



Oral History of Harry Nelson

Interviewed by:
Sellam Ismail

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Sellam Ismail: Sellam Ismail, Software Curator for the Computer History Museum. Today is February 2nd, 2005, and today we're interviewing Mr. Harry Nelson, who worked on, among other things, the Cray Blitz Chess Playing Program. And so I guess we'll first start with all the basics. If you could tell us when you were born, and where you grew up, that sort of thing.

Nelson: I was born in 1932, in Topeka, Kansas, and lived around there until I was 17, and off to college, and I practically never lived there after that, but maybe a little bit.

Ismail: And so can you just tell me a little bit about your parents, what they did.

Nelson: My father was in the banking business, and my mother was a housewife, homemaker, whatever they call it nowadays. And my father did have a store of knowledge about interesting things like puzzles and games and I got a little bit of an enthusiasm from that as a young child, and grew up interested in mathematics and puzzles. And then when computers came along, I got a masters degree in mathematics and then went into computers.

Ismail: So as a child then your influences in terms of things like technical and mathematical, you would probably say your father and were there any other things? What kind of hobbies did you have when you were growing up?

Nelson: No. My father didn't really have much of an affect, except in the early childhood, just getting me interested in that type of thing.

Ismail: And so what were your hobbies, then, when you were growing up? What kinds of things did you pursue?

Nelson: Hobbies, oh, boy. Well, I was in the Boy Scouts. I had a lot of interest in camping and swimming, that kind of activities. Hobbies. Boy, I don't remember any specific. Sports, yes.

Ismail: O.k. So what I'm getting at is when you entered into college, and I assume you sort of levitated towards kind of computer science.

Nelson: No, no. This is before computer science. I couldn't study computer science. They didn't have it. O.k.? But I studied mathematics, and that led into computer science later on.

Ismail: O.k. What university did you attend?

Nelson: Oh, I started at Harvard College in 1949. At that time, Harvard did have a computer already.

Ismail: Do you remember what it was?

Nelson: Called the Mark II, or something.

Ismail: Oh, the Harvard Relay.

Nelson: Relay computer, right. It wasn't even electronic, but it was a computer. But I had no contact with it at all during the college career. And then there were no computer science classes. Then I graduated from there. I went into two years of army service, and then came back in 1955, and went to graduate school in the University of Kansas. And they didn't teach computer science either. But they did have a computer.

Ismail: Do you remember what kind of.

Nelson: In the mathematics department. It was a IBM 650.

Ismail: O.k.

Nelson: And I did take a course in programming the IBM 650. But there was no formal computer science training.

Ismail: What was the nature of the course? In what context was it offered? Just kind of straight programming?

Nelson: Yes. Straight programming. Learned the basics of how to use it.

Ismail: Did you have any exposure to computers while you were serving in the military?

Nelson: No.

Ismail: What branch of the military was it?

Nelson: Infantry.

Ismail: Okay. Army.

Nelson: Yes.

Ismail: Okay. And so what would you say your interests were that might have prepared you later on for computer science, like during say your teenage years and your college years.

Nelson: Yes. Well, you know, I mean I played bridge and I played the various games, the intellectual stuff. And I was interested in mathematical puzzles and games. But computers just seemed like a kind of a natural thing to go to. And there was more of an emphasis on having studied mathematics before you went into computers at the time. Nowadays this is probably not as much of a consideration, but all of the people I knew in computing at the beginning had come through mathematics.

Ismail: And so how about chess then?

Nelson: Well, I played chess, and that was one of the games- I was personally not a very good chess player. But I was interested in it and along about 1970, or so, I played more chess because I was in a group of programmers that were interested in it. And one of the things that came to my attention then was books on chess problems, problems and puzzles. And so I was quite interested in it in that period.

Ismail: And so would you say- we went from about 1955 to, you know, we're talking about 1970s now.

Nelson: Yes.

Ismail: What did you do in those intervening years?

Nelson: 1955 to 1959 I was in school, a post-graduate.

Ismail: What was your field of study?

Nelson: Mathematics. But I took numerical analysis and things that later on were useful in computers. And then in 1959, we left school. I was in the midst of a doctoral program but I hadn't written a thesis yet, and I wanted to get into computers. And there was nothing in Kansas at that time, couldn't study the subject. And so we left Kansas. Came to California. Had a job as a computer programmer at North American Aviation, working on the Recomp II, which was one of the computers in the early 1960s. That's when I really started my career.

Ismail: At what point did you decide that you wanted to get more into computers?

Nelson: That's where the jobs were.

Ismail: So you were just.

Nelson: Yes.

Ismail: It was strictly as a practical matter.

Nelson: Practical matter at the time. Well, it was a nice thing to do, and it was time to go to work. And I stayed there only one year and then I got an offer to come to Livermore, to the Lawrence Laboratory, and program the big computers, which seemed very interesting to me.

Ismail: So from your experience at The University of Kansas, when you took the programming class for the IBM 650, what other computer experience had you gotten that enabled you to get the job?

Nelson: Before that?

Ismail: So when you applied for the job in California.

Nelson: The jobs in mathematics at that time were in computers.

Ismail: Okay. I understand now.

Nelson: And there were many offers. We had opportunities with IBM and various people, and there were plenty of job offers.

Ismail: So instead of we want you to do this job in computers and, of course, math. It was the other way around. We have a mathematics job and your tools are basically computerized.

Nelson: In this particular case, we had a company that had built a computer for the Air Force that wanted to convert it into a commercial application. So they needed people to write programs for the machine, like assembly programs, compilers.

Ismail: This was the Recomp II?

Nelson: Right. For the Recomp II. And after about a year, the project I felt wasn't going anywhere really. And it was a small computer, and I had, by that time, heard about the big computers. And that seemed like more interesting, and Livermore had all the latest, biggest machines, so I got interested in that.

Ismail: So when did you move over to the labs then?

Nelson: About December of 1960. And then I worked there at Livermore until I retired in 1991.

Ismail: What kind of projects did you work on initially?

Nelson: I worked on weapons codes, and also my main emphasis was on codes like assemblers and compilers that were of general utility to the operation, as opposed to specific applications, though I did work on applications. And pretty soon after five or six years, they made me a manager of a group of programmers, which I managed to stand for five years or so. And then I decided, you know, I really wasn't cut out to be the manager. And so I went back into the applications area. And that was about the time that I actually had opportunity to work on computer chess.

Ismail: Okay. So then when you were at Livermore, then during the 60s I believe there were projects where folks were working on, maybe not chess playing programs per se, but there was like the Blitzkrieg program. Were you involved in that?

Nelson: No. I wasn't involved in that. There was an AI project that was started. I can't remember the name. Maybe you remember the guy that was the head of it. He was blind. And he was a very good chess player. And he was very interested in artificial intelligence. And he came to Livermore and set up a group. I knew about it, but I wasn't in it.

Ismail: I'm not familiar with which one.

Nelson: Yes. I can't recall his name. But I programmed puzzles and games to a certain extent, as well as my regular work. And I was interested in chess, and knew about it. But I hadn't done anything along those lines. My experience and my expertise was in optimization techniques. In particular, at the time that computer chess came along, I was an expert on optimizing the Cray computers, that line of computers. But I had worked on Stretch, Lark, several IBM machines, 704, 709, 7090. All these machines were brought into Livermore and then the job of myself and my group was to bring them into use in the community there.

Ismail: And so were you involved at all in the Octopus Project?

Nelson: Yes. The Octopus Project. But mostly as a user. I was never in the Octopus group certainly. I was the tester of the Octopus program, and sort of famous in my own way there, as being able to find all the errors in the Octopus when it was built. But I knew the people, John Fletcher and several others. It was a large project. In a sense, at Livermore, we built entire operating systems, entire connecting computers together and, you know, equivalent to the same thing that Microsoft did, or anybody did. We did it in-house, and for ourselves. It was a government project, and it was classified, so we weren't in the market to sell those things.

Ismail: And so at this time, was there, you know, getting back into more of the chess angle of it, did you start to play chess at this point more? Or how did you get involved .

Nelson: Right. And the way I got involved was through the Cray. Let me explain what happened. Robert Hyatt, who was a professor at the University of Southern Mississippi, wrote a chess program in FORTRAN. And the reason he wrote it in FORTRAN is because he wanted to make a lot of changes to it. He knew it was a developmental project, and would have to have many, many, many changes over the next several years. He worked on it from, I would suspect, around 1970 on. O.k. And he built a program that could play chess and had a certain amount of expertise. At that time there was a organization called the ICCA. This is their journal, International Computer Chess Association, that conducted annual tournaments. The main organizer was David Levy, who wrote the book that you are showing me there. And they held annual tournaments in which computers competed against each other to play chess. In those days, there was a human operator who actually sat at a chess board, made the moves and then when the opponent made a move, the operator's job was to tell the computer what had happened. And the computer would compute and decide on what the next move was. So the human's only task was just being the operator there. Later on, they got automatic things that would be able to read the board directly and so forth. All the logic and all the choices and all the moves had to be done by computer. And it had grown out of the AI community. Levy was connected with the AI community. And there was a lot of speculation then, about how good computers would become and so forth. And David Levy, himself, around mid-1970s, made a bet. The takers of the bet was the AI community basically, against Levy, that no computer would be able to beat him in playing chess for the next ten years. I think that was roughly in 1974, when he made this.

Ismail: Well actually he made the bet in 1967.

Nelson: Earlier than that. Then he extended it for another ten years or something. It was at least 1984 before it was-

Ismail: The bet was made in 1968, and it there was a lot of people over the course of the next two or three years who were putting money in the bet until it came up to like \$1,250 British pounds.

Nelson: Okay.

Ismail: And then it was 1978 when he played the computer. That was the ten-year mark,. And then by the end of 1978 -

Nelson: Well, there was some extension in that, because my newspaper here, which is dated 1984, has Cray Blitz, which I was working on playing against Levy.

Ismail: Okay.

Nelson: And my recollection was, that was the final year. Perhaps it had been extended additional five years.

Ismail: I believe the initial bet was that from ten years from 1968, no computer would be able to beat him.

Nelson: Right.

Ismail: And then after that period, after 1978, then there was additional betting.

Nelson: It certainly didn't happen. And there was some additional extension, and it went on until 1984. And in 1984, our program had sort of a last chance to beat him, and we lost. He did win that bet.

Ismail: Sure.

Nelson: But it stimulated a lot of effort, and people who enjoyed doing that sort of thing.

Ismail: Do you think that sort of like threw down the gauntlet in certain ways?

Nelson: Yes. I think it was a fixed point of challenge.

Ismail: But I mean for you personally and the other people, did you think, oh, we know. We really beat Levy now and did it give you a goal now?

Nelson: Yes. Yes. Yes, absolutely. Absolutely. It gave us a goal. And Levy, himself, as I recall, was surprised that he had won in the final match. He thought computers had gotten to be his ability level, which is National Master, or something. Not Grand Master, but very.

Ismail: I believe he was an International Master.

Nelson: International Master, but he was not a Grand Master. Anyway, Yes, but I think that was a big thing. Well, anyway, I was explaining about Hyatt, who was the originator of Cray Blitz. He had written a program which was called Blitz, period. And his real goal was to play speed chess. He had a board that could read magnetically, read the moves. The human would just move the piece, and the computer would automatically pick it up and respond almost instantly.

Ismail: At this point, what was the computer that he was writing the chess program on?.

Nelson: Well, he was running whatever he could get a hold of, but they were very, very slow machines, his local school machine, whatever USM had at that time.

Ismail: And since it was written in Fortran.

Nelson: Yes. I would say machines, probably the CDC 3600 speed roughly. It would be the fastest machine you could get a hold of. Well, about 1976, or so, he was able to connect with the Cray company, and the Cray salesman, I guess. Anyway, he had some connection with Cray. And Cray, which had the fastest machine in the world at that time, agreed to support the program of Hyatt's. We would be able to use their machines in the annual chess tournament. So Hyatt converted his program. Well, it was written in Fortran so it was no problem. He just moved it over to the Cray. And it would have been Cray 6600 at that time, at the first time.

Ismail: Well, it was the Viper 6600.

Nelson: I'm sorry. That was- so it was after that, right. This was the first Cray machine. Cray One.

Ismail: Cray One.

Nelson: Cray One, right. That was the preceder, right. Well, that was a Seymour Cray machine.

Ismail: Right.

Harry Nelson: Right. Well, I was working at the laboratory on Cray machines, and doing a lot of consulting between us and Cray, itself. So after Hyatt put this on here, then I heard about it, because I was connected with the Cray projects. And so I was able to get a copy of the program and use it and run it for my own purposes, just to see how good it was, and so forth.

Ismail: So Hyatt was happy to give the code out? He wasn't afraid of people.

Nelson: No. He wasn't. That's no problem. He gave the code out. And so I did some tests with it. I was very surprised that some of the things it did very well, and some of the things it did very poorly, just for my own interest. So I contacted Hyatt myself and said, you know, I can help. I don't know a lot about chess. I'm not very good. But I know a lot about the Cray. And I'm sure I can improve the running speed of your program. Is that important? Yes, that's important. And so I was able to contribute a lot of hand-coded loops and things like that. And that result was that the program ran ten times as fast. And this was important, because you get to look ahead a whole other ply in the chess tournament. And then the Blitz,

which was then now called Cray Blitz, became very competitive, at the highest level of computer chess when they had found the ultimate machine, and the ultimate speed out of that.

Ismail: And would you say- this might be in speculation, but do you think it was the strength of the algorithms of the software, or the strength of the speed of the computer that enabled it to become that world class.

Nelson: Okay. First of all, it had good algorithms. But it didn't become top echelon until it had the speed to go with it. So both were important.

Ismail: Okay.

Nelson: I made a lot of contributions to the programming ideas and even the chess ideas, and some of the things that we could do.

Ismail: So you were involved, not only at a programming level.

Nelson: I wasn't a chess expert, but knowledgeable about it.

Ismail: So you were the expert definitely in optimizing the program and even faster.

Nelson: Right.

Ismail: But you also had ideas to contribute to its strategy, for instance?

Nelson: Right. Contributed-

Ismail: What kind of things, for instance?

Nelson: Well, for example, at the time I got started on the program, the program could not win in the endgame knight and bishop against king. Couldn't do it. So I contributed algorithms that allowed it to do that. So we would recognize when that position had come up, and we could win. Now we could win in that position.

Ismail: So would it be able to win algorithmically, or did you have endgame databases programmed in?

Nelson: No, no, no. Just an algorithm. No, no, no endgame database. The only endgame database we had basically was pawn, king and pawn against king. I mean, those simple things like that. There was no real heavy body of chess knowledge in the program, and there never was. But it did get very fast, which meant basically you could study- we could study ahead and we could foresee for every move the opponent could make, we could then look on beyond where their own depth was, so that we basically examined everything ahead of time.

Ismail: How many ply did it do?

Nelson: Well, in the early days, in the late 1970s, we normally ran about six or seven ply, which is a term I guess I could explain. Maybe I can.

Ismail: No, no. I understand it.

Nelson: But anyway, that would be the depth of what we had.

Ismail: That's basically.

Nelson: Humans, for example, look ahead maybe 20 ply, but only on very specific lines. Cray Blitz is a wide-search program that checks everything and every ply up to certain limits. So that's a different thing. And it's a very good strategy to use in speed chess. And Cray Blitz was an excellent speed chess. It had a rating, official rating of over 2,000, which is Grand Master level.

Ismail: Was this by the 1980s, or was this by the-

Nelson: By the mid-1970s.

Ismail: All right.

Nelson: And even before the Cray machines got even faster.

Ismail: Were ratings assigned separately for different levels, types of play then?

Nelson: Well, no. There was regular chess play, which is computer against human, or human against human. And then there's another association for speed chess, which is every game had to be finished in five minutes.

Ismail: And they had separate ratings?

Nelson: They had separate ratings.

Ismail: I see. Okay.

Nelson: And we were excellent in speed chess. And we played thousands of games against humans in order to develop this rating. Anyway, that's what I remember about that. So Hyatt had written the program, and I just basically improved- made some improvements to it and specifically to speed it up.

Ismail: And so can you describe some of the algorithms that it used, like the Alpha Beta pruning, and minimax, and all that good stuff.

Nelson: Right. No. It used Alpha Beta pruning and minimax. Absolutely. But, you know, I don't know what all that means. That's AI. I have a vague understanding of it okay. .? But I really never did really understand all that part of it.

Ismail: Did you implement the algorithms?

Nelson: I implemented the algorithms. I could start from the FORTRAN description of the algorithm, and then basically put it into an optimized order.

Ismail: And so how did it, for instance, determine opening moves? Did it have any sequence of opening moves programmed into it, or how did it initiate a game?

Nelson: Yes. We had a large book of opening moves and we actually had a person, not Hyatt and not myself, somebody. I can't remember his name.

Ismail: Can't remember his name?

Nelson: I know. But he was our opening book expert, and, yes. We would probably be able to make the first six moves or so, at least, from the book, from already prescribed situations. And the book was designed to keep the program in certain kinds of games where it seemed to do better than in other types of games. So it would force certain types of games, and not play other types of games.

Ismail: So during the game, you are saying it would use an in-place strategy where it would try to force the game into a known.

Nelson: Well, a particular of line using the book. It would play with the automatic book moves the first five or six moves, and then it would get out of book, and then you'd have to just compute to decide what the next move was.

Ismail: So was the program capable of identifying certain book positions, and then maybe getting back onto the book positions?

Nelson: I don't think so. After it got out of the book, it never went back. But after that, then you had just algorithms. You said you would give certain amount of points to kings, jacks, the kings, queens, knights, and so forth. They had certain value. You also had positional values, things like forks and whatever would come up. All these things were computed and calculated and set into a number, and then you'd try to minimize that number to be as high as possible. Other computers that we played against in the computer championships, had different rules, different algorithms. So they would come up with a different number than we would in the same kind of a situation. So you didn't really know who was right or better in that regard. The first time that Cray Blitz actually won the world championship of computer chess was in 1980, I believe. No. I take it back. In 1980 we lost. We didn't win. The program from Bell Labs won that year. But we came in second. And it was very close. I was there in New York, and I wrote up about it and the title of my paper was, "How We Lost the Computer Chess Championship." But, you know, it was very, very, very close. We were playing as well as any of them. Bell Labs had built-

Ismail: Bell.

Nelson: Yes. The program named *Bell*, that could only play chess. That was the machine. It couldn't do anything else. It wasn't a general purpose computer. But it was fast, and it was very good at playing chess, and it had practically no strategy at all, just look ahead. And then an algorithm to compute a number from that. So Cray Blitz had a little bit of algorithm, and a lot of look ahead. Other programs had lots of algorithm, and very little look ahead, so there were all kinds of variations, and that was good for the chess as a whole at that time.

Ismail: Do you remember how many positions it could evaluate per second?

Nelson: Well.

Ismail: Millions?

Nelson: No, no, no. Hundreds of thousands. Hundreds of thousands, even at the last. The final version of the program that I worked on, we were using a four processor, XMP. Then we got up to a hundred thousand positions. But Bell was already doing more than that, even many years before. They did much less evaluation and a lot more speed. So in 1980 we lost. The next tournament was 1983, and it was in Edmonton. And we won that one. Cray Blitz was the champion. And then we repeated again in 1986, in Cologne, Germany, is where the championship was. And I brought this poster from Cologne, which was advertising the chess.

Ismail: Now obviously you didn't trek the Cray all around the world with you. Was it always stationed at Livermore?

Nelson: No. It was always stationed. It was stationed in Minneapolis at Cray headquarters.

Ismail: Oh, okay. Oh, at Cray headquarters. Okay.

Nelson: We used only the Cray headquarters machine for playing of chess. Yes.

Ismail: And so you programmed it remotely?

Nelson: I programmed remotely, Yes. Yes. I didn't use Livermore machines except maybe occasionally, but not extensively. I just logged in directly to Cray in Minneapolis.

Ismail: What was the environment like?

Nelson: It was in Chippewa Falls, some of the time, too.

Ismail: What was the environment?

Nelson: Programming environment?

Ismail: Yes. I mean, in terms of like the links, were they like 3000 baud links, or 9600 baud?

Nelson: Yes. Not high. Not high. I was on a remote. I would just log into their computer. Livermore had pretty good line, pretty good connection with the rest of the world. 76K or something, probably. It was high in those days.

Ismail: So these were direct links?

Nelson: Yes.

Ismail: It wasn't like over early Arpanet?

Nelson: No. It was early, Yes, early network stuff. Yes. And Arpanet. Yes, we used Arpanet.

Ismail: And so how did the program communicate its moves, just through a terminal, some sort of terminal or something?

Nelson: Yes. Print. It would print on a printer that such and such a move was what it wanted the human operator to make. They would make it, and then we would put it back in the same way. We would send- well, there was a link to the program. The program could read input files, or input typing. So it knew what it was supposed- compute it.

Ismail: So you would just put in standard algebraic chess notation or something?

Nelson: Yes. Pawn to King 4, that kind of stuff.

Ismail: So throughout the life of the program, initially it started out on whatever computer Hyatt had, and then it went to the Cray. And then forever thereafter it was a Cray-based program.

Nelson: Right.

Ismail: Were there major iterations of the program, or was the whole history of the project just incremental improvements of the programs until it.

Nelson: Yes. Incremental improvements. Most of the development work was done at whatever university Hyatt was at. He moved from Mississippi to Birmingham, University of Alabama at Birmingham, where he was a full professor then of computer science. And so we used their machines. He used those machines to do this development work. But then when he actually wanted to play a game in competition, we would arrange to get a hold of the Cray for three or four hours.

Ismail: In other words, what would the Cray be doing? Just working- doing whatever for.

Nelson: Yes. It was the in-house machine that the sales force used to take new customers. Give them opportunity to work on things. And it was a telephone connection. We didn't have really a direct base. I

would dial up that machine, so only phone speeds. But there wasn't much information that you had to pass, just what the move- the name of the move was, and then it would do the same thing back. It would do all its computing internally.

Ismail: And so when the tournament was coming up, Cray would be notified in advance, of course.

Nelson: Yes. And we arranged to get some of the in-house time. And it was usually late at night anyway, you know, off hours. So that wasn't a real problem. When we played in Germany, for example, the games were in the mid-afternoon in Germany, which was very early morning in Minneapolis. Yes. When we were actually in Germany, it was quite a complicated connection, as I remember. That's like they had to dial up a phone in Sweden and then the Swedish put it on some network that the army had, and then it went to somewhere in the United States, and then it got kicked back down to Arpanet, and then it got over to Minneapolis some way or other.

Ismail: Do you remember in a typical game how long the program would take to generate its move, or generate a reply?

Nelson: Well, that was a program situation. As long as we seemed to be doing all right, we didn't foresee that we were going to get mated in the next move or something, there was an algorithm in there to tell it to stop computing after so many- two minutes, or whatever it was, depending on. Your games are all scheduled. I mean, you have to make 60 moves in two hours or something like that. So it would divide the time up pretty equally for each move. But when it found that it was getting in trouble, it would take a little more time. Maybe double the time.

Ismail: Okay. So it was then adaptable to the situation.

Nelson: Right.

Ismail: On the board.

Nelson: And that probably wasn't a very good idea, because if you're already in trouble, it didn't matter how much time it took you. You're lost. And as I say, very initially it was written for speed chess in which you had to move every five seconds anyway. So the time was pretty evenly divided among the moves.

Ismail: Did the Cray Blitz software, did it ever end up in any commercial products?

Nelson: I don't think it ever did. No. But there's a thing now called Crafty, C R A F T Y, which you can use on the internet interactively. Someone somewhere has made it available.

Ismail: Is Crafty based on?

Nelson: Crafty is based on Cray Blitz.

Ismail: Oh, okay. Interesting.

Nelson: Right.

Ismail: And then so when was the Cray Blitz program officially retired, I guess.

Nelson: Well, I don't know. After 1986, when we did win the World Championship. After 1986 and that tournament then the next one was in 1989, the next-- the world championship and by that time the program that is currently the world champion as far as I know and the one who actually beat the human, deep thought was I think the name of it, Deep Blue or anyway it was an IBM project. That had come along and they were our competition and they were ten times as fast as Cray Blitz and on a dedicated chess machine and so we lost and we could foresee that we would continue to lose. Cray lost interest in supporting the project ,but we'd used, you know, thousands of hours of their time. And so it kind of dissipated but it went back and it eventually became this Crafty program which was meant to be an interactive thing that you could connect to on the internet.

Ismail: Well let's talk a little bit more about why at the end of 1989 when Deep Blue came out things started petering and there has to be more reasons, and maybe you're not privy to all the particular reasons of course but why didn't Cray sort of take this is a challenge and say oh IBM is surpassing our technology, maybe we ought to answer this or how was that?

Nelson: I think probably the sales department just decided this isn't a top project, they originally had agreed that we should become the champion and it happened twice and that took their interest out of it in a way. That's what they contracted for so we had done that but I'm not sure and I retired from the lab in 1991 and quit working on it about that time myself. So in 1989 we still were scrambling and by 1992 which is the next 3 year cycle., I wasn't even connected with it then.

Ismail: How many hours would you have put into working on the Cray Blitz software like say in a given month?

Nelson: Oh myself personally?

Ismail: Yes.

Nelson: A few dozen, Yes.

Ismail: So a few hours a week basically?

Nelson: Yes several hours a week.

Ismail: Several hours a week.

Nelson: And more at the beginning, more early on.

Ismail: And this was sanctioned by the lab?

Nelson: Yes I could do it in my own time, whether I wanted-- it was not a lab project no. I mean I was able to use some of their equipment to connect to the machines in Minneapolis.

Ismail: I guess what I'm asking is did you do the work on Cray Blitz while you were at your office job or at home or after hours?

Nelson: It's all the same, didn't matter.

Ismail: Okay.

Nelson: I did it in the office because that's where the hook up was and not at home but certainly was on my own hours to the very great extent.

Ismail: So your wife was kind of a computer widow then, you're saying you spent a lot of time at the computer?

Nelson: Of course, the normal situation but my children were very supportive and my wife very supportive and we enjoyed going to the actual tournaments and being the operator of the machine and talking with the people there and some really interesting stuff, there was the Turing test in general, well there was a specific Turing test for chess it's just a specific activity which was that you would ask a human to sit down and play a game of chess and decide if it's opponent was a human or a computer. And when the human couldn't tell the difference then we would say that computers had passed the Turing test for chess. I remember once in Denver, not at the world championship but at another local tournament, we had a human chess master playing simultaneously 8 games against unknown opponents, the human master would only see the moves on 8 chess boards that the operators were putting. But he was unaware of who the actual opponents were except he knew that there were several computers and several humans that were being sent moves and playing against them and so he played this simultaneous, he played 8 games and he lost 2 of them and won 5 of them and drew one as I recall. And then he was asked, you know, which opponent was a computer and which opponent was person and also the audience was asked the same question. There was an audience watching this as the games progressed and the human master that was playing this got six of them right and two of them wrong, he thought one of the computers was a human and he thought one of the humans was a computer and the other one's he got correct. Some of the computer chess programmers and people in the field that were watching were able to get all 8 correct but the human himself who was not a computer chess person, just a good chess player, he couldn't tell and that was in 1985 I believe to my recollection of the year.

Ismail: So how many actual computer players were there?

Nelson: There were 5 computers and 3 humans in that particular case as I recall and so we felt at that time, you know that the level of play had gotten to the point where even a human couldn't tell. I remember he made remarks like boy that guy is really tough, you know, and this is one of the weaker computers that suddenly looked really good to him and he was sure that was a human master that he was playing against. And I think they may have had a human in there that was trying to think like a computer on purpose to fool him I don't know, I'm not sure of that. So not more than one of those. But it's a kind of a Turing test, but I was out of the field again before the Deep Blue got to be so good. Although we did play against Deep Blue, Cray Blitz did play against early versions of it and it always beat

us so it was better against computers than people to start with and then it got really good against everybody.

Ismail: But did you continue to follow the advancement of computer chess?

Nelson: Yes I followed it, kept up with it, because another incident that I remember now is that at each of these tournaments they put out a questionnaire to the participants in which we were asked to guess or choose a year by which computers would be better than humans at chess. And, you know, I had a number and everybody had a number, some people said, you know, 1992 and some people said 2055 and some people said never and so forth. And my estimate in the mid 1980's was that it would be 2008 before it'd be able to win against humans. But I was wrong it happened much sooner, it happened in 2000 and.

Ismail: Gary Kasparov.

Nelson: Yes Kasparov, well Kasparov may have had a bad day but it was still close.

Ismail: Because I think he predicted.

Nelson: Well Levy, what was Levy's prediction it was pretty accurate as I remember.

Ismail: Yes Levi seemed to be the person.

Nelson: Yes he was an AI person and a chess person both.

Ismail: Was there ever any controversy or controversial games.

Nelson: Every game against Hans Berliner was a controversial.

Ismail: And why is that?

Nelson: He's a controversial person and he had a chess program that he was quite of fond and they lost to Cray Blitz many times and it was always controversial.

Ismail: What was his complaint or what was his?

Nelson: Pick a complaint; first of all he was sure that we must have had a human actually making the moves out there in the network some place because no computer could do this sort of thing. And I don't remember but none of it was true of course.

Ismail: Well I'm just kind of curious because actually the controversy sort of flared up recently in our investigations to gather information it was just sort of an informal behind the scenes kind..

Nelson: There was a board of inquiry one time about some moves that were made and so forth and I had to basically re run the situation and show that our machine in fact produced the move that was controversial, it did, it worked, and it worked fine, no problem. We never did anything funny but it looked funny.

Ismail: It's interesting because he's so passionate about it.

Nelson: Have you interviewed Hans?

Ismail: No we haven't yet.

Nelson: You got to do that.

Ismail: Yes we definitely want to; hopefully we will have an opportunity to. But there was one instance where he said there was one game that was played behind closed doors and I believe that Cray Blitz against some other program or maybe I'm not thinking of the right one.

Harry Nelson: I don't know that.

Ismail: Maybe I'm not thinking of the right one but he was there.

Nelson: They were always behind closed doors I mean all we see is a computer terminal that's connected to something somewhere; you don't know what's at the other end.

Ismail: I was thinking of a particular game where he was saying that the moves were done in secret or it was something of that nature, but it seems interesting to me that there's so much passion behind it. Did you feel that kind of competitive level, I mean were you really?

Nelson: No I didn't ever.

Ismail: So you were just happy to be involved?

Nelson: I was happy, I'd sit there and operate and let my program do the stuff.

Ismail: So you're sort of the opposite of Hans, you didn't get personally involved?

Nelson: Well the thing is I didn't know when the computer made a good move or a bad move personally and he did or he thought he did anyway. So Yes he would say that a certain move, a certain type didn't make any sense from his understanding of the computer either. Well it could have been a bug in our program for all that matters I don't know.

Ismail: So a bug that could have made it work better?

Nelson: Yes well one of the interesting things about it was that when we started running on multiple processor machines, things could happen out of order and out of sequence in such a way and we also had a big file so we kept track of everything that had happened, of all the things that we used. I'm trying to think we call it a hash table, we had a hash file in we remembered all the things that we'd done when we were searching at lower levels and sometimes those would get overwritten by the opposite processor I mean the one processor was running here and another was running here, they were both writing into this file, so it wasn't 100% determinative but it was almost determinative so that could lead to strange things now and then. Before when we only had one processor that we didn't have that problem then it was determinative.

Ismail: So you're convinced that as far as you're concerned everybody was noble and there was no cheating, you don't think there was ever any cheating going on at all?

Nelson: No I never knew about anything.

Ismail: I mean not in your team of course but I mean in any other team?

Nelson: No not at all I mean there were commercial programs entered in these tournaments that would have benefited probably from the notoriety of being able to win but I did never see any of that, no.

Ismail: So I found the page in the book where the predictions were made, your prediction and this was the estimate of the year in which a computer will defeat the human world championship and you said 2008 and Highett said 2000 and he was probably right.

Nelson: He was pretty accurate, what was Levy's?

Ismail: Levy said.

Nelson: He was conducting the interview, I'm not sure he had a number.

Ismail: 2014.

Nelson: Oh okay he was even farther off.

Ismail: I believe the Kasparov game was 1998 was it not?

Nelson: Somewhere in there Yes, I don't remember exactly.

Ismail: The person who predicted 1998 was Kevin O'Connell, 1997 was John Stanton. Do you keep up with these folks and people who used to be in your team and other competitors anymore?

Nelson: No, no, I retired.

Ismail: So that's it.

Nelson I'm in the puzzle business now, so I don't even have the computers connections anymore.

Ismail: Do you make puzzles?

Nelson: Make puzzles Yes.

Ismail: And do you publish them?

Nelson:{Shows a puzzle} I brought a puzzle to show you. Now what do I say, these are mechanical puzzles right not paper and pencil, not mathematical puzzles. Although I've been connected with mathematical puzzles. I'm trying to do this under the table here. There here we go, there's two pieces that go together and make a cube, very simple puzzle, I like puzzles like this and then you have to fit them back in the box. But anyway that's an example of the kind of stuff I do.

Ismail: How long did it take you to come up with this?

Nelson: This was actually devised by a friend of mine, Bill Barrow, I just built it and used it and there's an international association of puzzle collectors, there's an international association for everything so and I'm working on things for that group this next year. At one time in the past I was the editor of the journal of recreational mathematics, which is about puzzles and things and I've always had an interest in that. Now it's more in collectable then actual mechanical ideas.

Ismail: Is there anything else you want to add or anything we missed perhaps, I think we're kind of at the end.

Nelson: No.

Ismail: What's this cartoon that you have here?

Nelson: I have a couple of cartoons in which I thought I would contribute to the Computer [History] Museum.

Ismail: Oh okay, very good.

Harry Nelson: These were published in the In House magazine in Livermore.

Ismail: Oh at the labs, these were done by yourself?

Nelson: No. <shows cartoons>

Ismail: Oh somebody else.

Nelson: But that's me.

Ismail: I recognized the guy with the glasses.

Nelson: I'm one of the characters, here's another one.

Ismail: Okay excellent, thank you, we'll add these to the Museum collection. Alright well I guess that concludes the interview then and why don't we take you out.

END OF INTERVIEW