I was a savant in software.

Weaver: Did you ever have a chance at that time to utilize the slightly higher-level languages like early C or PL/I [Programming Language One]?[2]

Bushnell: Not at all. No. In fact, I had never heard of C. I mean, remember this was 1967, 1968. Was C around then?

Weaver: I was curious in terms of University of Utah, how sophisticated the software department was. You couldn't even get a computer science degree. That's why you got an electrical engineering, right?

Bushnell: Exactly.

Weaver: Because a computer science degree did not exist, right?

Bushnell: Did not exist.

Weaver: Right. Okay.

Bushnell: I feel like I was hearing about Lisp [LISt Processor] and Unix. Unix was around at the time, I think, BSD [Berkley Software Distribution] Unix.[3]

Weaver: Yeah, ALGOL [Algorithmic Language] for sure, and Lisp, Unix a little later.

Bushnell: Okay. Oh, ALGOL. I learned a little ALGOL.

Weaver: Right. Well, so when you talk about, for instance, speech parsing—and I'm assuming you were on the hardware side of that.

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[2] C was originally developed at Bell Labs by Dennis Ritchie between 1972 and 1973 to support utilities running on Unix. The PL/I language was first specified in detail in the manual "PL/I Language Specifications. C28-6571" written in New York from 1965.

[3] The Unix operating system dates back to the mid-1960s when the Massachusetts Institute of Technology, Bell Labs, and General Electric were developing Multics, a time-sharing operating system for the GE-645 mainframe computer.

Bushnell: Absolutely.

Weaver: Right, because the software side probably would have been Lisp.

Bushnell: Yeah.

Weaver: And that wouldn't have done it, either, because it would have had to have been Bayesian and other things, right?

Bushnell: But this was pre-microprocessor, so you couldn't even get next to a computer for less than twenty-grand at that time.

Weaver: Well, this was also really discreet, right? This was a time when you were not even a TTL [transistor-transistor logic]—

Bushnell: Exactly.

Weaver: Right? And we're going to get to that, but I think it's important in terms of the context. Looking back, everything tends to compress. That's why I wanted to make sure that we were talking about your early days in the sixties when computers were so amazingly underpowered. If you had 1 or 2K of computer memory, you were doing well. Right?

Bushnell: Yeah.

Weaver: And that your principal areas of interest were really in the hardware and not the software.

Bushnell: Yeah.

Weaver: You graduate with a degree from the University of Utah, an electrical engineering degree...

Bushnell: I've got to tell one story about that, if I may. One of my core skillsets is being an anarchist [Laughs.]. My belief has always been that any bureaucracy can be beaten and that doing things the normal way can always be exceeded. When we were getting ready to graduate, everybody was sort of going around talking about they had recruiters coming on campus, people were getting job offers. And at the time, I was the bottom of the class. I was 186 out of 187. You know, I was number 186 out of 186. I was the bottom of my engineering class. So, I went into the placement place and the guy who was there looked and my grade point and everything. He says, "Well, you're kind of going to have to settle." Well, them's fightin' words to me, you know. You just don't settle. You redesign the thing so that you are number one.

              I knew what the highest start—what the "A" student's job offers were. I just went to California over the Thanksgiving break and stayed with my wife's sister, who

was living in Saratoga, California, and I papered the landscape with my résumé. Did a little puffery, per chance, and asked for $25 a month more than the highest [start]. I got two job offers and I accepted one of them. I sort of took it back and did the, "Nah, nah, nah, nah, nah, nah." [Laughs.] And I'm sorry, but you just have to do that when you're me. I mean, I have to do that. There was absolutely no question that I was going to get the highest starting salary, because it was a contest and I was going to win, even if I had to cheat.

Weaver: [Laughs.] Okay. Let me pull back from that. Is that how you went to California?

Bushnell: Yeah.

Weaver: It wasn't because of *Go*[4] competitions? Oh, very interesting. So, all right, let's go there, because the research is wrong.

Bushnell: Oh, yeah. Well, now let's back up and let's just go down the *Go* thread a little bit.

I played number-two board in the Chess Club at the University of Utah, and the guy that was number-one board, who I could never beat—I was a pretty good chess player—was a Korean. And one day after he'd demolished me yet again, he says, "Want me to show you a better game?"

I said, "Better game? Come on."

And he showed me how to play *Go,* and I was mesmerized. I went to the library, I found there were a couple of books on *Go.* I checked them out and went through them and what have you. I told my wife about it, and, in Utah, she was able to find a *Go* set and *Go* stones and gave it to me for Christmas. So, I played with a couple of my neighbors, unsatisfactorily.

And that Christmas holiday, we went to California, discovered there was a *Go* club in San Francisco. Then one that met at the Tresidder Union on Wednesday at Stanford. Then there was another one at the Buddhist church in Mountain View on Thursday night. When I was working Sunday mornings, I would get up at 8:00 o'clock, I would be in San Francisco by 9:00, start playing *Go,* and leave about 3:00. That was kind of my pathway.

Then one night at the Stanford *Go* Club I met Jim Stein. We got to be really good friends and played [each other]. He was working at the AI Lab at Stanford and he reintroduced me to *Spacewar!*.

Weaver: Okay. So that's fascinating. In terms of this issue, I want to go into the *Go* thing for a minute, because what you just said obviously is very interesting, because

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[4] *Go* is an abstract strategy board game for two players which originated in east Asia, in which the aim is to surround more territory than the opponent.

now we know how you were introduced to the SAIL [Stanford Artificial Intelligence Laboratory] lab, right? That's kind of where I want to go now for a minute.

Bushnell: Cool.

Weaver: So, Nolan, this fascination with *Go*, you've said in the past here that you had sort of a deep but mercurial interest in things, right—

Bushnell: Yes.

Weaver: —it was sort of a sine wave of interest, and *Go* basically became fascinating to you, I guess even more than chess.

Bushnell: Correct.

Weaver: So, just briefly and then lead into Stanford, what was it about *Go* that so captured you?

Bushnell: There were two or three things that really fascinated me about *Go*. It was the game itself, which was what I've come to believe as the highest figure of merit of gameplay. That is, you take the rule set and you divide it into the richness of the game. With *Go*, it's *massively* simple, and yet the complexity of the actual game is astounding. In some ways, if you look at business as a game, the rules are quite simple or they're complex. In a lot of societies, it's simple. You buy low and sell high [Laughs.] and you keep score with money. It's pretty simple game dynamics. In some ways, war is the same thing. You know, you want to take the other guy's stuff, and you throw your whole economy behind it. It's massive complex in execution, but the objectives are actually quite simple, and while there should be a lot of rules about war, like you should never have them, from a game construct, it's very simple.

              The other thing about Go, when I was learning it, it had a tremendous amount of Japanese culture associated with it. There was this book that I got that was called the *Go Proverbs*. *Go*, unlike chess or unlike almost any Western game, has an elegance in which the best win is by a half a point, not by 100 points. *Go* is about building walls one stone at a time. You only get points for the vacant squares that you surround, so therefore there is a thing about if you try to surround too much area, by definition your walls are weak, and sometimes you can be invaded from the inside. If you build too strong walls, you can't surround enough territory. So, it's this game of balance which is very Asian and Buddhist in concept. [It was] the philosophy of the game I became fascinated by. It is also a game that it reflects your mental state to a very high degree. Meaning that I moved from being a four-Q to a shodan without playing a single game, but by getting my life in order. I basically learned a lot of things, and I think I became intellectually healthier and it automatically displayed itself in my game skill. Now, that's cool. [Laughs.]

Weaver: Did marriage also do that for you?

Bushnell: Yeah.

Weaver: Both marriages? You were married twice.

Bushnell: Yeah.

Weaver: So just stepping into that for a minute, Paula was your first wife.

Bushnell: Correct.

Weaver: Now you're married to Nancy. I mean, obviously I don't want to tell your story, but were there similarities and differences in terms of how it affected you, given the different times in your life? Because if I remember correctly, the difference between your divorce, which we'll get to later because it's not in your best times, was only one year, right?

Bushnell: No. I think I was separated for three years.

Weaver: Right, right, but the actual granting the divorce.

Bushnell: You know, I don't have any recollection of when that was.

Weaver: Oh, okay. I think it was only one year.

Bushnell: Okay.

Weaver: Right. Interesting. Okay. We can go back to that, but I was just interested in terms of *Go* matured you, Lagoon matured you, your wives matured you.

Bushnell: Absolutely.

Weaver: These were almost like external things that you put in place because you knew you needed boundaries.

Bushnell: Yeah.

Weaver: Right? Is that fair?

Bushnell: It's a very fair statement, because I am not a moderate person. [Laughs.] You know? I've always felt that I'm out there on the 2-sigma-, sometimes 3-sigma-activity world. [Laughs.]

Weaver: So just briefly, I heard that you wanted always to have been an Imagineer at Disney.

Bushnell: When I came close to graduating, I wanted to be an Imagineer, I wanted to work for Disney, and I felt that it was probably the only place in the world where I could combine my electrical engineering degree and my amusement park experience.

Weaver: You never did become an Imagineer, right?

Bushnell: They didn't want me. I had for years, and I've lost it since, but I had a wonderful turndown letter. They said they weren't hiring at the time, but that was bullshit. They just didn't know how good I was. [Laughs.]

Weaver: But later on, you were going to prove them wrong.

Bushnell: I don't think that was a big part of what I was doing. I just assume that big companies are going to screw up, so I wasn't necessarily surprised.

Weaver: When you decided to go into business, you were already in California, but you chose the Bay Area. You chose the Silicon Valley area in your search for employment, right?

Bushnell: Correct.

Weaver: Why?

Bushnell: There were three reasons and I'm not sure I can list them in order. I knew that Silicon [Valley] was the future, and when you want to join the kingdom, you want to sit on the right hand of the king. I felt that was Intel, AMD [Advanced Micro Devices], and Fairchild. Second, I had really developed some respect for Stanford pretty much through Dr. Evans at the university, who spoke very highly of it, even though he was a Berkeley guy. And the third was my wife's sister lived in Saratoga so we had free housing until we could find an apartment. [Laughs.] And we had a little girl at the time, and so being next to a sister, there were some babysitting issues and things like that. Probably the proximity of her sister was equally important to the other things.

Weaver: Okay. Let me ask a question that's going to get into the next part. You mentioned AMD and Fairchild, for instance. Why Ampex?

Bushnell: They offered me the most money. Ampex offered me the most money. They hit my goal of making $25 a month more than the best engineer.

Weaver: And what part of Ampex did you work?

Bushnell: It was Videofile Division. Ampex was the inventor of the videotape recorder. What they wanted to do was use that technology, because compared to regular audiotape and the tapes that were even being used for computers, videotape held data at a ratio almost 50-to-1. It was data storage that was just massive at the time.

It was the first time anybody ever heard of a terabit. Now you buy terabit drives like it's going out of style. In those days, there was this idea that you could do a terabit of data storage on videotape in an area about the size of a good-sized house with refrigerators and air conditioning offsite and all that stuff. But one of the problems was that data, unlike video, needed to be accurate, and videotape, any tape, has a coating of iron oxide on a substrate. That coating often has pits and blemishes which cause a dropout. Not a big problem with audio. Sometimes it's a pop, snow in video, destruction of data in the data world. I was there to create algorithms and hardware that brought the error rate to less than 1×10^{-6}. That's to the 26th decimal place. And we accomplished that.

Weaver: Was Kurt Wallace a boss or a mentor?

Bushnell: Yes. He was my boss and a mentor.

Weaver: And how did that affect you?

Bushnell: Well, first of all, he was British, British-trained, still had a British accent. He was a very, very good person who loved mathematics and was able to explain technical problems in the language of mathematics, which really appealed to my sensibilities. It was also an area where, prior to Ampex, I had taken a class in formal logic and Boolean algebra and things like that, but I didn't get it in my gut. He introduced me to the TTL logic set. That was where I really developed the skills to understand from a very flip-flop AND gate, NOR gate aspect computer hardware.[5]

And, you know, there's a really big difference between an abstractive layer of understanding and a physical layer of understanding. I think that a lot of people say you can't really understand something until you teach it. I think you can also say you don't really understand something until you can build it. Then once you deal with just building something that somebody else has built and then from there modify it—and that is really one of the areas where I think that teaching, for me, is a really high art if you can figure out the right breakpoints. For my kids, I took them from playing video games to modifying video games with a level editor and things like that. I don't know if you remember *Doom*, the *Doom* mods, and some of those things.

What's really fun is to see your kids at the dawn of realization of control. I experienced that with virtually all my kids with *Doom* mods. For those of you who don't know what a *Doom* mod is, it's a level editor that is extremely powerful at a time when everything was hard. You could not only populate a cavern with different resources and weapons and health packs, but you could change the outline of the dungeon. You could take a piece of art and attach it to the walls in this virtual space. All of a sudden they say, "Well, a piece of art. What about a picture of me? Can I put my picture on the wall?" Yeah, you can.

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[5] The AND gate and NOR gate are a basic digital logic gates that implements logical conjunction in a circuit.

All of a sudden, playing *Doom* was not nearly as much fun for them as building that. My kids, because we had a big house and we had a network before anybody had a household network, could play these massive multiplayer *Doom* games in which they'd have ten of their friends over after school. Of course, the network would crash, and I'd get the systems operation telephone call. After a couple of times, I told them what to do and they'd get the network back up. Then I'd say, "I'm not taking this call anymore. You're going to have to figure it out yourself." And, of course, they did. That self-reliance at kids ten years old, eight years old, twelve years old, playing games, being responsible for the hardware, being able to modify the software, I think that was a breakpoint for my kids who are all heavily involved in technology. A couple of my kids are world-class programmers, and I believe that they're that because they were exposed to a breakpoint in their learning at an appropriate time. I've always said video games are really the training wheels of computer literacy, and that I know of no good computer designer, programmer that's not an avid gamer.

Weaver: Let's go back for a minute to Ampex. When you were early on there, I believe it was your boss, Kurt Wallace, who had you share an office with Ted Dabney.

Bushnell: Correct.

Weaver: Was that the first time that you met Ted Dabney?

Bushnell: Very first time.

Weaver: And he became, I believe, your future business partner.

Bushnell: That's correct.

Weaver: As best you can, what were your first impressions of Ted when you were in the office? And did you guys become social friends?

Bushnell: Ted and I became fast and good friends. Ted was a guy who got his technical training in the Navy and was very good hands-on and he really understood monitors to a much higher level than I did. For example, my TV repair business was really, when I look back on it, pretty pedestrian. I was a tube swapper. But if it was something where a capacitor or a resistor had gone out under the chassis, that was not my meat. Ted could go in and he could—that was his meat. He could do that standing on his head.

When it became time for me to build the technology, for us to build the technology, there were two or three constraints. Vector graphic monitors at the time cost about ten thousand, twenty thousand dollars, so I knew that vector graphics was out. You could buy a 12-inch portable TV for eighty bucks, and so I said, "Okay. I know that we have to make this thing work on an eighty-buck TV, economically, so we're not even going to explore any other aspect. It has to be a commercial TV because it has mass production."

My first thread was that we were going to buy a Data General Nova 800, and it had a blistering clock speed of 800 kilohertz. The idea was that I knew that the machine had to sell for under $1,500 per coin slot to make it work. In my mind the—I think we got the quote of a stripped-down NOVA 800 for 3,500 bucks. So, I said, "There has to be four monitors timeshared." [Laughs.] When I think about this 800-kilohertz timesharing now, I was delusional. Oftentimes when you start out delusional and you just keep solving problems, pretty soon the delusion is less delusional.

This all happened probably around July of 1969. I started working on the interface logic, the thing that would take the raw data from the minicomputer and give it in video form to the monitors. I just kept running out of time. There was just not enough compute power. But my solution for that was I would take over certain aspects and just do it in hardware, because another thing about right timing is the TTL Caterpillar chips that were the logic building blocks of flip-flops, AND gates, OR gates, decoders, what have you, had just dropped in price by two orders of magnitude. What used to be fifty bucks to do a flip-flop was now fifteen cents. Talk about right timing. It was really great. Doing little circuits using digital logic and Boolean algebra, it was trivial. I mean, it was very cost-effective.

The first thing I did is I took over the star field, which was part of the space, the background. Then I did the score, in which I just decoded a certain segment of the screen. Maybe I should back up. I started out knowing that the computer had to be crystal-controlled so that we would have a clock speed that was equivalent to the horizontal position of the raster, and so I determined that we would have an active screen area of 256-by-256, 256 pixels horizontally, 256 pixels vertically. So that just turned out to be eight bits. [Laughs.] So, I had eight-bit counters horizontally, eight-bit counters vertically, and it just worked. It worked out.

The first thing you do is you get the TV set to conform and show raster. Then you decode a pixel and you make it bright. Then you decode another pixel and you make it bright somewhere else. That was all working really nicely. Then the idea was once you could make a pixel bright somewhere, that the minicomputer would spit those coordinates out to you into eight-bit bytes. Then you can change it and what have you. That was where all of a sudden the wheels came off. [Laughs.] I just couldn't get enough pixels out of the computer to do a rocket ship, let alone two rocket ships or a rocket ship and a flying saucer. Then add on to it the calculations of a missile and whether the missile could intersect this other item and track and have velocity and angle. I couldn't get the math to work for one monitor, let alone four at the same time, and at that point, I abandoned the project.

This was over the Thanksgiving holidays. My idea was I was going to finish the design over the Thanksgiving holidays. I started literally Wednesday night and got up on Thanksgiving Day, worked all morning. Before dinner at 3:00, I

abandoned the project. I say, "Time's not right. Math doesn't work." I don't know whether it was the tryptophan of the turkey dinner or what have you, but you always do this after Thanksgiving dinner, you always lay down and have a nap. During my nap, my hind mind came up with the solution.

Screw the minicomputer. Get rid of it. Do it all in hardware. Make the game out of this collection, just make it a simple state machine. And the minute that happened, it was like knife through butter. Not only did I get the cost down, but what was budgeted for $1,500 worth of minicomputer, the whole damn computer cost me less than $300 in glue parts. So, I knew that I had something.

Weaver: Going back for a minute, you had said that when you first met Ted Dabney, that Ted had been the guy who would go beneath the tubes, for instance, right?

Bushnell: Right.

Weaver: And we skipped around a little bit chronologically in terms of setting the stage for obviously what was going to later become *Computer Space*.

Bushnell: Right.

Weaver: Just to put us into the context, you're at Ampex, you're a relatively new employee. You've just met Ted—

Bushnell: Not then. I'd been at Ampex a year and a half.

Weaver: Right, right. But when you met Ted.

Bushnell: Oh, when I met Ted. Right.

Weaver: We were talking initially about social relationships with Ted. When you were talking about the *Computer Space* game, were you playing *Spacewar!* at this time at SAIL, at Stanford?

Bushnell: No. Well, yes. I was playing *Go* at Stanford.

Weaver: Playing *Go* at Stanford. Okay.

Bushnell: To get the timeline accurate—perhaps there's one more step—one of the things that I had to do was do a lot of testing of the machine. I had to create a little state machine. I think this is meaningful, because I designed this state machine out of glue logic that would essentially run this videotape recorder thousands of cycles. I could leave it running all weekend, and then I'd come back, and I'd get all kinds of data of how good we were able to get this error rate down. When you're talking about 10^{-26}, that's a lot of stuff. You have to get a lot of statistical data in order to prove the efficacy of what you're doing. My engineering lab book at the time just had page after page after page after page after nauseating page of data

[Laughs.] and calculations, because you had to show your work and all that stuff. To streamline it, I had to build this little controller that actually could allow this to run this tape recorder all night. A lot of the design skills that I developed in building that controller I now pull over into doing the state machine for the video game.

Weaver: Just to clarify, when you talk about the statistical data, etc., your job or some portion of it sounds to be that you were attempting statistically to lower the bit error rate, the BER. Correct?

Bushnell: Precisely. What my job was to lower the error rate and simultaneously record and accurately play back data at six megabits a second, which was *blinding* fast. I mean, it was the fastest in the world. If there were *Guinness Books of World Record of Data Recording and Retrieval,* I would have won it hands down. [Laughs.]

Weaver: By the way, in terms of a context, why was this important at Ampex? What did Ampex do that this was so important to them?

Bushnell: Ampex had a contract with the Los Angeles Police Department. The Los Angeles Police Department wanted to have a giant database of every criminal, fingerprints, mug shots, that had ever been through the system to accurately and quickly retrieve it within I think it was two minutes, which was blinding fast in those days. The primary record locator was Social Security number, and so all of us, we had a little hidden file in the code so that if it ever hit our Social Security number, it would erase our file. [Laughter.] We were engineers. Never know when that might be valuable. [Laughs.]

Weaver: What other relationships at Ampex besides Ted Dabney became important to you and that you maintained?

Bushnell: Oh, literally probably 100. Probably to start, Larry Bryan, who was head of the software group of the Videofile System. He was really a good guy and smart as a whip and really good. Larry Emmons, who was one of the project managers in my department. Steve Mayer, who was a project manager there.

But probably the most important was Al Alcorn and Steve Bristow. Now, Steve Bristow and Al Alcorn were direct reports to me. They were students at Berkeley in the engineering department in the work-study program. The way they worked it is they wanted actual hands-on experience in industry. Al was a senior, Bristow was a junior in electrical engineering, and they Ping-Pong-ed each other. They would come for six months. Bristow would come and do his six months, then I'd get Alcorn back. I just really got a lot of respect for both of them. They were both just smart as a whip and really practical in a lot of things.

When Ted and I broke away, our first hire was Alcorn. Bristow actually came to work at Nutting when I left. The company [Syzygy] wasn't really formed until

probably Christmas of that year. I'd pretty much got the existence proof that we could hit the financial targets, but I hadn't figured out the circuitry for rotating the rocket ships yet. There were a lot of holes in my design. I decided that the next phase was to actually build it, because this was all on paper at this point.

Weaver: What year was this?

Bushnell: 1969.

Weaver: Oh, okay.

Bushnell: When it came to getting it started, I knew that I needed to get a good modified monitor, I needed to start getting glue parts, a wire wrap gun, just stuff, and so I said, "Gee, I need some help."

When we got back from the Christmas holidays at Ampex, I said, "Ted, do you want to be part of my company?"

He said, "What?" [Laughs.]

I said, "Well, we'll be equal partners. We'll go off and link arms and do this wonderful thing." I'd been talking about *Computer Space*, and Ted hadn't seen it yet.

We agreed to each put in $250. You know what? There's a disconnect here, because I asked Larry Bryan to be part of the company. I think I decided that we were going to do the company before Thanksgiving, because Larry Bryan was part of it when I was still playing with the computer. Larry hadn't put his money in, but Ted had. Once we had eliminated the computer, we didn't need Larry anymore. [Laughs.] The fact that he hadn't put his money in, that was just like a godsend because I didn't have to let him down quietly.

We worked on that and we maybe—I'm trying—I have this distinct recollection of Ted bringing the TV over. I had kicked my daughter out of her bedroom and turned it into a lab. I have this distinct recollection of us putting it all together and getting the spot moving around. A week later we had just a rocket ship that'd go up and down and that's about it, at a velocity. Yeah. So, we were making progress all through this period.

Then there is the January dentist appointment. The January dentist appointment was a breakpoint or a happy coincidence that I describe my project to my dentist halfway with cotton in my mouth. [Laughs.] He said, "Hey, one of my other patients works at a coin-operated game company in Mountain View."

I said, "Give me his number."

And I called Dave Ralston, who was the guy, and he was the head of marketing for Nutting Associates. I called him up, described what it was. He came over and he saw it, asked me can we bring this over to his place. I said, "Yeah," and I brought over, set it up in the conference room. They really liked it. I said, "Can your engineer do it?"

He said, "Well, he just quit." But I didn't realize they just fired the guy. [Laughs.] And so, they didn't have an engineering department. They had a room that was the engineering department, but there were no people in it.

I thought to myself, "Okay. They've had a chief engineer in here. I'll come in as chief engineer."

They said, "What's your salary expectation?"

I said, "I'm really expensive."

They said, "Well, I think we can afford you."

I told them exactly double what I was making, and they said, "Yeah, we can do that." They said it too fast. Being an old carney guy, I know when I've got somebody on the hook, on the line. I said, "And a company car." And I got both. [Laughs.]

It's one of those things where you walk out of a place and you kind of pinch yourself and you say, "This is happening too good and too easy." All of a sudden, after a year and a half, I'd gotten a job offer that was more, by a significant amount, with royalties on top of it for the product. It was higher than the job I could have taken if I'd stayed in the amusement park business. It was like a vindication.

But then I come home, I tell my wife what my new salary is and all that. She looked at me, "Was that a good thing?"

I said, "It's double my salary. Yeah, it's a good thing."

She said, "But are they a real company? I mean, they're not like Ampex."

I said, "No, they're smaller, but they're a company."

"Well, okay."

Instead of throwing confetti and popping champagne corks, I was just kind of amazed. In a way, that was kind of the beginning of the end of our relationship, looking back on it now. One of the things that I knew I needed is that kind of support. I mean, if you're not celebrating the same things, what's in it? There was one other thing with a trip to Germany, but that's another story. I guess what

we do in life is very much a question of what your appetite for risk is, and my appetite for risk was extremely high and my wife's appetite for risk was very low. I hadn't really recognized that, because when we first came to California, every weekend we'd be out somewhere. We explored everyplace from Mount Lassen to the Gold Country to Mendocino to the Central Valley. We went everywhere, and it was great fun to really explore all the time, because we were there. It was a new state and we'd never been there before. Fisherman's Wharf and the pier in Santa Cruz. It was a great adventure. But when it came to life choices, that's where the adventure stopped.

Weaver: Nolan, I'd like to take you back just for a moment. You told me that you had basically kicked your daughter out of the bedroom and taken over her bedroom and turned it into a mini lab. What were Ted's responsibilities at this early juncture on *Computer Space*? Did he do something similar?

Bushnell: I think so. I think he had a daughter that was roughly the same age as Alissa. I think he possibly did the same thing. I don't remember, because whenever we would marry the computer and the monitor, he would bring the monitor over to my house and we'd put everything together there. I never, ever took the computer over to his house, so I never saw his lab. It's a blank spot for me.

Weaver: That was sort of the division of responsibilities in terms of when you were creating *Computer Space*— that he worked on monitor and related issues and you worked on—

Bushnell: Correct. Ted was a very good craftsman. He was responsible for the cabinetry, the mechanical design, how we would connect the coin slot, and the mounting of the buttons. It was kind of hardware mechanical, the physical stuff. I was the computer; he was the monitor and the hardware. For example, when we got to the point of doing the cabinet, I thought it'd be cool to do it in fiberglass. I had molded this thing on my kitchen table out of modeling clay. He took that to a boat manufacturer and got it scaled up. You know, really clever. If you're going to do fiberglass, who does fiberglass? Well, a boat manufacturer. [Laughs.]

Weaver: Where did that cabinet idea come from? Just you, from your head?

Bushnell: Yeah.

Weaver: Why don't you describe the cabinet and how you came up with it.

Bushnell: I wanted to be spacy. I wanted to be different. I needed a vertical side in this thing so that I could mount the coin mech, because the coin mech had to be straight up and down with a coin return and all that sort of stuff. I offset the control panel so that you were not quite straight in front of the screen. I thought it added a lot of panache to the design. I mean, I thought it was an elegant design. I was so proud of it. It was really good, but when I saw it blown up, it was even better! It was bright yellow, and it was just really magical. I can remember looking

at it and saying, "This looks like it came from a real company." [Laughs.] Not thinking that we were building something from a real company. Anyway—

Weaver: At this point it was young engineers, bootstrapped, seat of the pants?

Bushnell: Not anymore. Well, it was up until Nutting. Now, Nutting didn't want to bring Ted over yet and Ted didn't want to move yet. I'd kind of maybe stomped on him a little bit because I got the chief engineer spot. If he was going to be just an engineer at Nutting, he'd be making less than me, which was less than he was making at Ampex. There was an economic conundrum there. But every night, Ted would be there helping me. I would work on a couple of Nutting projects. I had to finish up a couple of their other projects as well, and then I worked on Computer Space with Ted all night, till about midnight, 1:00 o'clock.

Weaver: You were now at Nutting; Ted was still at Ampex.

Bushnell: Correct.

Weaver: Did Ampex know that during this transition you were building this new technology or this new game? In other words, how did it end with Ampex? How did you transition from one to the other?

Bushnell: Well, after I got the job offer, we agreed on a start date. I gave two weeks' notice to Kurt. Kurt says, "You know, I expected it." He says, "I knew you weren't going to stay here that long." He says, "You've got too much of an itch." I hadn't realized I'd described an itch to him, but he said—and I remember this in the exit interview— he says, "You've got to promise me one thing. Offer me a job," which later on I did. [Laughs.]

Weaver: In fact, the names that you mentioned previously about five minutes ago, Larry Emmons and the rest, you employed at one time or another virtually every one of these people, didn't you?

Bushnell: Absolutely. Plus, Kurt Russell, who ended up running the whole purchasing department. He had purchasing job at Ampex and he came. There was a real benefit [with our connection to Ampex], because Ampex was going through a rough patch just at the time that Atari was on the acceleration. I became the first stop if they got laid off or got afraid of being laid off. We even hired the plant nurse from Ampex. She became head of our HR and plant nurse at Atari. [Laughs.]

Weaver: Had you known of Nutting before they offered you a job? In other words, Nutting made some sort of a quiz game, didn't they?

Bushnell: I had no knowledge of them whatsoever. I don't even think we ever had one of their machines in my arcades at Lagoon.

Weaver: Interesting. What exactly was the relationship between Nutting and Syzygy?

Bushnell: Syzygy was the company that we founded that was the recipient of the royalties. And we never anticipated that we were going to be in the coin-op manufacturing business. That was a little bit too crazy for us, because we had no money. I mean, we started the company with $250 each. We had had a blistering startup capital of $500. Our plan was that we were going to be a studio. We were going to design products and get royalties [for ourselves] and to the other guys, and we were going to be happy. Well, we got to deal with Nutting, got close to them, and realized that they were really a bunch of bozos. I've often said that Silicon Valley is Silicon Valley because if you work there for a couple of years, there's a high probability that you're working for a company and your boss is an idiot. What having a boss as an idiot gives you is confidence to believe that you can go do it yourself and you're at least not going to make the mistakes that bozo did. Then I joke and say, "Well, Steve Jobs worked for me, and so I was his bozo." [Laughs.]

Weaver: There were no other engineers at Nutting when you first came?

Bushnell: None.

Weaver: Is that why they made you the chief? Everybody had gone?

Bushnell: The engineering lab was empty.

Weaver: How many things did Nutting give you to do that you had to do because you were now their chief engineer? How did that affect *Computer Space* in terms of your separate company that you had with Ted?

Bushnell: It turns out that it was kind of lucky, because my half-credit class in business law taught me about things like shop right [patent law] and various things. In crafting the royalty agreement, I made sure that the fact that they were hiring me to work on things did not give them a right to the video game technology. I carved that out and kept it [separate]. They wanted to do a quiz machine for dentist offices, which was a small, countertop. It had to be very, very low cost. I was working on that during the day. They also had this thing called an ESP machine, which was stupid, but they wanted me to do it.

                But we knew that we had to have the product ready for the fall AMOA [Amusement and Music Operators of America] show. That was kind of a hard deadline, because that was in the time when there was only one trade show for the coin-op business, and it was in the fall. I think it was October 15th or so, or something like that. As it got close, I still had some problems. It was mostly about board layout. We had a "works-like" prototype and we had one cabinet. [This was in] August. At that time, it took two weeks to ship things from California to Chicago, so we knew when we had to ship it in order to get it there.

We built the four and got them going. We got all dressed up, went to Chicago, and had our first thing. We opened up the boxes and every one of the monitors had broken loose in shipping and were down in the bottom. We thought, "We are really hosed." Well, Ted and I, twenty-four hours before the show opened, we had these four units that were totally trashed. We basically did an all-nighter and were able to get three of them working. The fourth one had broken the neck off the back of the monitor. We decided, okay, that'll be the one that we will turn around and we'll have the backdoor open so they can see what it's like on the inside. The show opened and it looked like we knew what we were doing. Of course, we didn't, but fake it till you make it.

Weaver: What was the response at AMOA?

Bushnell: Puzzlement. Nobody had ever seen anything like it. Some of the people said, "Well, the people in my arcade, they'll steal the TVs." [Laughs.]

And others said, "Well, it looks like this thing is touch-typing. Are people going to do it?"

Probably during the month of August we'd taken the one machine that we had, the working prototype, and put it in the Dutch Goose, which was a bar adjacent to—and it's still there—adjacent to Stanford. It's what we call a false positive. It made a lot of money because all the people that went there were Stanford students and a lot of them were engineers. The whole idea of Newton's second law, that items remain in motion and that if you want to change it, you had to turn the rocket ship around and retro thrust and all that, they got it. That was normal. That's the way a rocket ship should work. Man, you put it in a beer bar, which we didn't do until after the show, it earned no money. It was too baffling.

It turned out that we sold a bunch at the show. I told a story about how much money it was making at Stanford, at Dutch Goose. I didn't say it was Stanford, but I said it was close to Stanford. The business is driven by telephones. All the distributors talked to each other and they talked about what success they had here and what success they had there. Anybody that had arcades or bars close to university campuses bought them. Then we had a big problem scaling up because we could only pull one cabinet off of one mold in one day. Okay? How many molds did you need? What was the velocity? Etc.

Basically, from the time in October until Christmas, we were just scrambling to ramp up production and tighten things up. We had a lot of spaghetti on the circuit boards, so we cleaned those up. We turned it into a manufacturable item. Ted did the documentation on it, and we were ready to go.

Then all during the spring, I was sent out on the road to teach service schools of how to repair the thing. This was a world in which everybody had a pair of needle-nose pliers, a file, and a soldering iron. That's how you repaired a pinball machine. There were other arcade machines, but they were mechanical

nightmares. Most of the times, the guys that were good could kind of see what was a problem. They'd tweak things, they'd file down the contacts as they'd get corroded and what have you.

When it came to what we were doing, it was really about teaching them how to swap out boards, because we didn't want them messing with the boards. They didn't have *any* skills at repairing them. But it was really beneficial because I got to know the whole distributor network: the owners, the head of service... That became very important. I was starting to get a little bit of a reputation as this crazy guy from California. Sometimes they'd call me that to my face. "Oh, you're the crazy guy from California. Oh, yeah, let's talk." And they'd take me out to dinner, we'd chat it up, and various things.

The next breakpoint was probably once we kind of got manufacturing ramped up, they said, "We need to do a *Computer Space* two-player instead of one rocket ship against a flying saucer."

I thought it was a massively stupid idea. I said, "This is going to solve the problem." I could tell that we were going to probably max out at about two to three thousand units, which to me was a big win. They were $1,200 a piece, so it was almost $4 million in sales. For a kid from Utah, that was a big win. 5 percent of that $4 million was $200,000. It was a lot of money. Anyway, I'd pretty much figured out with decisions that had been made kind of along the way that these guys were bozos and that I could not hitch my star to them.

Weaver: "These guys" being Nutting.

Bushnell: Nutting. Bill Nutting was working on his airplane in the back warehouse instead of tending the business. Rod Geiman was a political shithead. I shouldn't say that. Can't say something nice, don't say anything at all. They were petty. For example, Dave Ralston, who'd cut a pretty good deal with them on *Computer Quiz*. It was sort of at end-of-life, so sales were really tough. He had a pretty good commission structure All of a sudden, he started doing really well with *Computer Space* and they fired him. Not because of bad things but just because of stupid ideas. I mean, they could have come in and said, "We're going to drop your commission because this is an easier sale," but, no, they fired him. All of a sudden, there was nobody at Nutting that had any kind of relationship with the distributors except me. [Laughs.]

I decided that if I was going to stay there, I gave three demands. I said, "I need to get options on at least 20 percent of your company. I need to have a lot more say in decisions affecting my products. I want to build something other than two-player Computer Space."

They said, "Well, let me think about it." They came back and said, "No, no, no."

I said, "Well, tell you what. I'll build you your two-player Computer Space, but I'll do it on a contractual basis." We cut a contract and did it. Now, what I didn't tell them is that the week before, I'd been in Chicago and I had gotten a contract with Bally to build a driving game. I had two contracts now and the royalties. I felt that was enough to start my studio.

Weaver: The contract with Bally, the letter with Bally, if I remember correctly, talks about two things.

Bushnell: Right.

Weaver: One of them was a pinball game and one of them was a hockey game.

Bushnell: No, it was a driving game. I'm pretty sure.

             [Pause in recording.]

Weaver: Nolan, I just wanted to show you—because you were talking about this letter. You had a contract with Bally—

Bushnell: Right.

Weaver: —and, in fact, I just happen to have a copy from researchers of the letter while you were still Syzygy. This was before you were Atari.

Bushnell: Would you send this to me?

Weaver: Absolutely.

Bushnell: I don't have this in my archives.

Weaver: See, isn't this cool?

Bushnell: I appreciate it.

Weaver: This is your letter to John Britz, who was EVP at Bally, basically memorializing what you obviously had discussed with him. You're telling him that you're going to have something delivered to him. The first thing is a flipper mockup for a standard pinball game, and the second was a video game with a hockey theme.

Bushnell: Interesting. Why have I remembered that as a driving game? That's very interesting.

Weaver: Unless—the only thing that I can think of, and you tell me if this makes any sense to you— hockey's far more complex than Pong, than a Ping-Pong game.

Bushnell: Right.

Weaver: And you had just hired Al Alcorn, right?

Bushnell: Correct.

Weaver: What did you want to give him? Did you think that he could do a hockey game right off?

Bushnell: No. I felt that he needed to—think of it as Tinker Toys, and I wanted him to learn the base set of Tinker Toys before he had to deal with some of the other stuff.

Bushnell: [Reacting letter, See Appendix 1] This is really fascinating. Holy shit. Right. What was the date on that letter?

Weaver: The date of the letter was 7-10-1972.

Bushnell: It was July. I've always thought it was May or June. No, it was April or May, so that would fit.

Weaver: It was just a little bit later. Did it act as a mnemonic?

Bushnell: Yeah.

Weaver: Good. Excellent. Okay.

Bushnell: Wow. That's really fun to be shown in black and white that I'm full of shit. [Laughter.] I think I've told the story a hundred times that we had a deal for a three-player pinball machine and a driving game.

              Do you know what? [Pauses.] I think I didn't want to give Bally the driving game because I thought it was going to be a huge hit. I was thinking in my mind's eye that the adaption of the *Computer Space* methodology to a driving game was more about changing the pixels and the dynamic things. Literally, I could have turned a *Computer Space* into a driving game in a week because all the core elements were the same.

Weaver: To make sure I understand, you wanted to give them the driving game because it would be so cheap and easy for you and hold back the hockey game?

Bushnell: No. I think what I flipped it on is that the hockey game was going to be even easier. See, the number-one entertainment game in my arcade was a thing called *Chicago Coin Speedway*, which had sold more coin-operated units than any coin-operated unit before. [The driving game] was going to be the magnum opus. That was going to be the *big* kahuna. I felt like I need one more hit, because I was going to go for a 10 percent royalty.

Weaver: Got it.

Bushnell: God, all of a sudden I'm remembering this, and that it was part of my diabolical plan to become filthy rich.

Weaver: You had just hired Al Alcorn. What did you want him to do, and why did you give him Pong to do?

Bushnell: When we did *Computer Space*, it could be split up into little modules. Think of them as Tinker Toy or Lego bricks. If you put them together a certain way, it was one kind of a game, if you put them together another way—and there were sort of simple building blocks that would be the same everywhere. Then there were more complex weirder stuff on top, like stuff that rotates and things. That was always a hard one. I just wanted Al to become successful quickly. I think that completing a project, taking it all the way from start to finish, from a game description to getting a playable game is a very important milestone in creating a strong technical engineer. That was really what the game *Pong* wanted to be for me, training project. Never thought it was going to be commercial.

Weaver: Going backwards for a second, do you remember in your *Computer Space* game the controls—a number of people have talked about the controls, that they were somewhat complicated.

Bushnell: Correct.

Weaver: But the controls were very similar to *Spacewar!*.

Bushnell: Yes, identical.

Weaver: Oh, so it was because of the influence of something that you knew worked?

Bushnell: Yes.

Weaver: Okay.

Bushnell: The reason the controls on *Computer Space* were rotate right, rotate left, thrust, and fire, those were the buttons on *Spacewar!*. My concept was to bring *Spacewar!* to the masses. The initial idea of doing *Spacewar!*, I needed it to be a one-player game because that's what people wanted to buy in the arcade business. I had to have it be a rocket ship against a flying saucer. That turned out to be easier. That was how it happened.

Weaver: Let's talk about the Atari years, because it seems about right that we've gone from Syzygy, right?

Bushnell: Well, I think that what we should do is say that the Atari years—well, I guess it was June of 1972 when we incorporated. I had left Nutting, just barely, and we

decided that we would incorporate. I was already having problems with the name Syzygy. Nobody could spell it, nobody could pronounce it, and I was just starting to get my head around the idea of building a brand.

Weaver: By the way, what did Syzygy mean, and why did you pick it? Because you have a history of picking very interesting names.

Bushnell: Syzygy is the last "s" in the dictionary, and it has two meanings. One, it's an alignment of planets in the solar system. When they're all in a line, it's a syzygy. It's also plant sex. I thought both of those had a pretty cool construct.

Weaver: Okay. You said just a moment ago that you incorporated Atari in 1972.

Bushnell: Correct.

Weaver: But wasn't there something that occurred that forced the issue a little bit?

Bushnell: Well, once we incorporated, it turns out that Syzygy had already been incorporated with some candle maker in Mendocino. It was not available. Incorporating in those days was very balkanized; that is, you can incorporate with a name in one state and somebody else can incorporate with the same name in another state. It was just starting to be coordinated a little bit, but it was in the world of snail mail. We did our incorporation request by mail. In the form you had to fill out first-choice name, second-choice name, third-choice name. Here's a piece of paper that I would love to have. I would love to have that document, because as I remember it, Atari was name number three. Syzygy was name number one that got rejected. There was another name, "name number two". We were somewhat disappointed when it came back that we were Atari. I don't remember what that number two was.

Weaver: Where did you derive that third name, Atari, from?

Bushnell: The third name, Atari, came from the game of *Go*. It was the polite warning to your opponent that you were about to take a group of his stones. Think of it as "check" in chess. "You've got to do something, or I'm going to get you." I thought that was a really cool name, suitably aggressive. "Get out of my way, world. Here I come."

             It turns out, though, that in Japanese it also means "jackpot" when you're playing a slot machine or bulls-eye. But I get a kick out of several times in talking to Japanese, they say, "Very, very cool name, but perhaps too boastful for Japanese." [Laughs.]

Weaver: Did Bally tell you something that caused you to leave Nutting?

Bushnell: All the distributors told me that they thought that Nutting was a jackass company.

Weaver: Did Bally also tell you that they would not work with you until you had formally left Nutting?

Bushnell: I don't remember whether they made that requirement or not, but I can believe that they would. There would be some conflict of interest and that sort of thing. So, yeah, I think that is [what happened]—but I was planning to do it anyway. If they'd have come back and said, "Yes, yes, yes," to all my demands, I don't know what the hell I would have done.

Weaver: Would it surprise you to find out that Bally wanted you to formally let them know that you no longer worked for Nutting just a few months before Atari was formed?

Bushnell: No, I have no recollection of that.

Weaver: Okay. The Atari years starts with you and Ted—

Bushnell: Then Al.

Weaver: You had some royalties, a coin route, and a desire to develop games for the big manufacturers, all of whom are in Chicago.

Bushnell: Correct.

Weaver: Why would they pay attention to you?

Bushnell: They paid attention to me because they saw the potential for video. I think due the incestuous nature of Chicago, they'd kind of run out of ideas. At the time, California, the Summer of Love, everything, we were kind of getting the reputation of being these crazy Northern California guys that were thinking outside the box. I think they wanted to give a shot at it. Plus, if I do say so myself, I think I can be a pretty convincing presenter of new ideas. Instilling confidence, instilling the idea that, "Hey, yeah, let's join up with this quest and link arms and march into the sunset together."

Weaver: Had you already been introduced to most of these people from your time at AMOA or through Nutting?

Bushnell: Pretty much through the schools that I was teaching with all the distributorships. The Chicago manufacturer, which is an interesting thing, was called Empire Distributing. One of the partners—there was two partners, Joe Robbins and Gil Kitt, and Gil Kitt really liked me and kind of took me under his wing. He was one of the ones that says, "You've got to leave Nutting." He says, "Those guys are bozos."

             He introduced me to a guy named Sam Kline, who I think was a made man out of Cincinnati. He was on the Bally board. [Laughs.] This was in the early days,

and I'd read all the history of the coin-op business and how a lot of it was heavily mobbed up in the thirties and forties. I always said, "If they give me an offer I can't refuse, I won't refuse it." [Laughs.]

Sam says, "Let's go out to lunch." The first thing he says, "But first I've got to get you a new pair of shoes." Now, who does that? So, he went in and he bought me a pair of shoes. I think I'd paid $15 for a pair of shoes, the most, in my whole life. He bought me a 120-dollar pair of shoes. They were Italian jobs, the kind of thing I would have never picked out for myself, but he says, "That'll be cool." Then we went to this black-leather, red-drape Italian hangout place for lunch. All the guys were kissing each other and slapping each other on the face. I mean, it was right out of central casting. Like, I just knew that if I got out of there alive, it was going to be really happy. [Laughs.] But then I thought, well, he bought me a pair of shoes. But he actually turned out to be a mentor and a good friend. He said that he was going to grease the way for me to get a deal with Bally. Funny. One of those crazy things that happened.

Weaver: In retrospect, do you think that he was one of the reasons that Bally decided to do something with Atari?

Bushnell: I think so. Maybe. I think it didn't hurt.

Weaver: Was there any other reason that you can think of that a big company like Bally would take a chance on a nonexistent Atari?

Bushnell: I believe that they didn't see it as taking a risk on Atari. I think they saw me as an engineer that they could hire by another means. I think that the risk for them was minimal.

Weaver: Al Alcorn was your first engineering hire, right?

Bushnell: Correct.

Weaver: From Ampex.

Bushnell: Correct.

Weaver: Steve Bristow, your second engineering hire?

Bushnell: Not an engineering hire. Steve was still in school, remember. He was younger and hadn't graduated yet. But when the four prototypes from the show came back, I bought them and put them on location. That started the Atari-Syzygy coin-op route. We started to place machines in locations. These four prototypes for us, I think we bought them for $300 apiece, basically parts cost. We were the only ones in the world could keep them running. They were so low standard. But we paid $300 apiece for them and they were making $150- 200 a week. You didn't have to take rocket science to say this was a good deal. One of the places

that we wanted to set up a route was in Berkeley. Steve was going to manage that route. We rented a little space on top of a coffee shop. You went up the back stairs, we put a bunch of games up there and it made a lot of money. Of course, Berkeley was a little seedy. It had a lot of hippies and some homeless and that sort of thing. Steve, when they'd collect the money, his wife would follow him with a hatchet. [Laughs.] No guns allowed in Berkeley and all that. But they never got accosted. [Laughs.] It's just one of those funny things. So, he was a part of the Atari family early on. As soon as he graduated, I brought him in.

Weaver: You made a Ping-Pong game for Bally and you showed it to them.

Bushnell: I didn't make it for them. I made it—okay. Let's get the chronology right. We had been in the video game business. All of a sudden, I heard there's a video game at Burlingame Hyatt that is being shown. I went up and I posed as the owner of the Magnavox store that I passed along the way. I signed the logbook, signed in and went in, and I saw the Magnavox *Odyssey*. And, whew, it was like an exhale, because it was fuzzy. No sound, no score. I called it a kiddie game. But one of the games that people were playing and looked like they were having fun. Even though you could curve the ball after you hit the paddle with a knob— it was like it was designed by somebody who didn't understand game design. I noticed that they were having fun with it—and that was exactly the first day of Al Alcorn's employment where he showed up.

I went up to Burlingame about noon, came back, talked to Al, told him—and so it was fresh-hot in my mind. That's when I defined *Pong* to him and said, "This is what I want you to build. You've got two weeks." And as they say, the rest is history. [Laughs.]

Weaver: In the three-tiered coin-operated games industry, a game will only succeed if distributors decide it's worth buying and pushing out to their operators.

Bushnell: That's correct.

Weaver: So, who were the early champions of *Pong* in that community?

Bushnell: The early champions was a thing called Advance Automatic Sales in San Francisco. Turns out they were a little bit of a double agent too. They had heard about the earnings. I mean, the story which is worth retelling is that we put a [*Pong*] prototype unit, half-size things, put it on a barrel at Andy Capp's. That's where the coin mechanism totally filled up and wouldn't take any more quarters in three days. The game quit working; we got a service call. They came down and found out the coin slot had been totally filled up, and we thought to ourselves, "We can fix that. Bigger coin box."

We knew we had something on our hands that was unique, but we still didn't have a lot of money. They were just putting it out on location for the test when I went back [to Chicago]. I thought, "This game's pretty fun. Let me see if I can

get Bally to accept that instead so that we can fulfill our contract early and then we can work on some other stuff."

When I got back, back there, I pitched it as hard as I could. They had just purchased Midway. Bally was doing coin-op machines and pinballs and Midway was just doing regular arcade machines. They wanted me to present it to both, so I presented it to Bally and then I presented it to Midway. Both of them had the same problem, that it was only a two-player game. Doing it against a wall wasn't fun. They said, "Let me think about it," and the other one said, "Let me think about it."

I got on the airplane kind of tepidly disappointed. Then I called back [to Atari] before I got on the airplane and they told me what was happening at Andy Capp's. My greedy little mind said, "Hmm." Remember we were in the operating business then. All of a sudden, I realized that I had a game that had a parts cost of under $300 that was making $300 a week. I said, "I don't care if I don't sell any. I'll just operate these puppies." But then I thought, well, but we can sell them as well.

I knew exactly how much money we had in the bank and I knew exactly how long it was going to take us to build them. I released thirteen units. These were the famed orange-fronts. We ordered the cabinets, we ordered the TVs, we ordered the parts, we built them up, and shipped I think three of them to Advance Automatic. We couldn't ship because we hadn't gotten the shipping carton yet. We had to put it in a truck and actually drive it down to Los Angeles to Portel Automatic and to C.A. Robinson. Those were the two big guys down there. I think they took two each, so that was four, four, three, and we had two that we put on our own route and sold them for cash. We, all of a sudden, had a lot of cash, so we built thirty-six. Then we built 125. I can remember going in to Al and saying, "In three weeks, we're going to ramp up to 100 a day."

He says, "Nolan, are you crazy?"

I said, "Yes! But we're going to do it nonetheless." That's when we rented the roller-skating rink and got it going.

Well, unbeknownst to me, of the four we sent to Automatic Sales in San Francisco, they sent one to Allied Leisure in Florida, which promptly knocked us off. All of a sudden, we were the hot game in town. I think at one time I had 1,000 back orders. I just knew that anyone that we didn't ship within a few weeks, it was going to go to somebody else. I was just bound and determined to not let the other guys out-produce me. They had factories and they had people who knew purchasing and they had logistics. They had shipping and receiving. They had quality control. We had nothing!

It turned out that our biggest problem was we had no labor. Where do you get all these people who are laborers? Do you go down to the state Unemployment

Office? Not really. I was thinking that they're all drug dealers, drug users down there. We found out that the TVs were easily fenced, so we had that problem. [Laughs.] But slowly but surely, we got rid of the bad seeds and we got good people.

Then we found this tech trade school. All of a sudden, our dreams were answered because we hired everybody in that school to come up and do tech support. As you built the computers, there would be solder bridges and things like that. The components had a very high infant mortality, meaning that they would just burn out in a couple of days of use. These all had to be fixed and we'd burn them in overnight. We had to push the reliability of them. Every day there were twenty fires to put out and problems to solve and things to fix. All of a sudden, we found out that people with static electricity were getting free games. They had to figure out a way to stop that and give a patch that could be easily installed in the field. You know, just one thing after another.

But we got up to 100 a day, then we got up to 150 a day. We were rockin' and we were just crushing it. We were selling them for 900 bucks. The total parts costs, including labor, was 300, so you make $600 every time you ship one out the door. Slowly but surely, you start getting a little capital equipment. The most important thing was a wave solder machine. That was $5,300, which was a *lot* of money in those days. But, piece by piece by piece by piece.

Then we kind of woke up one day and said, "You know, *Pong* isn't going to last forever." We still had the weakest financial statement, weakest factory, the weakest process, the weakest infrastructure. I said, "The only thing that we have is innovation."

Then the 1973 AMOA, which was kind of a breakpoint that I'm quite proud of. At the show, there was a conference that was labeled "The Future of the Video Game Business." Only people that were up on the stage—it was a panel discussion, and there were four copiers and the emcee. I wasn't asked. I was fuming. You can't imagine how offended I was by that. I heard these platitudes, these idiots, you know, pontificating about this and that and what have you.

When the question-and-answer time came, I just called them out. I said, "These bozos don't have a clue about what's coming out next because they don't know what's in my lab since the only thing they've been able to do is copy me and my people. I can tell you every time that you buy from one of these jerks, you're cutting your own throat because you know that your lifeblood is based on innovation. You need new games, new designs. Do you really think you're going to get it from these guys? They've shown no capability. They're not even in California." [Laughs.] I said, "Everybody knows that technical innovation comes from California. We're there. We've got the best engineers in the world. These guys are ciphers."

When I sat down, I got a standing O. I feel like that was a breakpoint where all Atari became a serious player in, I think, everybody's mind that was there. It was all the distributors, all the people that were important.

Weaver: There'd never been a company quite like Atari before that was starting by brash young engineers in this area, right?

Bushnell: Right.

Weaver: Who were the mentors and the experts that you turned to for advice? How did you educate yourself on running this company? Because it was all nascent to you. How did you become this big juggernaut? Not just from the purchase, but you've glossed over the issue about mass production and other things. How the hell did you pull this off?

Bushnell: I think that in some ways my Lagoon experience was very important. I set up systems to track things. We actually had a pretty easy system, in a way. Most of the cost of the *Pong* game was in the cabinet, the monitor, the coin mech, and the power transformer. That was like 80 percent of the cost in four items. So, I basically became a purchasing agent for those four. We were funding ourselves with accounts payable. If I could bring the stuff in, turn it into a product in three days, ship it out for cash, I knew that I was operating a positive cash flow. I didn't have to pay the vendors for thirty and sometimes sixty days.

Then something that happened that was really important was the American Electronics Association had a quarterly dinner. I was seated next to Bob Noyce from Intel. Bob, besides being one of the nicest guys in the world, was a chess player. So, we talked. Intel wasn't doing MSI chips, but they were doing a lot of other stuff. It wasn't like a customer-vendor relationship with us. He liked me and gave me a lot of advice over time. A lot of times it was over a chess board, because Bob had this house in Los Altos Hills that had a lake behind it. It wasn't a very big lake, but he had a little pier out that was fun. We'd sit out on the end of the pier, had a couple of nice chairs with cushions, and play chess. Of course, Bob, at the time, was a chain smoker. I mean, he would light one off the butt of another, and I was a pipe smoker, so we'd be out there pontificating. Talking about business and playing chess and drinking beer. It was delightful. That was just something that was really important to me.

Later on, I developed a similar situation with Jerry Sanders, but whereas Bob was on the manufacturing, technical side, Jerry Sanders was Mr. Marketing. He was as fascinated about my amusement park experience. Of what's it like to make money off of carnival-goers twenty-five cents at a time. I told him how I'd developed this one game where instead of twenty-five cents a throw, I added fifty cents a throw, and you could get these big animals. Or you could do a dollar a throw and get these great big animals, you know. He was really fascinated about it. He loved my story about putting hot girls into the Guess Your Weight category. I'd say they were good mentors.

As I started hiring people, I started getting people with experience in various things. Hiring a person who'd actually run manufacturing before. [Laughs.] A lot of these people were ex-Ampexers. Like, Kurt Russell came in, and Steve Pereira. They just whipped the purchasing department into shape. Incoming, receiving, and all the things that make a factory work.

We wrote an employee handbook that I think there's a couple of those floating around. We had these lofty ideas and goals. We were actually ahead of our time, because we postulated equal work for equal pay. A lot of things that were just not part of the lexicon at that point in time. But probably the most important one was that we really believed that a company should be redesigned to be a meritocracy. To totally abandon process in favor of outcome. That's where the dress down, "You're not meeting customers. You can look like crap if you want to." That's where the beer-busts came in. This was a time to celebrate. I mean, it was kind of like a little bonus. That came from my amusement park. You hit your quota; you got a bonus. In some ways, it was re-metaphoring some of the things that I'd done at the amusement park in terms of employee outcomes.

Remember, the average age of the employees at Atari were like twenty-six. I mean, all of us who were running the place were in our late twenties, early thirties. Most of the employees were nineteen to twenty-five, nineteen to twenty-three. When we put in health insurance, they looked at our demographics and it was so cheap. We'd ladle on optical and we ladled on dental. It was a Cadillac plan, but it was cheap because of our demographics. But they didn't calculate on one thing. I went down to the production line and these nineteen and twenty two year old girls were stuffing the circuit boards. I looked out and they looked at me and it was like a flash. Every one of them had braces. [Laughs.] It was a thing where they figured braces—nobody's married, nobody has kids.

We also had this open-door policy. I had a beer keg in my office. The light came on at 6:00 o'clock every night. Anybody in the factory could come in and have a beer in my office after 6:00 o'clock. Nobody abused it because we always had a prototype of our next game to came out. We'd play it and there was a chalkboard next to it. We'd make comments as to what was fun to play and what was not fun to play. People would have a beer. We did a lot of Liar's Dice and things like that. I felt like this was a very relaxed way to figure out what was going on. Under those circumstances, people would talk about problems. We'd talk about how to solve it and this sort of thing. I always tried to manage by walking around. I'd make a circuit of the factory every day and I'd stop and talk to one person and then talk to another. They got to the point where they'd expect me to come. They'd bitch at me about this and they'd say this and that. When we'd have a staff meeting, I'd know more about what was going on on the factory floor than the people that were there. It was just a really heady time.

Weaver: Nolan, in mid-'73, you hired your brother-in-law, Dr. John Wakefield, to become president of Atari.

Bushnell: Correct.

Weaver: And then you brought on two Hewlett-Packard executives.

Bushnell: Correct.

Weaver: I think that was Les Oliver and Dick Mobilio.

Bushnell: Right.

Weaver: Why did you require a new management team? What did you think these men were specifically going to do in order to take Atari to the next level?

Bushnell: I think that in order to understand my thinking, you have to understand what was going on at the time. I knew of no CEO of any company that was less than forty-five. I was twenty-nine at the time and I felt that clearly some age would be good. That some experience would be good. I felt that Dr. John Wakefield was a really smart man who had been working with CEOs from all over the country as a consultant. Then there were these two guys that were head of International at Hewlett-Packard. One of them in the finance department, Les Oliver. I said, "These guys can bring some order to the chaos," which our massive, massive growth was causing. What I was looking for were people that were better than me, which I've always tried to do. I've always felt that no matter how good you are, there's somebody out there better. You want them on your side. You want to get rid of people that are really toxic and capable, and you want them working for the other guy. It's game theory. See if you can't mess with your opponents. See if you can't steal the good people.

              It was part of my methodology to try to do the right thing for the company. I was a major stockholder. I felt that doing good for the company was doing good for me. It wasn't about ego or anything like that; it was really about what's the best thing for the company. I was shocked and amazed at how good we were before those guys and how bad we were after. [Laughs.] It started kind of with little things. When we were growing, the last thing I wanted to do was spend a lot of time on office furniture. There was a place called Repo Depot and I would tell everyone, "The good news is you get to buy your own desk here and your own chair." I said, "The bad news is it can't be better than mine."

              And they'd say, "Well, that's okay."

              Then they'd look at my desk, and my desk was literally from an old schoolhouse that was this horrible blond. It had a green linoleum top and it was godawful. It was a thing where it set the tone, I thought. Well, Wakefield went and bought him a two-thousand-dollar desk with a side return and a really nice chair. I said, "Eh, that's kind of not the Atari way, but I'm not going to say anything."

Incidentally, I want to—my secretary started ragging on me about getting rid of my desk after the company got successful. I said, "No, it's my lucky desk. I just don't want to get rid of it." While I was out of the country, she took my desk. Had it stripped and stained. Took out the linoleum, put in black Formica. It turned into a gorgeous desk, but it was still my lucky desk., I couldn't really get mad. [Laughs.] I guess when you don't have money, you get used to making the decisions that help the company and their cash flow. They're not about your ego. Your ego's the most expensive thing you have. If you can get rid of that, all of a sudden, you can save a lot of money in a lot of ways. Like, we never had signs of our company. We'd just paint "Atari" on the front window. [Laughs.] We figured out we could actually do it cheaper with a stencil. As we got multiple buildings, we would just have the Atari logo on that and spray paint it through a stencil. Done. [Laughter.]

Weaver: Did you bring these people on, by the way, when you were going international? Was it one of your ideas to have more seasoned management as you started expanding internationally?

Bushnell: No, that actually happened earlier by accident. A guy came to me and said, "I'd like to take you international." He says, "I'll pay my expenses and do everything, but I'll set you up, and you just have to give me 5 percent on sales." Done. Hadn't even thought of going international. Hadn't even thought of it. I really didn't. He said, "Let's do that."

He made a trip over there and he came back with a bunch of orders, and he says, "To really cement it, I think they need to meet you." We did one of these *Tuesday, It Must Be Belgium.*[6] Started out in the UK and we went up to Scandinavia. We went down to Paris. Went down to Wiesbaden in Germany. Literally, it was my first real experience in Europe. We were working, so we were in Paris and all of a sudden, oh, there's the Eiffel Tower right by it. [Laughs.] It really wasn't a vacation at all, but it was very, very interesting.

I remember I was just newly single. I'd left my wife. We were in Torino at the beginning of a long weekend. He says, "Well, what are we going to do for the long weekend?" He says, "I know. We need to go to Costa del Sol on the south. There's 747s full of stewardesses that come down there to vacation."

"Sounds good to me."

We ended up taking a quick trip down to southern Spain, checked in. Turned out that we were two weeks before all the stewardesses showed up. The only thing that was happening in town was a chess tournament. I ended up playing chess with some very, very good players. It was actually more fun than chasing stewardesses around. Not. [Laughs.]

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[6] *If It's Tuesday, It Must Be Belgium* was a 1969 film which featured the main characters going on a road trip across Europe.

Weaver: It's true, isn't it, that Atari never built a large domestic distribution network like Bally, but it did do something to establish the distributor Merlin Enterprises in Utah?

Bushnell: No. No, we never had any distributorships. Merlin Enterprises, they might have done after me, but not during my watch at all.

Weaver: Got it. Okay. Would you speak briefly about *Gran Trak 10*, which was ultimately successful but caused a lot of difficulty during development?

Bushnell: Well, *Gran Trak 10* caused our summer of discontent. We almost lost the company; I mean almost lost the company. Remember, we never were thickly capitalized. We'd grown and got a little fat. We had a no-layoff policy at the time and a few things like that. Because we were slow to ship the *Gran Trak 10*, our cash flow dried up. Pretty soon we were ready to go into production and one of the parts that was critical for it, a hybrid circuit, they hadn't started it yet. It took six weeks to do. They didn't tell us that because of our slow pay, that they hadn't started it yet. We were hosed. We had a huge layoff, which turned out to be really kind of good, but that's another story.

                Lo and behold, our payables just got stretched more and more and more. We started getting lawsuits. We didn't defend them, so we got summary judgment on these things. We started having sheriffs come to the lobby to attach our assets. All they really want to do is attach your bank account. They don't want the furniture and all the other stuff. What we did is we opened about nine bank accounts, so whenever they'd attach one bank account, we'd make sure that the checks would go into another. Then they'd find somebody that got a payroll check since we were doing our own payroll. Once they figured that, "Oh, that's their bank account," we would never have any money in it. We just kept bicycling our cash around, and they never got a penny.

                But I thought that it would be interesting to see if I couldn't confront it head-on. A summary judgment is actually not much better than a promissory note. I said, "Here's the deal. I don't have the money to pay you all right now. If you need cash right now, I'll pay you thirty cents on the dollar cash. If you want cash in sixty days, I'll pay you in thirty days," or something like that. "You'll get 110 cents on the dollar if your payment is pretty much up to us when we get to go. And we'll give you as many coin-op machines as you want out of our warehouse to satisfy things." We had some overhang and machines that hadn't sold. And I said, "If you work with me, you'll be my preferred vendor. If you get messy with me, I'll blackball you. You'll never get any more Atari—we just won't use you. You'll be a blackballed vendor." They were kind of thinking. I said, "Hey, if we fail, it's no big deal, but if we're really successful, that might be a problem."

                Then I had a real problem because I needed parts. New parts to get the line going again. I went to Jerry Sanders and said, "We're on credit hold with AMD, but I need $50,000 worth of semiconductors from you. You'll be my preferred

vendor from now on if you get me out of this." Jerry said yes. We got our line back going again. He became our preferred vendor and I think it ended up being worth about 50 million bucks to him as Atari kind of went up. AMD was a second-tier manufacturer. Texas Instruments and Fairchild were the primary of the TTL family and AMD was kind of the also-ran, and we put them right on the map.

Weaver: Atari started as an arcade company, but it held ambitions to become a home entertainment company before finally doing so in 1975. In other words, so did you view Atari as a technology company? Or was it an entertainment company?

Bushnell: I saw it as an entertainment technology company. Remember we also had a game route, you know. We'd put them in bars and restaurants and collect the money, and that turned out to be a significant source of cash. Our summer of discontent was part of that, because I had sold off the route to Dabney. When we separated, he took that part of the business, and it was the only real heavy cash flow-positive part of the business anyway.

I think that I was always interested in the technology. Al was always interested in the technology. One day, he came into my office and he says, "I think the time's right."

I said, "What do you mean?"

He says, "Well, I believe that we can put *Pong* on a chip," single chip. It was n-channel MOS. He says, "I've got the guy who can do it. Let's do it."

He got it working. The architecture was a little bit different to do it on the MOS chip. We took it to the toy show, and we sold none. We were in New York, we had a booth, we had the whole thing, and we thought, hey, everybody wants to play *Pong*. We'd been massively successful in the arcade, and we knew all our neighbors wanted to buy *Pong*. What's wrong here? Well, it turned out that the toy stores felt that the maximum price that they could charge for a toy was $29, and we were $79. We thought, okay, we'll go to appliance stores. Zero takers. None. TV stores, appliance stores, none.

Then our sales guy called up Sears, Sears Sporting Goods. How he ended up over at sporting goods I'm not for sure, but Sears Sporting Goods turned into a recreation room area in the winter. Selling pool tables, Ping-Pong tables, what have you. I think the reason he ended up there is the year before, they had a home pinball machine that they sold out of. They thought, "Okay. Pool tables are in bars, Ping-Pong tables are in bars, pinball machines are in bars, Pong is in bars, and so this is the right thing for the home."

The next day, he shows up at our front door, the buyer. I thought, "That's a good sign."

We went in and sat around, and he talked about this. We gave him a big sales pitch on why this was the next coming for entertainment in the home and he played a couple of games. He said, "Yeah, I think this could work." He says, "How many can you build?" Had no clue.

Says, "Let me check on that."

We went out and huddled. We were building coin-op games where a big run was 5,000. We thought and thought, and my head of manufacturing says, "I think we can build 25,000."

I said, "Okay."

Well, I was a little worried about having exclusive, so I went back in and I said, "I think we can build 75,000," just pulling it right out of my butt.

He says, "Oh, okay."

He wanted it to be a single source, so he came back with a purchase order for 150,000 units. All of a sudden, we'd gone from our mindset of 25,000 to all of a sudden an order for 150,000. This was actually instructive to me, because we are often a victim of our own minds. That when it comes to actually having a problem, you can figure out ways to solve it. We started thinking, we said, "Okay. Rather than one production line, we'll have three. We're going to have to rent a little bit bigger building. The injection molding, we can do multiple cavities. Yeah, we can solve that. The chip's no problem," because once the chip's built, you just put in for a number and they show up.

Then we thought about people, how are we going to get the people? We said, "Well, I think before Christmas we can run two shifts and maybe a third," and we figured out we could have a shot at it, except for one thing. There was no way I could finance it. We just didn't have the cash. We didn't have the liquidity.

I called up Tom Quinn, who was the buyer, and I said, "I can't take your order. We can't fund it. We don't have enough cash flow."

"Oh," he says, "don't worry. I'll introduce you to Sears Bank," he says, "and we'll set up a bonded warehouse at the end of your production line, and you get 70 percent of your sales price when it drops off into the warehouse." Boom. Problem solved. And during that year, we built and shipped 180,000 units.

Now let me tell you about the timeframe. The timeframe was set by the Toys Show in February. By the time Tom came out, it was April and the chip wasn't complete. The injection molding wasn't [finished]. We had built our prototype, which was a carved piece of wood painted to look like plastic. So that you couldn't tell that it was painted wood, we actually stuck it to the bottom of the table so you couldn't pick it up. The computer, the circuitry, was in an apple

crate that was under the table with a hole up through the table into the unit. The whole thing was faked. But now we had the order, and we just went lickety-split towards it and it really turned out to be a big win. [Laughs.] Fake it till you make it.

Weaver: You've mentioned a few times about what you did when you and Dabney split. What year was that?

Bushnell: Ted and I were great friends. We bought a sailboat together, we did a lot of great stuff, but when it came to being an executive at Atari, he was an unmitigated disaster. No matter what I did, he would get involved and piss people off. Change directions in stupid places. It sort of came to a head right after I went on my European trip with the distributors. I came back and it was almost an armed revolt. Several things that Ted had done—I mean, his job title was manager of the game route, but everybody knew he was a 50 percent partner. He wouldn't stay in his box. I said, "Ted, you've got to leave, and I've got to buy your stock out." And I said, "You're creating more havoc."

He says, "I'll be good."

I said, "Ted, it's just not in your nature." And I said, "I love you dearly, and we'll hang out on the boat and all that, but I think we have to split. I'm going to give you the cash-flow portion of the business."

At the time, the route was more profitable than Atari was, because at Atari we were plunging every penny that we had back into the business. It was highly risky. It looked a lot more fragile. Whereas the route, you got the machines on location, it was like an annuity. Finally, we went out to a bar and both of us got a little bit hammered and he agreed [to leave]. We signed up the paper and he went away. The problem really was that he wasn't a salesman. After that, he kind of started losing locations and couldn't get it back. Then he hired his brother and his brother stole from him. It was just a litany of one disaster after another. I felt bad, but, you know, shit happens. It's one of those things where I think in 20/20 hindsight, I should have left him with some of the stock, but I needed to get him out of there. You feel like, "Gee, you helped me when it was really hard and we were just starting up, and nights we spent at Nutting and all that." Then all of a sudden, I throw him off like an old shoe. It feels bad.

Weaver: After Sears, between Sears and Warner, what happened, and why Warner?

Bushnell: After *Pong* was a success, the next time, we decided we were going to do other games, so we did *Stunt Cycle* and *Video Pinball* and *Super Pong*. That was our next year. But we knew that wouldn't continue, so we started immediately on developing the VCS [Video Computer System], a Von Neumann architecture[7].

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[7] Von Neumann architecture is based on the stored-program computer concept, where instruction data and program data are stored in the same memory.

A lot of people don't understand that the microprocessor hadn't been invented. By 1976, all of a sudden it was good enough and we knew it was good enough. Our skills at dealing with n-channel MOS [Metal Oxide Semiconductor] was good, and so we had the video part of the chip. The microprocessors at the time were pretty slow. I mean, they were faster than the Nova 800, but not by much. But we had learned enough on how to take care of the video in the n-channel. What we learned from doing *Pong* and what we learned from the other things that we were doing; we were pretty sure that we could create a cartridge-based system that was good enough to have it play at least sixteen or eighteen games. Maybe twenty-five. We started the design.

We had a strict price point that it had to come in at less than $200 retail. We just started making compromises and doing designs. Figuring out what we could do and what we couldn't do. We knew it had to have a couple of joysticks and a power supply, because we couldn't do it with batteries. It was actually a highly constrained system, in reality, which led me to one of the biggest mistakes in my life, technically. [That] is we had a twenty-two-pin cartridge slot. For another nickel, we could have had a twenty-four-pin slot. With a twenty-four-pin, we could have addressed 4K of memory and we could have put in a read-write line so I could have put RAM out in a cartridge. With RAM out in the cartridge and bigger address space, all of a sudden we could do some really, really cool stuff. Anyway, but we didn't, so we only had twenty-two pins.

Then the nice thing happened that software became very, very strong. But then we ran into the same problem. It was actually a bigger problem, because the following year, we had expanded our market to not just sell Pong and Super Pong to Sears, but we had open up to Federated Department Store and Target and all these other things. At that time, that year, Sears was probably a third of our business instead of all of it. We knew that when we were dealing with the VCS, that because the price point and various things, that the relationships we'd built with the other retailers, that we couldn't do an exclusive with Sears. When we looked at the manufacturing issues of the 2600, it was very clear that instead of a 30,000-square-foot factory, we needed a 150,000-square-foot factory. The production lines were longer and bigger and harder. The injection molding had to not just be multiple cavities, but they had to be 150-ton presses because the size, instead of 50-ton presses. All of a sudden, the capital consumption became huge.

Also, at that time, it was very clear that the retailers were not going to be—that you shipped the stuff in November, and you get paid in January. That was the way Christmas worked. I just couldn't make the numbers work, so I decided in June that I needed to go public. We started writing an S-1. We appointed Dean Witter as our—that's a name that you don't even know anymore, as our investment banker. But it was a good tier-b. I mean, it wasn't Goldman Sachs, it wasn't Merrill Lynch, but it was a good underwriter. They were going to take us public. Then the market kind of hiccupped and they said, "We can't do an IPO

now, no matter how cool your company is. Besides, we're not sure games are really going to be here for the long term."

We said, "Okay. Let's see if we can get a corporate partner," because the amount of money we needed exceeded the venture capital market at the time. Venture capital was in its infancy at that time. Like, when Don Valentine invested, there were four of them. They each invested three quarters of a million each. We only got three million bucks from them, from their whole venture round. It was clear that we needed about fifteen million of cash in order to bring the 2600 to marketplace. I deemed that to be improbable in the VC [Video Computer] world, and so we started looking for a corporate partner, looking for them to just make an investment.

We uncovered Warner, who, by serendipity, the chairman had taken his kids to Disneyland and they'd spent over an hour playing *Indy 800* at Disneyland. Being the kind of guy he was, he did the mathematics in his head and he said, "Holy shit. This thing's making a lot of money." [Laughs.] So that was his market research, one.

Sent the jet out for us. I'd never been on a private jet. It was a Gulfstream. Myself, Joe Keenan, who was my president, and Lipkin, we climb onboard the G2. I felt like a Utah boy with hay sticking out of my collar. He said, "I hope you don't mind. We've got to stop in Sun Valley, and we're just going to pick up a friend." Well, it turned out it was Clint Eastwood and Sondra Locke. We got to fly into New York with Clint Eastwood and Sondra Locke. To put it in a timeframe, it was for the premier of *Outlaw Josey Wales.*[8]

They check us into a suite at the Waldorf Astoria. Of course, it had about ten rooms, a billiard room, a library, all that sort of stuff. We were wandering around. Were we impressed? Yeah. Were we smitten? Yeah. Did he warm us up and, you know, ready for the kill? Yeah. Did I want to be a part of this organization? Yeah. I mean, when I think about it, you just have to really hand it to somebody that's a bigger con artist that you are.

Weaver: By the way, who was that?

Bushnell: Steve Ross. Brilliant guy, brilliant man. We started negotiations at, like, 10:00, talking about various things and various deal structures and what have you. Then we got a premier of the movie in Steve Ross' private viewing room. This was not video. This was full 35 millimeters in the penthouse of a Fifth Avenue apartment on the Upper East Side. Was I impressed? Yeah, I was.

We left there and got up the next morning and kind of went in, and we shook hands on a deal and agreed to sell.

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[8] The release date for *Outlaw Josey Wales was June 30, 1976.*

Weaver: May I assume that the Warner purchase gave you a degree of personal wealth?

Bushnell: I was very happy. My portion was thirteen million bucks.

Weaver: To put that in perspective, this was in 1976, $13 million?

Bushnell: Yeah.

Weaver: So that would probably be worth at least twice that today.

Bushnell: Five times.

Weaver: Five times. So how did you feel you were personally doing right about then?

Bushnell: Oh, I was happy. It actually exceeded, in some ways, my aspirations. When I was in college, I can remember having a conversation saying, "All a person ever needs would be a million dollars. You can invest it." This was in the day where it was pretty easy to get 6, 8 percent interest, because that's the way it was. Remember, graduate electrical engineer, you could $10,000. All of a sudden, 6 percent on a million dollars, $60,000, that was so much above my pay grade at the time.

            Well, what I hadn't realized is your expectations escalate over time. I bought a 15,000-square-foot home in Woodside, California, on 16 acres for $500,000. Okay? Now, it was a fixer-upper. It needed some work. But what it did, it made me feel settled and I decided that I wanted to get married again. I'd had three years of pretty much running around, you know, dating, and while it's easy to date beauty, it's not as easy to date substance. I just decided one day that I was going to focus on substance and capability and integrity. Someone who could be a true partner and an adventurer and would be a great mother. I kicked the girl— I had a live-in girlfriend at the time, gorgeous skinny blonde who my daughters hated. That's kind of a bad sign on a lot of things. I liked her in a lot of ways, but I felt that she was a placeholder for somebody that I wanted to make a permanent relationship with. And I crossed out the names of everybody in my black book except three, and Nancy was one of them.

Weaver: Nolan, would you please tell us sort of what I would call the Kee Games scenario? In other words, how did Kee Games come about? Where was it in the chronology? What was the story behind it?

Bushnell: When Atari got successful, it turns out that we had an exclusive distributor in each city, but because of pinball lines and jukebox lines, there tend to be two or three other distributors in those same cities. Those distributors were trying as hard as they could to nurture a competitor to Atari. I didn't like that, so I decided that there needed to be a competitor to Atari. We took the number-two—well, it actually wasn't the number two. Joe Keenan was my across-the-street neighbor. Smart man, and he'd been in the timeshare marketing business. I felt that he

had all the skillsets that were necessary to run a coin-operated game company. He liked games. He'd come over and drink beer with us after—he was kind of a hanger-around because he was my next-door neighbor. He finally left his position and said, "I want to come work for you, Nolan." He says, "What are your problems?"

I told him, "We've got this dual distribution that we should do." And I said, "How would you like to be president of your own game company?"

He says, "Well, that's kind of a big step."

I said, "Yeah, but you're good enough." I said, "Here's what we'll do. We'll take the number-two engineer in Atari, we'll take the number-two marketing guy, we'll take the number-two manufacturing guy, and you go across the street or up the block, rent another building. Since your name's Keenan, we'll call it Kee Games, so it'll look like you're the entrepreneur. We'll compete with ourselves and we'll keep it a secret." I said, "Secrets don't last, so we're going to float the idea—." I mean, this would have never worked in the day of the Internet. "We'll float the story that you stole some of our people and that we sued you. That we got a settlement and got a percentage of your company as a settlement. Then it'll morph to we ended up with a majority of the shares in your company. Then about a year later, we're going to acquire the rest of it and become a wholly owned subsidiary." And it worked like a charm.

This was just before trade show. Joe signed up every one of our old—of the distributors that were across the street. It turns out that one of the games that we gave him—we gave him every other game that we had in our queue. He had a couple of pretty good games along the way. I mean, they were designed in our labs and the whole thing. When it came time, a lot of my distributors would have loved to have the Kee Games line, and, of course, the Kee Games distributors would love to have the Atari line. We said, "Okay. Here's what we're going to do. We're going to give you both lines." And we were the only coin-op company that had dual distribution in the whole business. And we did it just that way. We slow-rolled the disclosure and then brought them all back together.

That's when I made Joe the president, because I'd thrown Wakefield and Oliver and those guys out, and I brought Joe in as president. We'd gone through the summer of discontent, so we'd gotten rid of all the deadwood. The old story that that which doesn't kill us makes us stronger, it was like we launched out of that. We were lean, we were mean, we were really good. We were rocking on all cylinders. Literally by the time we sold to Warner, we had probably a 70 percent market share in coin-op and we were going to start a Pinball Division. It was pretty cool. We were nailing it on all sides.

Weaver: When Warner bought you, did you find that you were able to capitalize on the potential of the market? In other words, what was your vision when Warner

bought you, other than personal wealth? How did you feel that you could capitalize upon the purchase, other than the money?

Bushnell: Oh, I had all kinds of fantasies and projects that I felt could be funded now but talk about bait and switch. Instead of funding my side projects, they canned them. The biggest one that's my major really disappointment is that I wanted to build a telephone game network. We had a project to build the fastest modems in the world and we did. We hired a couple of the really crackerjack communications experts. In fact, remember U.S. Robotics? That was all Atari technology that Warner sold them.

Weaver: Elaborate on that. You're saying that U.S. Robotics, the modems that competed with Bell—

Bushnell: Yeah.

Weaver: —at the time—

Bushnell: Right.

Weaver: Why don't you talk about that for a minute? Because I've never heard that before.

Bushnell: Atari built the absolutely fastest, lowest latency modems in the world, and it was aimed at our game network. The objective was we wanted to be able to play games over the telephone network. But we were really stupid. We asked the question, "Will the players want to talk to each other?"

              We said, "Well, over modems that's pretty hard."

              I said, "Well, would they be willing to type to each other?"

              They said, "Oh, people don't type. Of course not." [Laughs.]

              But literally our IP stack, though it was eight bits shorter, was almost identical to the IP stack of the Internet. We were going to put closets of modems in every area code for a free local call. We were going to connect them together with T1 lines. We had a lot of talk about whether we were going to try to daisy-chain or hub-and-spoke. It was kind of more expensive to do hub-and-spoke, but that would have probably been easier to manage. We just got there, and I believe that had Warner not decided to kill it, that Atari would have owned the Internet. Remember this was 1977 and the Internet wasn't released to the public until 1992. This was a full twenty-two years, twenty-four years faster than the Internet. That was clearly—I'm not sure—and I think we would have probably—I think [used] Mosaic, with the World Wide Web. An HTML markup language may have had to wait, because graphics in those days were pretty hard. But it was

pretty easy to do an app. We could easily have the graphics quality of what was normal on PCs in probably 1980 or 1981. I think it could have been the Internet.

Weaver: To what do you attribute Warner cancelling your projects? You might want to go down the list. Which products did they cancel? But overall, the overarching question is, looking back now, why do you think Warner—is it that they didn't have the vision? Is it that they didn't believe in your company? Why would they cancel these kinds of projects?

Bushnell: Warner, remember, was a TV, movie, and record company. They viewed Atari through the lens of a record company, not a record-player company. Their hires, their aspects of the cartridge business was all the mentality of record business. They didn't realize that the technology was moving fast. I mean, one of the reasons I left in 1978 is I told them in 1977 that we had to start working on the next 2600. We made a lot of compromises in the technology for the 2600, namely memory. Memory was very expensive, so we only had 128 bytes of memory. That's all the RAM we had. But if we could have had a full line buffer of memory in black and white, let alone color—we could have messed around and got fake color—but just one line of digital information would have just made it so different. The microprocessor, instead of having to keep track of sync signals and all the other housekeeping, could just be filling that line buffer up with game display information. I mean, it would have been magical.

            So, a lot of people ask about the implosion of the game in 1982, 1983, and I've always characterized it as Warner suicide. It wasn't homicide. What Warner didn't realize is that they had not eaten their own babies. They had not obsoleted the 2600 at the appropriate time. They tried to put thirteen million additionally 2600s into a saturated market. Since cartridge sales by the retails were key to hardware sales, all of a sudden they had thirteen-times-ten too many cartridges, and the market wasn't ready. The unit volume in 1982 actually went up, but the price dropped to 20 percent. Everybody lost massive amounts of money.

Weaver: Go backwards for a minute, because you jumped into the early eighties. Let's go back to the late seventies.

Bushnell: Right.

Weaver: Warner's cancelling your projects.

Bushnell: Right. But they also cancelled Chuck E. Cheese. Remember, we'd started Chuck E. Cheese inside of Atari.

Weaver: Oh, yes. That's right. Where did the idea for Chuck E. Cheese come from?

Bushnell: What I wanted to do was vertically integrate towards the market. Now, remember I had a really good taste for the operating business. We were selling games for $1,500 to $2,000 dollars that in their lifetime would take $50,000 in

coin drop. It didn't take rocket science to say, "I'm on the wrong side of this equation." But at the time, I didn't really want to go out and compete for Joe's Bar and Grill and Vinnie's Pizza Parlor, so I felt I had to create my own location. At that time, mall locations were highly sought after. I felt that I'd be competing with them if I even wanted to go into a mall for an arcade, so I felt like I had to do a standalone game center.

The most successful pizza parlor in my area was a thing called Pizza and Pipes that had a deconstructed Wurlitzer theater organ. They had lights on all the pipes and things like that so when that pipe was going, the light would come on. It was visually interesting. Of course, they had the tambourines and the drums and the cymbals and all that. My kids loved it, but only when there was an organist, which they often didn't have on weekdays, but they had them on weekends. I said, "Okay. Visual interest while you're waiting for the pizza, good idea."

I then went to Disneyland with my kids and went into the Tiki Room. I said, "Aha. There's no theater organist here. This is a canned prizo. They've got the flowers singing. Yeah, we can do that. We've got the Tiki gods chanting away. Yeah, we can do that." I said, "But it'd be nice to have a mascot."

So, to put in a timeframe, I went to the International Association of Amusement Parks, IAAPA—it's always in Florida—and I bought a costume, a walk-around costume, of a coyote. We were going to call it Coyote Pizza and the coyote was going to be kind of a Wile E. Coyote kind of guy, what have you. I took it to my engineers, I said, "Make this guy talk."

Called him back and I said, "You've got the coyote talking?"

He said, "We don't have a coyote; we've got a rat."

I said, "Rat? How do you know?"

He says, "Well, it's got a big pink tail, for one thing." I'd never seen it below the waste.

But when you have a caricature, you overlay your expectations onto the art. We didn't have a sculpture, so I felt that we had to kind of fake that a little bit. I was faced with a dilemma. I said, "Okay. We've got this rat that's getting ready to go. The easiest thing to change is the name." So, I said, "Rick Rat's Pizza."

Went into the marketing department, they said, "No way!" They said, "Rats are dirty. This is a restaurant. You'll get a 'D.' You can't even say 'rat' and 'food' at the same time."

I said, "Well, okay. Can it be a rat, but we'll just deemphasize his rat-ness?"

They said, "Well, that'll maybe work."

I said, "Okay. You name him, but I want it to be a happy name."

A week later I went in and they said, "We've got a perfect three-smile name for you."

I said, "Three-smile name, that's good." I said, "Well, what is it?"

He said, "Chuck E. Cheese. You smile three times when you say it." And that's how Chuck E. Cheese started.

We got the first unit opened, 5,000 square feet in San Jose, California. We knew the minute we opened the doors that we'd mis-sized it. It was two-level. Even though a typical pizza parlor is 1,000 square feet, we did 5,000. Too small. That happened essentially almost simultaneously with Warner buying the company. Immediately in a budget meeting that happened that December I said, "How fast are we going to grow Chuck E. Cheese?"

He said, "I don't think we want to be in the food business."

I said, "It's vertically integrating towards our market. We're still in the coin-operated game business, but we're now collecting tokens."

Then they hummed and hawed and that sort of thing, and they said, "Well, why don't you sell it?"

I thought to myself, "Boy, they just don't get it."

I hummed and hawed around a little bit, and come February, I says, "I don't think I can sell this thing. Should we shut it down? Or maybe I can buy it."

He says, "Okay. Why don't you buy it?"

The one location that we had was cash flowing a half a million dollars a year. They sold it to me for half a million dollars, 100,000 a year for five years. I mean, of course I was going to grow that puppy. [Laughs.]

I immediately found a 25,000-square-foot abandoned Safeway, because they were going to 40,000 square feet. [We] turned 25,000 feet into the number-two Chuck E. Cheese. It was a little too big, but, man, it was cool. We had a Dolli Dimples Piano Lounge in there and we had the Fantasy Forest Game Preserve.

The first unit we had had animals all around because I wanted it to kind of be a theater-in-the-round. People hated it. They didn't want to have to turn around to see what was going on. [For] the number-two, we did a proscenium arch where

it was all in one direction, you could sit, and you didn't have to worry about it. That kind of became the signature.

Weaver: Let's jump back for a minute to Warner. Warner now was shutting down a lot of your projects. You went from this high-impression state of Steve Ross to the realistic state of Warner as Warner was, realizing what Warner really was. You're now coming up to a meeting in which Manny Gerard has called a lot of people and you come in and you announce that you don't think VCS is going anywhere. Soon after, they terminate you. Talk about that story. What's the story of how this evolved from being something so positive, in your mind, to something so negative?

Bushnell: The story actually starts a little bit earlier. It starts a little bit with them selling me Chuck E. Cheese, because, all of a sudden, Chuck E. Cheese was providing an awful lot of creative outlet for me. It was under my control. I could kind of do it my own way, and I was hiring some good people. I was figuring out a way to package up these units and getting involved in franchise law. Figuring out maybe franchising could be a very interesting thing for us. On that, I just have to tell you a guy came and said, "I'd like to franchise this." He says, "But I'm going to have to buy the animals from you, and I won't pay a penny more than $125,000." I hadn't even thought of pricing it. Our cost of goods was about $18,000.

I said, "How did you know?" [Laughs.] So, we were off to the races there.

But with the proceeds of the sale, I bought the Woodside house, fixed it up, and went wifey. Did I take my eye off the Atari ball a little bit? Absolutely. I was a little bit of an absent guy. I told myself it was good because I wanted the other managers that they brought in to bond with—that's what I told myself. I was there for all the big occasions.

Literally, I was not as much there. I thought that I was giving a chance for the company to kind of gel with the Warner management, things like that. But there were a couple of big shocks to me that I felt, naïvely so, that I'd win a lot of arguments because the power of my arguments, not the power of my position. All of a sudden, I started losing some very obvious things to Warner guys. I remember one just being totally baffled when it came to the Pinball Division. We were making games that were called *Big Bertha*. They were wide-bodies. They were three inches wider, four inches wider than a regular pinball. I'd done the analysis, and the pinball business was kind of commodity priced. I mean, they all pretty much charged *x* number for a one-player pinball, $100 more for a two-player, what have you. I knew that we had a shipping disadvantage and a tooling cost disadvantage of almost 200 bucks. If we tried to be in the commodity business pricing like everybody else expected us to price, if we'd have done a regular pinball machine, we'd have been shipping about—we'd have zero margin. However, with the wide-bodies we were free to price a wide-body whatever we wanted to, and so we maintained good margins. But our distributors always told everybody, "Well, why don't you do just a regular pinball?" Because they wanted

the earnings of the wide-body, but they wanted to pay the price of the commodity.

I said, "Guys, it makes zero sense based on the reality of our cost structure."

Then the Warner idiots would say, "Well, can't you bring your costs down?"

I said, "Well, shipping is shipping, and 70 percent of the market is east of the Mississippi. We ain't gonna be able to change that. Do you really want to put a tool-and-die factory so that we're stamping our own parts and getting the vertical integration that'd be necessary in order to chop that other $150 to $200 dollars out of it?"

"Well, we can't really afford that much capital, and Chicago's probably really good at that kind of stuff. We probably don't even have the right kind of tool-and-die makers here."

"Yeah. We don't, and never will."

But in spite of that, they decided to do a generic pinball. It's just one of those things where you say, "Nobody home here." All of a sudden, I was really thrown back to "These guys are Nutting revisited." [Laughs.]

Anyway, then the other thing that was starting to happen is the corporate culture was being slowly subverted. I felt that, in true Summer of Love hippie fashion, that we were all in this thing together. Some of us made a little more money than others because we did different work and we had different—we had to pay for our schooling and all that sort of stuff, but we were all the same. We never had reserved parking spots. We didn't have executive dining rooms. Because I felt everybody needed to be kind of amalgamated into this one big pot. Well, that wasn't the Warner way. All of a sudden, reserved parking spots and an executive dining room Some of these things that I just felt cut at the fabric of the egalitarian "We're all in this together" kind of thing, which was disappointing and troubling to me.

Then the other projects [for example], Manny said to me one day, "Nolan, why don't you just innovate for me this year like you did last year?" He was totally unaware of what he was saying. He said, "Let's design some more cartridges." That just isn't in my playbook.

Slowly the ability to morph came out and we were starting to get ready to market the computer, the Atari 800 and Atari 400. I could spend a lot of time on that and feel pretty good about it. It was keeping me occupied because there was a lot of strategy going on, because the dust in the personal computer business had not settled yet. Apple was there a year ahead, but Apple did some things that were sort of fast and loose. It was to their benefit, but not to ours. We were selling through Sears, and there was an FCC regulation on how much a computer

in a home could radiate. We had a screen room and all the test equipment and everything. If you put an Apple II in the thing, it was like it was an RF light bulb. It'd just spread stuff everywhere.

Sears was worried about violating FCC regs and things like that, they wanted ours to comply. We had that cast piece of metal so that all our high-speed electronics were well shielded. We had all kinds of stuff in it. But we didn't have a bus. We didn't have the ability to put multiple cards in. We did have some new ASICs [application-specific integrated circuits]. We had sprites and stamps. We were highly integrated. It was a much better computer than the Apple II, with the exception for the multiple slots, and we didn't have Wozniak[9]. What did that really mean? It meant that we had a better computer. The operating system was better. The whole computer was more responsive. [It] was much better for playing games. But when the floppy disk drive came out, Wozniak built the drivers and the interface for the first floppy disk drive, these five-and-a-quarter disks. He did that in two days, night and day, and it worked flawlessly. Atari, because we had to go through the serial interface instead of having a nice parallel interface into that, it took Atari a year and a half. Okay. So, better computer, better technology all the way around. Apple only had a year lead on us. We could have taken them.

Now the big problem. Remember Warner was all about records. They decided, "Oh, we've got another record player here, so we're going to control the software."

Steve Jobs had guys out evangelizing software developers to write software for the Apple II. Atari was saying, "If you write software for the Atari, we'll sue you." So then strike two: VisiCalc. VisiCalc turned out to sell more Apple IIs than any other piece of software. People don't buy computers; they buy software. We didn't have it. We didn't allow it.

Now we come up to the budget meeting in New York, 15th of December. I had passed the point of no return in some ways in which I couldn't deal with the idiocy anymore intellectually. I basically laid out explicitly all the stupid things they were doing: Not having a proper replacement for the 2600 under works, destroying the corporate culture to destroying the pinball business. I said, "In the process that you're doing, you will close down the pinball business within eighteen months." Well, I was wrong; it took them a year. I said, "You're just not going to be able to make money, no matter what you think you can." I said, "And you've got to open up the Atari 800 to outside software, period. Document it. Help them. Encourage them. Even seed the market with some—hire some people." I said, "Here's the deal." I said, "Fundamentally, you're losing the software war. You can pat yourself on the back all you want to. You can drop the price of the Atari 800. It won't matter. Without the software, you're dead." Of course, they hummed and hawed. Manny and all the other guys, because this

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[9] Steve Wozniak was the lead engineer for the Apple II computer and also a former employee of Atari.

was in front of Ross and a lot of the other guys, they started covering their ass on various things[10].

I had made a mistake in which I said, "The 2600, if we really wanted to be smart about it, we should just airdrop them out of the back of a 727 over Los Angeles. The company will be positive cash flow on cartridge sale by the end of the evening." I said it jokingly, but all of a sudden, they decided that I'd lost my mind, and maybe I had. They said that I could remain chairman, but they wanted Ray Kassar to be CEO. [They were happy to have me] to do as much creative work as I wanted to for the company.

I said, "I don't think so."

They said, "Well, then you're fired."

I said, "Oh, not really, because I quit first." That's always been the thing: Did I quit, or did they fire me? The answer is, yes, both at the same time simultaneously.

Weaver: Nolan, would you go backwards just for a minute, please, and tell us one or two of the anecdotal stories about both the Atari culture and why the culture was the way it was relative to Silicon Valley? Then also a couple of the employees who were pretty noteworthy that you found, employed, etc.

Bushnell: Well, I think the Atari culture was designed for excellence and for outcomes. We tried to be as process-less as possible. We tried to encourage our managers to allow failure but to reward success. The beer-busts were really part of that reward of success. Most of our employees were in their early twenties, late teens, and they enjoyed a good party better than anything else. These were all hippie guys, hippie girls. Did they smoke some pot out on the back dock when it was not quite as cool or prevalent as it is now? Absolutely. Did they all find somebody to hook up with that night? Absolutely.

I even tell the story that one time instead of the back dock, one of the guys moved into an apartment that had a pool and a pool house for parties. He says, "I've got it reserved for the beer-bust tonight." We all went there, and after a while, we got two or three kegs into the evening and somebody pushes somebody in the pool. It's cold then, and so they get out and they put another person in the pool. The sociology at the time around hot tubs and hippie-ness was people had a hot tub as an excuse to get naked at the end of the night. I mean, the idea of swimming suits was never even thought of. I know that that doesn't work today, but it was the situation. To make a long story short, probably two-thirds, if not a half of the company, was in the pool naked by 11:00 o'clock that night. Now, if that isn't a horror show for any HR person today, I don't know what it

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[10] Steven Ross was the CEO, President and Chairman of Warner Bros Communications from 1972 until its merger with Time Inc. in 1989.

is. It was just one of those things that happened, and I look back on that evening very fondly.

One of the outcomes of that kind of culture said that we could hire anybody, everybody. We could hire the best of the best. All we had to do is identify somebody as being an excellent engineer. We'd go after them, we'd invite them to one of our beer-bust parties, and, boom, done. A lot of these guys had never met a girl and all of a sudden, we were just full of these hippie girls, you know, and it just worked like a charm.

Weaver: What about some of your employees?

Bushnell: Well, I think that we got the best of the best from Ampex, because we knew who they were. One of the things that happens, one employee out of a particular company, they know the star performers in that company. We would do that over and over again, so we had all kinds of superstars. Probably the most notable is Steve Jobs, who we didn't find; he found us. I believe that it is important to have a company that people seek employment for. And he came in the front lobby and said, "I'm not leaving until you hire me." I mean, it's typical Steve Jobs. We didn't know that was typical Steve Jobs at the time. We thought it was a bit brash, but we were looking for technicians. He could solder, and he knew a resistor from a capacitor. Al [Alcorn] came out and hired him.

A couple days later, he shows up in my office and he says, "You've got a cool company here, Nolan." I had an open-door policy, but I gave short shrift to people who were wasting my time. He says, "But none of your people know how to solder." He had a circuit board and he says, "See that. That's a cold solder joint. That's a cold solder joint." He says, "That's a failure. Once you have a cold solder joint, it'll deteriorate." Of course, not knowing that Steve was kind of a perfectionist, I can see how that would really irritate him. [Laughs.] If you ever looked at one of the boards he did, *every* solder joint was perfect, bright, shiny, just the right amount of solder.

Everything was fine for probably six months, and then all of a sudden, Al came in and says, "We've got to do something with Jobs. He just pisses everybody off."

I said, "Why is that?"

He says, "Well, he stinks. He doesn't think he needs to shower because he's a fruitologist." He says, "And besides that, he basically—if he doesn't think you're smart enough, he calls you a dumbshit to your face." He said, "His direct manager, he keeps calling him a dumbshit. I've had to intervene twice to keep from getting him fired, because we don't have enough technicians, anyway."

I said, "Okay. I'll put him on the night shift."

He says, "Well, we don't have a night shift."

I said, "We'll make one." I said, "Besides that, I've been trying to figure this out, anyway." I said, "We know that Woz [Steve Wozniak] hangs out with him and Woz is a technical savant. He's working at HP all day. If we put Jobs on the night shift and give Woz a badge so that he can come in and out at night, it'll be like hiring two Steves for the price of one."

Al says, "That's brilliant." So that's what we did.

I had designed a game that was called *Breakout*, but the problem was it was a ball-and-paddle game. Everybody thought at the time ball-and-paddle games were over in the market, particularly in coin-op. But I just knew this was different enough and it had some psychological hooks.

I thought, "Well, I can get Jobs to do it, and I know Woz will end up doing it." But I said, "I'll create a really tough timeline and I'll bonus them."

I set up and I offered a bonus based on the number of chips less than a number amount, and this design came back that was brilliant. It was one of the tightest, most integrated coin-op games. Our typical coin-op games at that time were like 100 chips. Woz got it down to forty. Unbelievable. Nobody ever thought they could do it. Unfortunately, it was a design that almost impossible to test using the normal thing because there were feedback loops and stuff. But they got the bonus, and it was wonderful.

Then Steve decided that he needed to go to India to find himself. Steve was very big in Eastern religion, and so he wanted to go to India. I said, "Okay, if you'll do one thing for me." I said, "We've got a problem with some machines that we shipped to Germany. They're being interfered with." All our TV sets run on 60-cycle and over there it's 50-cycle, and so sometimes they beat. The Germans could fix it, but they were just too snotty. I figured that if I sent Jobs to fix it, he'd piss them off enough whilst fixing the problem that they wouldn't bug me again. I said, "I'll buy you your ticket to India, but you have to go to Germany first, and then Germany to India."

He says, "That's really nice, Nolan. That's great."

We did that, and, of course, he was over there for a little while. He got a blood disease, had to be medevac'd back to California. He got better, came back to work, and that was when he really decided that he wanted to become an entrepreneur. He offered me a third of Apple Computer for $50,000. I turned it down. I subsequently regretted that. [Laughs.]

Weaver: Nolan, would you tell me about Kadabrascope? How did it start? What was the concept? What happened to it?

Bushnell: I felt that one of the things that we could add was animation, because Chuck E. Cheese was getting to be an important character. I felt that it had some IP and

brand value. I felt that computer graphics was getting close. I was wrong, but I felt that it was getting close. I bought a VAX 780, a couple of pretty good programmers and a couple of good digital artists. The idea was to build software that would in-between, so you'd do one drawing and another one and then put "dot, dot, dot" and it'd fill in the graphics in between. It was a way of speeding animation. Instead of single-cell, you were doing that. Well, that was all fine and good, but the problem really was—

Weaver: You realize you've just described a well-known concept called tweening?

Bushnell: Right. What we wanted to do was develop tweening, I guess. We wanted to be able to get multiple frames of animation with a tenth as much human intervention. The problem that we had is when you are doing it with a VAX 780, it seems like it's blisteringly fast, but it turns out the architecture is really not good for graphics. It's a long word size and a slow clock, and when you're doing graphics, you want a small word size and fast clock. In some cases, it was taking us forty-eight hours to render a single frame. It was just such a disappointment, because, when we got output, it was wonderful. It was easily to the quality of *Toy Story*, but the economics made no sense whatsoever. In those days, if you could keep a VAX 780 operation for forty-eight hours, that was a miracle in itself. A lot of times you'd leave it running all night and you'd come back, and it'd gone off into the weeds somewhere. We were maybe getting two frames a week. That's not a business. It's not even close to a business. I ended up selling to Pixar, Lucas, because they were interested in doing it for special effects, not full animated cartoons.[11], and I thought that might work. Kadabrascope didn't die; it just kind of whimpered for a while.

Fast-forward that a little bit, and I had taken Jobs through Chuck E. Cheese and showed him Kadabrascope and he spent a lot of time and was fascinated by it. I mean really fascinated by it. When he was thinking about buying Pixar off of Lucas, he came to me, he says, "What do you think?"

I said, "It all depends on your render farm." I say, "If you can do an NTSC frame in an hour, it probably makes sense. If you're talking about graphic quality for a movie, you've got to be able to do it in less than six hours." I said, "Right now it may be possible because of render farms." I said, "We didn't have those at that time, and it doesn't work. My advice to you is that I know that digital animation is coming. [It's] whether you can last long enough and get the technology good enough." I said, "The front-end input and software's good enough. The rendering is what kills you every time. I believe that it's very unlikely that you'll make a penny after spending a whole bunch of money for three years." I was almost exactly on the money. [Laughs.] Took him three years to come out.

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[11] George Lucas had established the Graphics Group as part of his Lucasfilm computer division in 1979, which would eventually be spun off into its own company called Pixar, co-funded by Steve Jobs.

Weaver: Nolan, I want you to repeat one portion of what you said because it was unclear to me. It seemed the way you had said it relative to George Lucas that they already had Pixar and purchased Kadabrascope.

Bushnell: Correct.

Weaver: They didn't, did they?

Bushnell: I'm not sure.

Weaver: Oh, okay. Okay.

Bushnell: I mean, I actually didn't do the sale. One of my guys did the sale, and he said he sent it to Lucas. I don't know whether Pixar was a renaming of Kadabrascope, because Kadabrascope is really a stupid name [Laughs.] in some ways.

Weaver: Right. But the real question is did it form the basis for Pixar?

Bushnell: I think it's highly probable that it did, but I don't know for sure.

Weaver: Okay. I'm about to go to Sente and then we're going to get to Catalyst. Why don't you just tell the story in your own words of the first and then where it went?

Bushnell: I wanted to get back in the coin-operated game business, because by that time, Atari had kind of lost its way a little bit. I saw a lot of opportunities in some simulators and some slightly different ideas, some out-of-the-box thinking in the coin-op business. I actually got some of my better game designers and I said, "Why don't you start a company, and I'm going to lend you some money, but it's not my company yet." I said, "At the right time, you'll buy it and it'll give you guys a good payday, and we'll be off and running."

Weaver: This is because you were still under a non-compete.

Bushnell: I was under a non-compete with Warner.

Weaver: For how long was that?

Bushnell: For seven years. Silly, but I was young and dumb, so I recognize that. We did a big hoopla. We had a new kind of game. We sold a lot of stuff and ultimately sold it to Bally. That was when I came on the Bally Board of Directors and had to become vetted for no mafia connections, which turned out to be a significant number of my old distributors. [Laughs.] But that's another story.

Weaver: All right. I want to talk about Catalyst. First of all, would you talk about what Catalyst was, how you came up with the concept, what the structure of Catalyst was, and what Catalyst would be called today?

Bushnell: What I wanted in Catalyst was an out-of-the-box company germinator, if you would. When I sold Atari, I realized that I had spent a lot of money on the modem project, on Chuck E. Cheese, on several other things that had no value to Warner. They only wanted to buy the one thing because they had television. I thought to myself maybe rather than clustering them all together, I could give them the advantage of a big company, but the autonomy of separate corporate structures for each of the individual entrepreneurs. I felt that I would have a big building that would have central services. I wanted all the accounting in one place. My theory was that people don't come in pieces. The typical small company maybe needs one day a month of accounting. Let them grow up a little bit and as the company gets bigger, they can start to add other people. But I wanted to streamline the corporate formation. I called it "funding with a key". I was being a venture capitalist, but I wanted them all under my own roof to begin with because I felt that I could nurture them a little bit. And sometimes they were my ideas and I essentially hired an entrepreneur. What we did is create a stack of paper that would open their bank account, incorporate them, give them health insurance, and a chart of accounts. Done. The Xerox machine was down the hall. It was just set up to mass-produce small companies, and it turned out to be a smart thing.

My idea was I was only going to spend a half a million on each one of them and then they had to exist on their own and get funding from venture capitals. Then I violated it with Androbot because I fell in love with the product, but that's another story for another time.[12] But, I mean, out of that company came the very first online ordering system. We had kiosks in airports that ultimately was sold to McKesson. It had Magnum Microwave, which was the precursor to a lot of satellite receivers. We were able to commoditize that and build very, very cheap receivers. Of course, we did Etak, and Etak—I just love this story. We wrote the business plan on the back of a chart in the middle of the Pacific Ocean when I was racing sailboats from Los Angeles to Hawaii. It was cool, 4:00 in the morning on the—

Weaver: I think it's important to mention the reason that you were doing that, who Steve Honey was, and what his relationship was at the time to you.

Bushnell: Stan Honey was working at SRI [Stanford Research Institute]. He was my navigator, and very, very capable guy. He and I were on the watch and we were over the chart table doing a fix. We said, "This would be really easy if we didn't have all this squishy stuff under us."

I said, "Well, a car could do that," I said. We just batted around the idea, and I said, "Let's fund that puppy."

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[12] Started in 1981 by ex-Atari employees including Bushnell, Androbot was known as a consumer robot producer with its most noteworthy products being the Topo and B.O.B. robots respectively.

We created the first database of automobile navigation. Today if you've got Google Maps or anything, it's all based on my database. Stan Honey later on was the guy who took the technology and adapted it. If you want to see where the phony ten-yard line is on a football game, that's his stuff. If you want to see where the putt goes, that's his stuff. Just to put that line through, we sold Etak to Rupert Murdock, who funded Stan in doing the other things. Rupert sold Etak to Sony and then Sony basically sold it to another company that basically turned it into a database company because we had the most complete worldview map of the world, plus or minus half a meter.

Weaver: And the algorithms to digitally store points and a lot of the mapping coordinates and algorithms that are still in use today. Is that correct?

Bushnell: Absolutely. I mean, unfortunately, our patents have run out.

Weaver: In addition to Etak, what were some of the other ventures that may or may not have done well that may not have gone anywhere, but they, nevertheless, indicated something for future use?

Bushnell: Right. One of the units we had was a thing called Camp TimberTech, which was a computer-centric summer camp to teach kids how to program. It was in the Santa Cruz Mountains. It was a gorgeous place and it was great fun. We thought we could create a fifty-cent display. The idea was that it was essentially a tiny projection system based on liquid crystal. We actually had it working. These were in days when displays of any sort were three or four hundred bucks, particularly high resolution. We were up into the 720 ADI—I want to say ADI. Anyway, high resolution, but with a cost structure of like $7 and battery operated.

Weaver: What about your fascination with robots?

Bushnell: My fascination with robots. That's one that hasn't closed yet. I built a company called Androbot, and I *love* that company. I felt I just couldn't imagine a future in which we didn't have robots running around our house. This was actually before *Star Wars*. We were building it, and we had every technical problem in the world. The core problem was that the technology was just not good enough. Multitasking operating systems were big and bulky and expensive. Sensors were crappy and expensive. We could not get the kind of noise immunity that we needed because when the unit's running around on carpet, it would pick up static electricity. When you get a spark, spark is like a little transmitter. In fact, the early days of radio, they actually used spark gaps as the primary creator of RF. That [effect] would reset a computer. A blue screen of death is okay when you've got a tablet or a laptop, but in a robot, all of a sudden, you've got a 45-pound hunk of metal driving full speed towards the baby. Not something you want to do. Or worse, towards a stairwell, so now the thing goes tumbling down the stairs. It shuts down all your sensors and all that. Crashes in a robot are dangerous. You've got to really have some other stuff and we could never get it solved. I ramped up too fast and lost a whole bunch of money. In fact, I lost every bit of

money that I made at Atari pursuing robots. Shame on me. But you've got to look at a failure either as a failure or as a learning experience. I'm still going to do a robot. It's on my bucket list. You will see it running around and it will be really fun. It'll do nice things for you and it'll tell you jokes. It'll serve you drinks. It'll bring you coffee.

Weaver: I don't remember how many things you funded through Catalyst.

Bushnell: Eleven.

Weaver: Eleven? How many were successful?

Bushnell: Five. Well, selling at profit or a slight profit is kind of okay, but outright losses, four, write-offs, no recovery, dead man hanging. The Magnum Microwave made a nice profit. Etak, made a nice profit on it. Ayro, made a nice profit on it. Camp TimberTech, made a nice profit on it. That's four. I did one more. Oh, Axlon. But that was kind of funny because I reconstituted that into my toy company, and so their product line wasn't profitable in itself, but its infrastructure was very good.

Weaver: By the way, what was Axlon?

Bushnell: Axlon made small handheld terminals. Think of them as a one-line tablet, that is, because it had a little keyboard. It was really good for people who needed computer access. It had a modem, it had a keyboard, and it had one-line display. There were a lot of places in the service world that they liked it in that. It just never got big enough.

Weaver: When you say that you repurposed to toys, what do you mean?

Bushnell: I made talking and cats and dogs and bears. Things that would run around and do things. The real power of what we knew at Axlon was single-chip micros when they were a brand-new technology. Single-chip micros, you could do amazing things and they cost fifty cents to a dollar. That was the technology that I put into the toy business.

Weaver: Was this the pre-Furby Furby?

Bushnell: Oh, yeah. We were cuter than Furby.

Weaver: In telling the story of your having almost a 1-to-2 ratio of success in your investments, I think you'd agree that you're better than the average of most venture capital companies.

Bushnell: It was better primarily because I would never fund anything unless I actually created the business model myself. I may look like a mild-mannered engineer, but I'm actually pretty good at Excel. I look at business as an engineer. I want

the inputs to be right and I want the internal algorithm to be right. I mean, if you look at a business, it's really a black box. It has inputs, it has outputs, and somewhere coming out the top is the profit. Inside, there's an algorithm. You want that algorithm to be internally consistent. If you're very careful with all the inputs and the algorithm is correct, you don't fail.

Weaver: Picking up on that—and I'm sure you've heard this before—some people have called you the P.T. Barnum of Silicon Valley, that you overpromised and under-delivered. But my real question is, do you believe that your biggest problem is not that you didn't have a vision of the future, but that your vision sometimes was too far ahead? In other words, you were believing too much in where the technology would be, and that was the problem, is that you were ahead of yourself?

Bushnell: There is no question that most of my failures were a problem of timing. Here's an interesting thing, and I think I fixed it with my new system. The new system is I write four-page business plans and I put it on a shelf to marinate. When one of those business plans talks to me, then I work on it. A lot of times, it happens because I feel like, oh, the timing is really right because this technology or this sensor just dropped in price by a factor of 100. Or all of a sudden somebody shows up and I say, "Boy, he'd be a good CEO," or, "She'd be a really great marketing person or CEO of this company." So right now, rather than—when you only have one idea, there's only one time—that's now—but whereas if you have—I think my marination pile right now is about eleven business plans. Things that I think are going to be important: a couple in the IOP space, a couple in the blockchain space, a couple in the entertainment world, two in the game world, and each of them are waiting for a trigger point. I think that will actually increase probabilities of success.

Weaver: Would you please tell me about your relationship with Don Valentine and Sequoia Capital?

Bushnell: Don Valentine, first of all, is a mentor to me. Smart man. Capable. We used to fight like cats and dogs, but in a good way. What Don had the ability to do, he was Socrates. He could ask a question at every board meeting that I couldn't answer, but the minute he asked it, I knew I should be able to answer it if I was a good CEO. It'd make me so mad that he'd get me every time, that I would start to bone up and study. [I would] try to figure out what's he going to ask me this time. Talk about a great mentor that can get you to do that. I feel like he's one of the formation figures in my business life.

Weaver: Is there any comment that you would have, albeit out of order, of that whole thing that happened between Magnavox, [Ralph] Baer, the patents, and who did what when? Is there any sort of pithy thing, commentary that you have that either no one's asked you or that you think should be on the record?

Bushnell: Well, to me, the Magnavox lawsuit was really kind of a gnat. A lot of people have tried to make big things about it, but I felt, first of all, I thought it was total bullshit. There was so much prior art and the technology that he claimed in his patents was, I thought, kind of hokey. I mean, there was the whole Willy Higginbotham stuff and all that. I really didn't worry about it, but I also knew that Atari had a very important strategic benefit to Magnavox. I held out and I said, "I am going to only pay you less than what it's going to cost me to defend this, and I'm going to require that if I settle with you, that you go after all my competitors. I want you hassling them." And that's what happened. We ended up with $100,000 a year as settlement for I think five—I think Ralph Baer said seven, but it really didn't matter, anything after two years, to me. [Laughs.]

But it was a thing where the only thing that ever irritated me about Ralph—and as much as I tried to follow my father's advice to not spend angst—is that he kept saying that I copied his game for *Pong*. In some ways I did, but he kept saying that he invented *Pong*. No. He invented Odyssey. That was a stone-cold failure. I invented *Pong*. Alcorn and I invented <u>Pong</u>. It was a big win. Okay. Next. Take credit for your inventing Odyssey. Done. I don't have any problem with that.

Then the other thing that really—this one did piss me off. We did a game called *Touch Me*, which was *Simon*. During the depositions, he came in and spent a lot of time in our game room. He played that. He then went and patented it and sold it to Milton Bradley. Now, I'm as mad at myself because I said he basically saw a game, saw another use for it, and made some good money. He shouldn't have claimed that he invented it, because we invented it. Anyway, that's another story.

Weaver: Let's run to toward the present day. What are you doing right now? Can you tell us about BrainRush? Can you tell us about a few of the other things that you're involved in, and why?

Bushnell: As you start getting towards your middle age, in your seventies where you know you're probably going to die at 140 or 150. You've got to kind of climb in and do something for your legacy. A few years ago, I did a deep dive asking the question "How do we learn?" It turns out that we are designed to forget. If it wasn't, we'd have data coming out of our ears because we're constantly seeing things, we're constantly hearing things. What differentiates something that we see, and we forget, something that we see, and we remember? It turns out it's not intentional. If you say, "Oh, I want to remember that," generally not very effective. But what we do does count. We created some algorithms that require a response. Requiring a response in association with a piece of data says that you have to consider it in your forebrain. That's where the pattern is created. We've developed software that in tests we can teach twenty times faster than a lecture, and it's so effective that we think that it will be the gold standard.

The company is struggling right now, but I'm about to do a re-launch on it because we didn't get it quite good enough. We're four steps up on Bloom's

taxonomy.[13] We think in order to fully cover K-12, we need to get up to level eight. We've got to create exposition. We've got to do a little bit more on synthesis. We've got to get better at abstractions. These are all the next things. We're not going to get all the way up to ten, eleven, and twelve, but we think at that level we can absolutely give somebody the equivalent of a high school education in a year. The equivalent of a college education in six months to maybe a year. I mean, the inefficiency of today's education system is astounding.

Weaver: What's over the horizon for you?

Bushnell: I've got three things. First of all, I decided to never be CEO of anything ever again, so I am now the chairman. That means I can do a whole bunch of stuff and just kind of be a gadfly. It's really liberating. I write business plans; I hire good people. I'm deep diving right now on blockchain and cryptocurrencies. I'm creating a game system that uses blockchain and cryptocurrencies for in-app purchasing. It's going to be a way for parents to reward their kids. Another piece of data: bribing your kids is the most effective way of getting them to learn. In a way, school is your kids' occupation from age six on. We're going to figure out a way to let parents bribe their kids per lesson. The other thing about it is the closer you can truncate the moment of completion to the moment of reward, the more effective it is. We think we can, using blockchain and cryptocurrencies, create a mechanism by which games, philanthropy, education can all be wrapped into this seamless ball that is effective and efficient.

And, of course, I have to be doing VR. We've got a VR Pong game, and we're just kicking butt with it. We just did a series of tests over Halloween at Castle Park. We had a haunted mansion in VR and a Pong game in VR. There were lines around the block for both of them. We're off to the races there.

I've got one more. Oh, yeah. I'm interested in what I call popup museums, selfie museums. You've heard of the Museum of Ice Cream? Basically, it's been sold out. All it is is a bunch of backdrops for people to do selfies with. They charge thirty bucks and they're sold out. In six months, they did $3.5 million. If it costs them more than a half a million dollars to rent the space and do the people and paint the walls, I'd be [surprised]—and so cash-on-cash return. We're doing a museum of illusion. We're going to do weird shit using technology and do a popup in downtown L.A., one in London. This is a business plan, but it's too stupid to believe. We actually think we can create a hundred-million-dollar company in a year because the economics. Once you prove the economics, all the stuff we're doing is going to be built in fixtures so that they can be picked up, moved and shipped. If somebody from Abu Dhabi wants to be a franchisee, they send me a big check, I send them a container. Beijing, South Africa, Sydney, Perth, what have you. Boom. Minute they're tired of it, they send it back and we

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[13] Bloom's taxonomy is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and specificity. The three lists cover the learning objectives in cognitive, affective and sensory domains.

send another. We're going to build a new kind of studio using the movie mode. They will essentially—every other place will be the theaters, and we'll put these new kinds of immersive experiences in using technology and hoo-ha.

Weaver: Any plan on slowing down?

Bushnell: I have.

Smith[14]:   Nolan, can we just bring it back to Atari? I'd just love to get a sense—I know you touched on when the company kind of went under in 1982/1983. Where were you emotionally? How did you respond to that, even though you weren't there anymore? I'd love to know how you felt and what your perspective was on it during that time period.

Bushnell: When the company was experiencing real problems in the summer of 1983, all I did was work harder. I never thought for a minute that it was actually going to fail. One of the ways you get rid of fear is you face your fears. You ask yourself what's the worst case it can be. In the case of that summer, I said, "Okay. If two of my creditors get together," or I think it was three at the time, "and force me into involuntary bankruptcy," I said, "I think I can get people together and we can buy it out of bankruptcy. I mean, the assets are de minimis, and so that's the worst case." But I said, "I don't think we need to do that. I think my ability to persuade these guys to work with me instead of against me is sufficient."

It turned out there were only two guys that were being assholes. They were de minimis and I was able to pay them off. Actually, no, I didn't pay them off. I thought to myself, "Fuck you." I think that one guy was able to get a little bit of money, but the other guy never got a penny. Every time you get the sheriffs down, it costs you money, and after you do two or three dry holes, the sheriffs get tired of doing it for you.

I just think that you should always believe there's a way to win. You just have to work harder, be smarter, be more devious sometimes, just be a bigger asshole, or be a nicer guy. You never know. You've got to have this toolkit that works in various places. If you use the asshole tool on the wrong person, it doesn't work. If you use the nice-guy person on the wrong person, it doesn't work. You've just got to read people. The worst case is when you're dealing with a person who's not a decision-maker, because persuasion once removed doesn't work.

Weaver: Just to wrap up to a certain degree, in looking back, let's assume for the sake of argument that people going forward are going to wonder what made you tick. In

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[14] Alexander Smith is a librarian and video game industry historian who regularly explores video game history as co-host of the podcast They Create Worlds. He earned a B.A. in History at the Ohio Wesleyan University, a JD in Law at Ohio State University, and a MLIS at Kent State University. He is the author of They Create Worlds: The People and Companies That Shaped the Video Game Industry.

other words, what kind of an elemental person is able to accomplish a variety of things, let alone so many?

Bushnell: You know, a fish doesn't discover water. My life has always been driven by curiosity. I'm basically curious, and I always have been. But also, I've always been optimistic. I've always felt that no matter what kind of a mess I get myself in, I can get myself out. I've gotten myself into some really big messes, and I've always gotten myself out. Not always unscathed. I think that optimism, curiosity—then there's this thing that—this is an old word. It's called grit, you know. I've often felt that I would like to take anybody that I've ever wanted to hire out on a sailing trip. There are times when you take a knot down where your boat is on the side, your spinnaker's full of water. The sheet that is holding all the water is underwater and you've got to dive down and let it go. Get it off the winch. There are people who in that situation have a death grip around the mast. That's not helpful. You've got to be people who are doers that can deal well under pressure and they have grit.

I think that I've always had grit, you know. Give me a bad problem, and the only thing I can do is think about "How do I get out of this?" Oh, do I have to dive under the water in 30-degree temperature water and it's in the middle of the night? Yeah, I can do that. [Laughs.] I think that that's been really important for me. I think when you take that attitude, you do solve your problems. You get yourself out of it. Worrying—there's this old hippie saying. "God, give me the wisdom to fix what I can, the stamina to fix what I can't, and the wisdom to know the difference." Boy, I really mangled that one. [Laughter.] But I really believe that's important, that don't worry about stuff you can't fix. Don't even put it on your plate. Deal with the stuff that you can fix and don't expect an outcome that requires you to fix the things that can't be fixed. Be realistic. I mean, that's—god, I'm really waxing eloquent here. [Laughs.]

Weaver: Sounds like a *Go* player.

Bushnell: It is. It has a lot to do with balance.

Weaver: Sente.
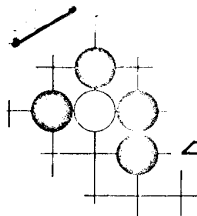
Bushnell: Yeah.

Weaver: Not Atari.

Bushnell: Right.

Weaver: Sente.

Bushnell: Yeah.

Bushnell: Keep the momentum. Make the momentum. Control the momentum.

[End of interview]

Appendix 1

SYZYGY CO.

ENTERTAINMENT ELECTRONICS DEVELOPMENT

2962 SCOTT BLVD.
SANTA CLARA,
CALIF. 95050
404-247-4825

July 10, 1972

John A. Britz
Executive Vice-President
Bally Manufacturing Corporation
2640 Belmont Avenue
Chicago, IL 60618

Dear John:

I was pleased to receive the contract and check and would like
to thank you for your vote of confidence in my skill as an
amusement engineer. I hope that our association can be long
and mutually profitable.

It is my objective to deliver games on a soon as possible basis.
My projected delivery date for the flipper mock-up is September
1, 1972 with the video game to be finished November 15.

The flipper mock-up is to be a radical departure from a stan-
dard four player. It is based on a three world theme in which
each world has its own unique scoring and ball action with the
ball traveling from world to world through feature opened gates.
The progress on this machine would be speeded by the receipt of
the drawings and parts we spoke of in June. These were:

1. A set of working drawings of a four player flipper
   game (Fireball).

2. A list of approximate prime cost of component
   parts.

3. A list of cost objectives concerning one player,
   two player, four player, and arcade pieces so that
   our design objectives can satisfy your profit
   requirements.

4. A parts kit which Mr. Lally and I spoke briefly
   of which would contain the basic parts in current
   production, i.e.

   a. Several thumper bumpers
   b. Several mushroom bumpers
   c. Assorted posts and rubber bumpers
   d. Coin unit assembly
   e. Ball unit count assembly
   f. 00-90 unit assembly

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g.  Player up unit assembly
h.  Four reel score assemblies
i.  Replay unit assembly
j.  Fifty volt transformer
k.  Flipper unit assemblies
l.  Score motor assembly .
m.  Assorted relays
n.  Kick out hole assemblies
o.  Gate assemblies
p.  Two uncut playboards
q.  Plunger assembly
```

There are many parts which we will ultimately need that will
be ordered using the appropriate part number when we have the
necessary paperwork.   The above will be necessary to continue
our work at maximum efficiency.

The video game has a hockey theme which has a great amount of
two player speed and excitement.   The features are: on screen
digital scoring, goals, field markings, multidirectional hockey
players with sticks, goal tender, puck with computer controlled
motion to simulate actual ice characteristics.

I hope that in future travels you or your staff can drop by
so that we can produce an optimum project, and get to know
one another on a personal basis.

Hope to see you soon.

                              Sincerely yours,

                              Nolan K. Bushnell

cdv