What's in the Box? Highlights and Summary:

Video Tapes – (EAF - should we capture these for the online archive)
25th Anniversary of Dendral Project
EAF “Where’s the Walkman?”
EAF “Tiger in a Cage: Applications of Knowledge-Based Systems”

Talking Points:

EAF – should we capture all of 25th anniversary, or just select sessions? I.E. ones EAF participated in

Tiger in a Cage - “So there's a big fat folder here that consists of a talk I gave which was a very important one for me and probably for the field. It was called "Tiger in a Cage". The tiger was expert system technology. The cage implied why hadn't this conquered the world? Why hadn't - you know, we expected a big expert system boom and then the - the world would be taken over by expert systems, you know, like it was taken over by spread sheets and things like that. But - but it didn't happen or it happened to some extent but not as - as much as we expected. So this was an invited speech for the American Association of Artificial Intelligence Annual Meeting called "Tiger in a Cage" and it has been referenced in many places.”

“And that was made into a videotape by a company that - that makes technical oriented videotapes and sells them to the public.”

Where's the Walkman? - “And this is a talk given to the computer science department's forum Industrial Affiliates Program in 1994 in February. Now this represents a shift in the nature of my work. In 1990 - perhaps in late '92, I was asked by the Dean of Engineering Jim Gibbons to look into a project that was supposed to be joint between the Engineering School and the Business School, The Sloan Foundation Computer Industry Project. And as far as he could tell, the Engineering School wasn't having any input into this project. So he asked me to go over and check it out. So I did and found that indeed Gibbons was right and, in particular, there was no one working on the software end of the computer industry. There was some work by Business School and Economics Department faculty on the hardware end of - of computer industry and Silicon Valley. So I formed a thing called the Stanford Software Industry Project as part of that computer industry project. And then in '93, 1993 in the spring, I happened to be signed up to spend the spring quarter at the Stanford-Japan Center in Kyoto, Japan. And during that period, I did my first batch of work on studying the software industry, mainly studying the software industry of Japan using the students at the - who had come over that quarter for the Stanford - for the Stanford-Japan Center as - essentially as
research assistants for helping with the study. And the results of that first study were presented for a while only as a talk that I was giving called "Japanese Software, Where's the Walkman"? That resulted actually in a publication that came out in 1996 in January in a book called "The Future of Software" published by MIT press. That's the written version of that talk."
Box 77

**What's in the Box? Highlights and Summary:**

**Video Tapes**

**Talking Points:**

Here is what was on the transcript from tape 4 about the video tapes (Box 77)

**SW:** Okay, now we're looking at a box of VHS tapes and it's sort of two different series. The first one is - is the computer science class number 408 which Ed taught in the spring of 1988. It's fo - let's see, it starts with disk number - with tape #5 and we're not sure where tape 1 through 4 are but then it ends with 19. So it's tapes 5 through 19 are the 408 class. Do you remember what the name of that class was?

**EF:** No, I don't.

**SW:** Okay, and then the other series is CS226 and there - there are eighteen of them and they are marked Chukyo University. And do you have anymore comments?

**EF:** So let's talk about these two different collections of tapes. They're from a very similar era, the '88-'89 timeframe. The CS226 was the course Introduction to Artificial Intelligence at the 200 level which means the upper division and graduate level. They're labeled - these tapes are labeled "SITN" which is the Stanford Instructional Television Network that handled a lot of of lecturing, distribution of Stanford lecturing done by engineering professors and computer science professors to local industries. In this particular case, because it is labeled Chukyo University, it may be that Chukyo University in Nagoya, Japan perhaps signed an agreement with SITN for this course. I was instrumental in helping Chukyo University get off the ground in the field of artificial intelligence. They actually established a school of, I believe it's called Cognitive Science and Artificial Intelligence. I gave one of the dedicatory lectures and it could very well be that they wanted a course and they simply asked Stanford to tape my course and basically bought the course from Stanford, purchased a - a use license for - for this CS226 course. I'm not sure of that and I haven't looked at those tapes but that's a - a likely thing that would've happened. Now the other ones are dated 1988. That's a year earlier. 1988 is the year in which the book "The Rise of the Expert Company" was published by Times books. That's the series of case studies about the excellence in applications of expert systems to various industrial problems. So it appears that what happened here is that I invented a course, CS408, I think it says - 408, yeah - which could very well have been - I'm just guessing - but it could very well have been called "Applications of Artificial
Intelligence" in which I invited people who - whose work was represented in the book, "Rise of the Expert Company" to come to Stanford, probably at their company's expense, because we didn't have any money to pay for this, to give a lecture on what they did and probably the textbook for this course was the newly published "Rise of the Expert Company". For example, I saw that one of the tapes here - they have in pencil who was giving the talk. One of the tapes was Dupont, Ed Moller. So the - in the - in the book there's a couple chapters on Dupont and Ed Moller. There's another one of the tapes on the application done by the company NaviStar - it's a truck building company. Then there are some people represented here who are not in the book but they are known for their applications of artificial intelligence. For example, Professor Ray Levitt in the Civil Engineering Department is represented as speaking on tape 16. Dr. Larry Fagan of the Medical Informatics Laboratory of the Department of Medicine is talking here on a program for diagnosis and - and treatment - I think it's for - not diagnosis but for treatment protocols for cancer treatment. And it's very hard to read some of these. Oh yeah...

SW: Dick Jackson but he...

EF: Yeah, there's a Digital Equipment Corporation is represented in the book and so there's one of the people from DEC who participated in that. There's Nancy Wogrin, W-O-G-R-I-N, on tape 13. Nancy was my teaching assistant in this course and she was a Master student here at the time. But she also participated in the DEC configuration advisor. There's someone from IBM talking - there's a chapter in the book about IBM, chapter or two. And someone from IBM came to talk about their work, etc. FMC, a company that I don't think even exists anymore - used to be in San Jose. Perry Thorndyke was working for them. He gave the lecture. It looks like IntelliCorp - somebody from - oh maybe it - maybe it's on IntelliCorp. IntelliPath may have been another company that so - came and gave a lecture.

SW: That's IntelliCorp right there, #11. That's IntelliCorp.

EF: Okay. John Kunz, a num - tape 11 - John Kunz is - is now the Director of the CIFE Laboratory, C-I-F-E, The Center for Integrated Facility Management in the Civil Engineering Department. And he was a student of mine who was Director of Applications at IntelliCorp and he gave a lecture that's on #11. And so on. Can't read some of this. It looks like there's a panel--#17 looks like a panel in which Peter Hart participated. And that's - Branscomb would be KC Branscomb. It's misspelled there but it's KC Branscomb who was the CEO of IntelliCorp. And - and there are - I - I haven't even mentioned 5, 6, 7, 8.

SW: Nancy Wogrin again.

EF: Nancy Wogrin, we've mentioned before.

SW: Round table.
**EF:** That's some kind of a panel discussion on applications.

**SW:** Oh, okay. Barr, so Avron.

**EF:** Avron Barr who had been a former student of mine and colleague.

**SW:** Inglemore and Wogrin.

**EF:** Yeah. And Inglemore was one of the - at that time, I believe he was still working at TechKnowledge. Inglemore had been a member of my research lab then after TechKnowledge was founded, I believe became director of their - Director of Applications for TechKnowledge and then he may have been with TechKnowledge when this tape was made but he came back here later.

**SW:** Paul Harmon.

**EF:** Paul Harmon is the man who was editor of ex - the - this kind of a newsletter in the expert system area - one of these expensive newsletters that keep companies up to date with what's happening in a fast changing area. And Paul did the - he did the appendix for "Rise of the Expert Company" with a whole list of companies that had done expert system applications. In this lecture, I don't think he recounts those companies. I think he's talking about trends in this lecture.

**SW:** Okay. And then the last one was Northrop Lindsay Joy, Tape 8.

**EF:** In the book "Rise of the Expert Company", there's a chapter about the Northrop Corporation and these two people are mentioned as having done the main contribution and they came to give the lecture. They came from Southern Ca - Southern California.
This is an interview with Edward Feigenbaum on August 19, 1986, with Henry Lowood and Roxanne Nyland, in his office in the Computer Science Department, Math Corner.

HL: - put into these categories, and we have little stickies there to indicate them. We didn't change any of your alphabetically arranged and subject files. And then your names files, except for (?). Those are just to (?) that we have them. And then we had some miscellaneous. I think about two - two or three boxes we couldn't figure out.

EF: Okay.

HL: And then we had - just all these boxes here I believe are books. The - Elliot I believe said that you wanted those back. And book-like things, like conference proceedings, and such, which I would have - we all have to have the questions about. Actually, I think they might be useful in the - in the papers because a lot of them I'm sure - a lot of those proceedings -

RN: (Inaudible) available.

HL: - no longer available, yeah. Or they weren't collected in time perhaps. But that would be -

EF: They - the pr - those things - those proceedings might be treasures (?) -

HL: Yeah. I think so.

EF: - library.

HL: Yeah. Yeah. So those - when she said you wanted the books back, I wasn't sure if you meant those as well. Most - there are a lot of books that seem just be review copies or your own library, or things that you - I can see why you would want those back.

EF: Well, so - so long as I can get a hold of them in the library, which I take it would be no problem.

RN: I have no problem with that.

EF: And there's no reason for the library not to have them. If they - if they ever f - ended up in the main Computer Science Library they'd be stolen.

HL: Mm-mmm. Mm-mmm.

EF: So -

RN: That's one - make sure and think about the archives. They - they're not going anywhere.
EF: Yeah. So that - that's right. So if they went in the archives it would be okay. I'm putting together a collection of papers right now - historical papers of the AI field. And for two of those papers I had to access a pair of volumes on my shelf which is the first AI conference ever held, and it's held in England, called *Mechanization of Thought Processes*, bound in paperback by Her Majesty's Stationery Office, which I acquired the year after when I arrived in London on a Fulbright. There's no way - I probably have one of the ten last copies in the world. I mean there's no way anyone's going ever find that thing again. And I had it right on my shelf, and I just went right into it and found -

RN: And it was still here though.

EF: Right behind me on my bookshelf. So those things are really valuable.

HL: So I was thinking what we could do with your time, there are two things then. There's - one is to go through some of these things we could not do anything with. And two would be maybe to look through some of these files making corrections or commenting on things as we went through.

RN: Describing the context and anything in particular that you think is worthy of pointing out.

HL: Do you have a preference?

EF: Why don't we go through the materials that you're confused about.

HL: Okay.

EF: And -

HL: Well, to start with, do you have any idea - on some of those tapes. They even look -

RN: We may end up just having to run them to see what's on (?).

EF: See, I have no idea, so running them is - is a (inaudible).

RN: Might even try to (inaudible).

EF: It could be that - that we were using a tape recorder to record a conference, and that things were - because that's - it looks like there are so many that it - it has the feeling of - of there being a conference and we had a tape recorder running.

HL: Okay.

EF: But I don't know.
HL: Yeah, these are -

RN: (Inaudible).

HL: These are all - this Box 9 has a lot of miscellaneous things in it. Oh, we - I guess I'll put the tapes in Box 9, too. (Inaudible.)

EF: Yeah, just - I don't know what this is but I'll just take it.

HL: That's fine.

RN: Tokyo. Society of Medical Sciences.

EF: You don't want that, right?

RN: I don't think that'll reflect much (inaudible).

HL: I think it'll - probably needs more - more (inaudible).

EF: That just says I gave a talk (?).

RN: And that the Japanese like to give it away.

HL: Yeah. And that's something you could have if you want it.

EF: This is - the PhD Thesis of a Berkley student that I supervised in the period 1960 through '65, Wayne Wickelgren, and Wayne is a faculty member at the University of Oregon, or was last time I checked with him.

HL: (Inaudible.)

EF: So this is - this would be a - what would be called - this is one of the earliest theses in what is now called Cognitive Science, which is the Psychology end of Artificial Intelligence.

HL: So what we need to do is have a little section called Berkley or something like that, that that would go into, or -

RH: Well, there - I - I think there were other theses, too, that we've come across. And what we might be able to do, which would be better access, is to separate those things out and that way we can have them catalogued separately - to - to find them.

EF: Okay. This is 1962. That's quite early in AI to be writing.

RH: Yeah.
HL: Yeah.

EF: Excuse me.

RH: No. I - that's what I was just thinking, that - that the information in that thesis is probably important enough to be - to merit individual access to it, and so we might want to think about that.

HL: Okay.

RH: I think I - I think there were other - other theses that we saw.

EF: This one even says Archive.

RH: That's destiny.

EF: Okay. Boy, I know what this is. Let me see if I - whose answers are these? New ones or (?)? (Inaudible) I - I know exactly what this is. Let me just - if this is my response, then it's a very important document, because I've been looking for this. I'll - I'll wrap them up in - in this. Oh, wait a second. I know that these are - probably actually different things. '73. A man named Steve Crocker - are you recording this?

RH: Mm-mmm.

EF: A man named -

RH: All systems go.

EF: What?

RH: All systems go.

EF: All systems go. A man named Steve Crocker, who is now the Head of Artificial Intelligence, and maybe some other things at Aerospace Corporation, was a young man serving at the ARPA Office in Washington - Advanced Research Projects Agency. In this period in which these messages are dated, mid 1973, ARPA was conducting a reexamination of the importance of research in Artificial Intelligence, which it had been funding for a long time, and was always subject to periodic re-review.

RH: Mm-mmm.

EF: The - the field was constantly under pressure to justify itself. This may have coincided with the rise to the Directorship of Dr. George Heilmeyer, now Chief Technical Officer of Texas Instruments. Heilmeyer was skeptical about Artificial Intelligence, so this was a response - this was a set of questions by Crocker to the wheels
of the field to give him ammunition for a document which would be, why AI, why is it important, what has it accomplished, where is it going? It's a planning document. And a justification document. For example, right in the middle of this batch of messages is a message from Al Newell at Carnegie Mellon to Crocker. Re: questions on AI field. And Crocker's questions are listed here, and Newell's answers are sketched out. Ditto for Peter Hart who's now Vice President of Syntelligence. And several other people in the field are in this package of messages. This then is an - the - this then is two different copies of an emerging document of that sort to which I contributed. And that's why I have them. And it had seemed to me at the time that would be important, so I'm - I call that Archive, and I call this Archive and put them all together, put this clip around it.

RH: Great.

EF: And that's what it is. So circa 1973, this is what the people in the field were saying about what they had achieved and where it was going.

RH: Uh-huh. Super. (Inaudible.)

HL: (Inaudible.) That's interesting. It's in the form of electronic (?), I'm pretty sure.

RH: Or - is - is that electronic mail?

EF: I - some of it is. Some of it is. And the rest is printed out off the word processor. Okay. This document is by a student of mine, Reed Smith, R. G. Smith. Reed came to Stanford. He was a double E student, Ph.D. student. He now works for Schlumberger, Schlumberger Research Laboratory. He was - he came to us from the Defense Research Establishment Atlantic of the Canadian Government, DREA, where he had been working on problems of sonar signal identification using computers. And he came to Stanford. I had been working on that problem about the same time. Reed had gotten interested in the field of Artificial Intelligence and had written this document for his own people inside. Copy 16 of 30 for the Canadian Defense Research Establishment Atlantic in Nova Scotia. And so this is in 1975 what Reed thought the field of Artificial Intelligence was all about. His summary for in-house people. I have no idea if you want to keep that, but that's what it is anyway. Let's take a look here. Computers and (Inaudible.) Okay. Now, we started a lecture series in the field, which for many years was the only award lecture in the field of Artificial Intelligence called The Computers of Thought Award Lecture. From the royalties of the first anthology of Artificial Intelligence, Computers and Thought, done by Julian Feldman and myself in 1962 and '63, the royalties were donated to the Association for Computing Machinery. Eventually the royalties found their way into the control of the International Joint Conferences on Artificial Intelligence to give a prize and a lecture called The Computers and Thought Lecture for young people in the field who had made outstanding contributions. The first of those Computers and Thought award lectures went to Professor Winograd, who's here at Stanford now. And a later one went to Patrick Winston. 1973 lecture went to Patrick Winston, now Director of the Artificial Intelligence Laboratory at MIT. This lecture apparently was tape recorded, and this apparently is a transcript of that lecture. The information here is ab - about it. It's session
13, Computers and Thought Lecture, August 21st, 1973. And - there is a - a front part of this which is a statement by me about the history of this - of this lecture, a more detailed description of what I've just given you. And then it says, "I'd like to introduce Pat Winston, who will present the second Computers and Thought Lecture - Second Computers and Thought Lecture." And then there's a break, and then Pat comes on, and this is a transcription of Pat's talk.

RH: So lectures were always given at the conference? Or -

EF: Always given at the International Joint Conference on Artificial Intelligence held every two years. So this is Pat Winston, second Computers and Thought Lecture. These conferences are called IJCAI, International Joint Conference on Artificial Intelligence. IJCAI '73, this would be. So this would be Transcription from Tape, First Feigenbaum Intro. Second (?) Lecture.

HL: Okay.

EF: Oh, here's some more of it. That thing I gave you with the clip on it?

HL: Yeah.

EF: Okay. This is - here's an electronic message from Bob Balsa at the University Of Southern California Information Science Institute called Response to Crocker's AI Request for Info. This is - some notes on Keith Uncapher's comments - I better write that down. KU is Keith Uncapher. He's the - Keith Uncapher is the Director of Information Science Institute. I was wrong when I said that it was a Heilmeyer thing because it says here that the report has to be in by October 6 for Lukasik. Lukasik is Steve Lukasik, Director of ARPA, and the predecessor of George Heilmeyer. Length, eight to twenty pages, and - and so on. It give - this gives the - the spec for this AI report that they want. These are notes for that report. And these are exist - these are in-process documents that I was preparing. Apparently I was in charge of writing this thing because you can see that all the - the edited manuscripts. This is the section on Information Processing Psychology. This is the section on Continuing Basic Research on Various Mathematical Logical Problems such Formal Models for Heuristic Gerte, Their Improving Methods and Mathematical Theory of Computation. And so on. This - all these sections are of this report from here. Here is a November 3rd, 19 - November - excuse me, November 9th, 1973 document. This document was prepared on the Stanford AI Lab computer. I can tell by looking at the name of the file. So this was pre-pre-SUMEX. It's called - the draft of this report as it is emerging is called Artificial Intelligence Research: What Is It, What Has It Achieved, Where Is It Going? This is the document I've been looking for and no idea where it is. And - this document is a return from somebody who - who was commenting on it and left some comments for me. Yeah. For example, one comment is "If anyone but Lukasik is to see this you will have to pay more attention to work that isn't yours and your students."

HL: Can you tell by the hand whose -
EF: No, I can't - I've been - I don't know. I - I have a feeling it's Al Newell, because I remember - well, first of all, this top comment is very Newell-ish in style. "As you say, it is very good." So I suspect these are Newell's comments. But I myself need a copy of this because I've been searching for this thing. I knew exactly what it looked like. I mean in my mind's eye it was exactly that. So it just didn't disappear from memory. This is a - an unpublished paper. It's not a paper; it was part of this report to - to Lukasik. Let's see what this is. This is an earlier draft of it dated the 5th of October, '73, in computer listing form, whereas the other one was dated 9th of November. The - I'm looking here at some additional notes labeled "JF" "JF" is Jerry Feldman, not Julian Feldman - Jerry Feldman who was a faculty member here at Stanford, now is a Professor of Computer Science at the University of Rochester, has been for many years, and these were Jerry Feldman's comments on the - the topic at hand, what we needed to put in this report. Message from Licklider. Licklider served as - two terms as a Director of the Information Processing Techniques Office of DARPA. And this about the same time, and I don't remember whether Licklider was back in office for his second term at that point. He started that Information Processing Techniques Office back in 1964 I believe, and then came back in the '70s for a second run at it, and he may have been Crocker's boss at the time. This message from Blue - well, it's not important. He - this is more from Licklider about the politics of this situation. All these messages from Licklider. He's sending it to me I guess saying, "Dislike to tease you, but dislike even more to keep Lukasik waiting when he expects something. Hope you can finish up AI report soon." So apparently I was procrastinating.

HL: So the hierarchy was Lukasik, and then Licklider, and then Crocker.

EF: Yeah. Lukasik was the Director of DARPA. Licklider, in his second run at that job, was the Director of Information Processing Techniques Office, and Crocker was a Program Manager. And we were all people who were receiving contract funds. So you - this is more on the - on the politics. And here are some more drafts and an outline of this - this thing. This would be really interesting to go through in detail because it shows what the field, and particular the field seen through my eyes, thought of itself in the summer and fall of 1973. Here's some notes in this packet dated February 22nd, '72, so actually this is going on for some time.

HL: Oh, boy. Yeah.

EF: It's interesting that this whole file is - is called "Archive AI." So even at that time I was thinking about archives.

RH: Yeah. And about the historical importance of these - this particular activity.

EF: It's fascinating that since this is dated '73, and here's a paragraph that says - that talks about the "what to how spectrum." And what's fascinating about this is this same text shows up in a critical part of a - the most important survey paper I ever wrote which was the - my invited speech at the 1977 IJCAI '77, and this is '73. And yet this very
same text shows up, so I must have gone back to this thing and lifted it and put it in there because I liked so much what I wrote there. And then I - I just try to summarize the whole field as I - as I see it. What the - what the goals and sub-goals of the field are. This is very early to be - this - many things in here that I'm surprised to see here this early.

HL: Was the - what - DARPA did occasionally stop programs, so there was - that - was that part of the pressure in this case to - with - with this report, was there a danger of that happening?

EF: Yes. There was a - a - the possibility of that. Lukasik I don't think was the kind of person who would have stopped this program. At a meeting of principal investigators in 1972, Lukasik drew a graph of the normal DARPA program, a five-year program which starts out at a certain high level of funding and decreases gradually over time until at the end of five years there's no funding. And then he drew a horizontal line on that graph and said, "This is AI. AI is my long-term investment. It doesn't decrease." So I don't think Lukasik actually would have cut the funding off. But Lukasik's successor, Heilmeyer, actually tried to do it. By this time, however, George Heilmeyer is one of the strongest supporters of AI in the world and was on the cover of High Technology Magazine in May in the lead article entitled Artificial Intelligence: The Heavies Get In, which was his Texas Instruments effort. George is also on the Board of - of Trustees of Directors of the Center for Integrated Systems. But he's very strong on AI now. But he was very skeptical during that period.

RH: What do you think changed his mind?

EF: I think the - the weight of all the argumentation that he received. He's a very rational, clear-thinking, scientific and technical person. And I think by pushing on these people, myself and Newell and all the other people in the field so heavily for so long, and getting such good responses from us about the importance of all of this that he finally - it just got to him that this was real important. It - it was very soon after Heilmeyer left his job at DARPA to take on the job of the Chief Scientific Officer of Texas -

[End of Side A]

EF: It was actually a matter of just a - a few weeks or - or maybe a few months that George called up me and John McCarthy asking both of us, "How do - how do I start an AI lab here at Texas Instruments?" So in spite of all the hassle, George became a kind of born-again AI-er. He loves it. I mean he's - we've been responsible for this massive effort by Texas Instruments. And I love it. I mean -

RH: That's - that's amazing that - but very gratifying to see a change like that in somebody - somebody whose opinion you respect.
EF: Yeah. That's right. So - but Lukasik I don't think would have - would have cut off the funding of the field. This was - this apparently was being written for Lukasik. Okay. I'm going to give you this.

RH: Shall we make a copy of that for you?

EF: Yeah. Would you?

RH: Is that -

EF: This one document I would - I would like to have a copy of, because I've been looking for it and - but do - do you know where it would go back into?

RH: Yeah.

EF: It's in a file called "Archive, AI," which has all these notes in the Emerging Document.

HL: I'll keep it with this so that we know we have it all - this stuff all together, and then that folder will be in with the other material on this report. I mean actually, we can put this in the folder.

RH: Okay, why don't we put that in the folder and put that in there, and put that with that.

EF: Yeah.

RH: And then we'll keep this (?) -

EF: Okay. Here's another thing called "Archive AI." This is something different. Now this - oh, amazing. This is amazing to discover this material. Quite amazing. I give a lot of lectures and have always given a lot of lectures. And this represents - and I - and I always write out outlines at hand - by hand. This represents a lecture given in 1968, April 15th. KSU might conceivably be Kansas State University. And my guess is that's probably it. These are - and I - Lecture 1-A, Introductory Remarks for the KSU Series of Lectures. So how these lectures are structured, first four in the area of Computer Models of Thought Processes Fifth. So it must be five lectures that I gave there. And these are - and I see here a categorization of different programs that existed at the time.


EF: Do we have an extra - do we have a lot of that stuff, so you don't lose the (?) shut? Shall we get more?

HL: Yeah. (Inaudible.)
EF: Okay. Now here's the - here's a packet of material called Lecture Notes, Heuristic Problem Solving. And these notes - I can imagine - I - I am pretty sure I know what these are.

RH: And they have nothing to do with the KSU lectures?

EF: Nothing except that I may have put them in the same folder because I wanted to make reference back to them. However, these particular ones which carry no date are very old. These are -

RH: They're typed.

EF: Yeah. These lectures are from - from the days - these are probably late Berkley days of mine, and early Stanford days which put them around, say, in the '64 - '65 era. And I'm talking about here, all the concepts that we were thinking about in the first decade of AI work. This is my post-graduate school early Assistant Professorship, and I was giving lectures on AI, and almost no one in the world knew about AI, and I was talking about the - the events of the time, so to speak. For example, here's - Element "C" in this lecture is "Trust Investment Process: Decision-Making Under Uncertainty, the Work of Jeffrey Clarkson," who was a graduate student colleague of mine at Carnegie Tech. And nobody talks about Clarkson's work anymore. That was just at the time. Here's something about Saint, Jim Slagle's work at MIT about circa 1960 - '61, that would have been prominent at the time. Simon's Heuristic Compiler was '62. MH-1 was the earliest AI shot at robotics, Mechanical Hand, MH-1.

HL: Where was that? MH-1?

EF: MIT. So - I would date these lectures somewhere in the 1964 - '65 period. This is a - a similar one. This is called Global Outline for a lecture on Heuristic Problem Solving, and it looks like - it looks like it accompanies - it looks like this is the Global outline and that's the detailed outline. They look the same.

HL: I think I've noticed that incidentally in your files before, it's just something maybe we should look out for, that you do have a tendency to take notes from another period and put them in with something that you're working with.

EF: Always. Always. I mix and match. Yeah. And then these are pieces from - that I would want to use in the lecture, maybe even make view graphs of. And I - I take them from other places. And these happen to be taken from the book Computers and Thought. These are pages - actually, they don't even look like Xeroxes. They look like I - I stole pages from a page-proof copy of Computers and Thought, because they look - they look actually printed. And then I would quote from them. So - now, Computers and Thought was - was published in '63, so I would have had page-proof copies. So this dates them after - after early '63. And it's pre-DENDRAL. DENDRAL was '65 because I know there's no mention of DENDRAL in here. So that really dates it. It tells you it's - it's after - it's af - that book came out I believe - it's copyrighted '83. December '82, and
probably it's a '83 copyright for that reason. And so it's in '83, been before - I - excuse me. What am I talking about? Talking about '60s, not '80s. '63, and -

HL: This is '65.

EF: - and before '65. And let - if you want to date that. Here's another one. Oh, these are all called Archive AI. Look at that. It's amazing. This is amazing. Okay. More - more on that big report that I was telling you about. This - these are dated August. And there's a lot of electronic mail from people sending in their ideas to me. Like for example, here are - oh, I'll have to go through this. This is interesting. Sorry. This is - this should go in with - you remember the thing I had printed out there, Newell's Response and Crocker's Response? Here's another copy of it. Electronic mail from the time to be sorted out. Bill Woods, now Chief Scientist at Apex. Bob Balser.

HL: The electronic mail, just one quick question about that. Would that - was that going over ARPANET at the time, or -

EF: Yes. ARPANET.

HL: And this was a typical way of collaborating then, just to send mail from one person to the other about ARPENET. And then -

EF: Yes. That's right. Here's - so here's that. It goes with - with that. This is somewhat different. The man who's currently Director of Information Processing Techniques is Saul Amarel, Professor of Computer Science at Rutgers. Here's a message - well, here - here are messages of various types, but the one that - that seems to be important here is the message from Saul Amarel about AI Summer Study. And the AI Summer Study was for a DARPA group called The JASONs. The JASONs are an elite panel, primarily physicists, who advise DARPA. They still exist. They're a kind of semi-secret elite panel.

RH: JASONs just like Jason and the Argonaut.

EF: Yeah. Except that - it's a very interesting etymology for JASON. J-A-S-O-N. July, August, September, October, November. It's the period of the year when they're active. They have a summer study, and then they work in the fall to do a report. So they call themselves JASONs. Saul joined JASON, and as part of this intense review of whether Artificial Intelligence was worth anything or not, Heilmeyer got the JASONs involved, these physicists, to take a look at whether this crazy field had any use. And Saul by this time was on the JASONs, although he was a computer scientist, not a physicist. And he was organizing all of us to come down to La Jolla where they meet every summer. The JASONs meet in La Jolla every summer. This was the AI Summer. They were going to look AI. And Saul was organizing all of us to come down to La Jolla to give talks on what we were doing.

RH: And this was what year? 19 -
EF: 1975. The height of Heilmeyer's skepticism about artificial intelligence. And Saul was telling us how to organize this thing. He says, "I suggest that you prepare the following, preferably in some sketchy written form. A description or definition of AI, together with examples of CS activity, which is clearly AI activity - ," and I can't understand the rest, which is not, and borderline activity. "An attempt at imposing structure on the field. Perhaps the same as in your last report to Lukasik," which is that other document. "A set of judgments about the state of affairs in each component. Achievements, scientific technical problems, opportunities, difficulties, ideas on generic types of applications that can benefit from some strong parts of the field." And then he asks me to talk about DENDRAL, and another program called 

RH: I'm not sure - the folder, too, reflects -

HL: Yeah.

EF: Now we're into a thing called "Roadmap." Now Roadmap was another project. It's still yet another one of these, "What is AI and Where are We Going?" For example - and this 1975. Here's a message from Keith Uncapher, Director of Information Sciences Institute at USC. "Subject: In Defense of AI, to myself and Licklider." And it's some ammunition from Keith Uncapher as to how we should characterize the field. Here's a message from Licklider to Nielsen and myself. "George Heilmeyer wants me to produce a roadmap for the IPTO - Information Processing Techniques Office Intelligent Systems Program, actually for the union of artificial intelligence and knowledge-based computer system applications. Yesterday I received word that the roadmap should be ready for discussion on April 19th, and that creates some schedule pressure." And he describes what the roadmap should be. And then there's all this material for the roadmap.

RH: So this is a whole separate second effort -

EF: Absolutely.

RH: That's the same thing. This -
EF: There's another - yet another one. This is a roadmap - with electronic mail about the roadmap. And I saved all of it. Various people are responding to the request for information on the roadmap. Here's one that - from Ivan Sutherland when he was working at Rand Corporation, after he finished - long ago he finished the tour of duty. He was Licklider's first successor, and then he went off to form Evans and Sutherland Corporation. And then when he made a fortune he decided to sort of semi-retire, and he went to Rand Corporation. And here he is writing about this need for the roadmap. And Keith - Keith Uncapher's response. I just printed out this file of all the things. Now here's some more on the roadmap. This is just - Heilmeyer gave me an extension, so the deadline of April 19 passed. "PI's, would you telephone to Dave," - Dave is Dave Russell - "I am off for a week of vacation in the Arizona deserts. Any immediate suggestions that you want to get into the roadmap before GHH," - that's George Heilmeyer - "gets his first look at it. I'll be back on May 5th and want to go immediately into the next iteration." So there's a whole - that's the next pass of this thing, after the April 19th deadline went by. I had - I'd forgotten how hectic things were at the time for AI. It was really a state of great challenge for the field.

HL: So you s - it was Fall of '73? And then Spring '75, and reporting the - another one in-between, and -

EF: All right. Here's a November 3rd, 1975. Now, by now we're way into the fall, you see, not April 19th or May. Here's November 3rd, and Al Newell was sending a message, "Response to October 24th draft of AI roadmap." So it's very interesting. Then here - this is - says "Russell's revision of Feigenbaum's milestones." Russell is Dave Russell, who was working for Licklider, and then took over Licklider's job eventually. These are milestones. Let me write down who this is because I recognize it from the handwriting. This is Bob Engelmore's comment. Bob Engelmore is currently the Executive Director of the Heuristic Programming Project over there. He - he and I worked together running that project.

HL: Is he the editor of the AI Magazine? Or -

EF: Yes. Yes.

HL: Oh.

EF: Here are revised milestones from me to Dave Russell. And Russell's revision of my milestones. These are - here's some Buchanan - Bruce - Bruce Buchanan apparently was responding. Russell - this is Russell's view of the roadmap. "Page three is vital," it says. I don't know why it's vital. "Description of current basic machine intelligence research tasks." Says, "Page three vital."

RH: And the milestones were part of roadmap - the roadmap.
EF: Yeah. Right. Machine Intelligence Program Milestones, like what's going to happen in fiscal year '77, along with different things that AI is going to accomplish. "Complete and test a rudimentary Morse Code decoder system for fiscal '76 and fiscal '77," etc. This is for their office program. The roadmap means, "what we're really funding, what we're going to get out of it." Basically all political documents. And here we have 21st of November, Duda - Dick Duda of SRI, and Nils Nilsson of SRI. Duda is now Ex-Intelligence with Peter Hart. They wrote a document for this whole process called State of Technology in Machine Intelligence. This is a draft of the Nilsson-Duda document. So that's their view of where it all stands. "Nilsson. Subject, Roadmap. Ed, here is our draft roadmap." I guess he was working with - he must have been working with Russell. You'd have to ask Nilsson about the draft roadmap, but this is - this is it, dated 12th of November, '75, big fat draft roadmap.

HL: Is there any reason that these - this couldn't go together with the other roadmap file?

EF: They represent a kind of a continuous history of this process of trying to justify the field. Oh, here's - here's a - a - now Burt Rayfield gets into it. Burt Rayfield is now - Burt Rayfield is now Hewlett-Packard. He's one of the early big names in the field, and he gets into it. Now his name is on here from SRI, and this is dated 6th of March, '77. And so it's a - yet - yet further revision of this thing. This is absolutely amazing discovering these documents. This next thing is different. This is from the Molgen Project. This is a - a very early - no, no, I'm sorry, it's not early. This is mid - mid course in Molgen. 26th January, '78 by Mark Stefik, early notes on - on Molgen. What he was thinking about as he - as his thesis was evolving. So let me write down Mark Stefik. Mark Stefik is now Manager of Knowledge Engineering for Xerox, Palo Alto Research Laboratory. Okay. So now this is Molgen. Molgen - here's to - yeah, that's it. (Inaudible.) Here's another Molgen. "Professor Feigenbaum," - and this is Mark Stefik - "The following write ups are most applicable to our work." This is just more Molgen. Here. This is just a bunch of Molgen stuff. Here's again more Molgen. And this is a proposal. This is a proposal. This must be our - our attempt to get NSF money from Molgen, and it was successful. And this was a draft proposal written by graduate student Stefik, or at least he participated in it. That's a - it says, "This is a proposal." And since we only proposed to the National Science Foundation, that's got to be what it is. Now here's another - another project underway at the time was called "Crysalis, C-R-Y-S-A-L-I-S. And this is a progress report on Crysalis dated 16th of May, '77. "The project recently recei - ", it say's here, "recently received a renewal of its funding from the National Science Foundation." A renewal of its funding, so it must have had a two year run before that. The new research period began on May 1st, 1977. So this is Crysalis. Accomplishments, funding. Okay, here's a project report - this is a project report for the Molgen project. Presumably, this project report went to - oh, this went - this one went to the National Institutes of Health. Each year every project on SUMEX has to report its - in short report, its status for the SUMEX Annual Report. So this is for the SUMEX Annual Report - of some year.
HL: Do - do HPP and SUMEX then are intersecting. They're not the - the same, are they? Or are they the same?

EF: No. HPP and - and SUMEX are - are not the same. HPP is a research laboratory started by Joshua Lederberg and myself originally as the DENDRAL Project changed it's name to Heuristic Programming Project when we broadened out from DENDRAL into other things. SUMEX is an outgrowth of a computer facility at the medical school that Lederberg and I started when I was Director of the computer center in the period '65 through '68. That facility was called ACME. And ACME grew into SUMEX. SUMEX became a - a PDP-10 timesharing facility for support of Stanford and National Artificial Intelligence Research in applications of artificial intelligence to biology and medicine. Now these were very closely alive because in both the ACME and SUMEX cases Joshua Lederberg was Principal Investigator, and I was essentially Director of Computing. I ran the project and Josh was - was PI of those things. When the goals of SUMEX came along, namely to support AI research, SUMEX became the computing facility of the HPP.

HL: I see.

EF: And essentially Lederberg and I were running the shows jointly. So the goals were extremely closely aligned, but they were different projects. SUMEX was supported by the National Institutes of Health, and HPP primarily by DARPA.

HL: So s - it would be in the SUMEX Annual Report as one of the pro - as a project being run on the - on the system - on the - on the -

EF: That's correct. Yeah. The various projects of the HPP were clients of SUMEX and had to justify themselves once a year with a statement of what we did and what our interactions with SUMEX are. There's a SUMEX Annual Report every year that has to go into the NIH, usually about an inch thick.

RH: That's beginning to make some sense there.

[End of Feigenbaum #1 – 8/19/86]
EF: Miscellaneous, strange little things that most people would never keep around. And I had no idea why they're ever (?). But they don't - they don't relate particularly to the Computer Science Department, they're a variety of things. And what I could do for you is - privately I could go through them and check out things that I think are silly.

RN: That might be the best thing.

EF: Is that - would you like me to do that? Would you like me to run through it quickly and pick out first order things that I think are not silly?

HL: All right.

RN: Okay.

HL: (?) - they - like (inaudible).

EF: Is it - the machine on?

RN: Mm-mmm.

EF: November '74, a file labeled An Intelligent Terminal Proposal. DARPA at the time was beginning a program called Intelligent Agents, and there was some discussion about whether we should propose research activity into that program. This is an outline and some text material for a proposal along those lines, and I can't remember whether we ever did decide to propose this sort of thing or not. But this is material from that - from that event.

HL: This would pertain to which - to which capacity of yours -

EF: That - as Research Director of the Heuristic Programming Project. Remember Fred Crawford, who is - is now Vice Chancellor of a university in Britain? He's now Sir Fred Crawford?

RN: Mm-mmm. Mm-mmm.

EF: This is Fred's attempt to organize a thing called Faculty Seminars to get Stanford to get together to discuss important subjects. This is dated 1979.

RN: Interesting, interesting. Because that kind of thing surfaces from time to time. And that - this -

EF: That's from Fred.

RN: (Inaudible.) Because (?) thought about this floating around now, (inaudible).

EF: Computer Science Department Faculty Minutes - Faculty Meeting Minutes.
EF: - for a thanks for a presentation I made to the National Research Council's panel on Applied Mathematics Research Alternatives for the NAVY, 1979. This documents the particular -

HL: This - this is - this is to this - you as a Stanford professor for a - as - not as chairman though.

EF: No, not as chairman. Just to me as a professional. These are view graphs that relate to the research project Meta-DENDRAL. I don't know what - what else to say about them except their part of some lecture I gave and I don't know why these three particular view graphs are here. But that's what they are. That - that's in - the DENDRAL Project. Meta-DENDRAL - Meta-DENDROL Project. This is department chairman stuff. This is a letter to Xerox thanking them for a gift of innovative computer equipment they gave to the Computer Science Department.

RN: (Inaudible.)

EF: Now this one - you remember we discussed the other day a MOLGEN Proposal that we were putting together for the National Science Foundation? This is a - a letter with a cover letter to the National Science Foundation. Enclosed is the continuation proposal for the MOLGEN Project, so this is a proposal for the next two years of work. Go - this proposal is going in March of 1979. So this is MOLGEN. This is in 1979 a list of all the Ph.D. students seeking employment, what their thesis was all about, who their advisor was, all the Masters students seeking employment, and all of the Ph.D. students theses titles in the department, in case you're interested in that. This is a Computer Science Department matter on arrival of scholars from China, a university memo about that. Presumably we had some. Okay. This - this is interesting. The National Science Foundation has a continuing committee in the Computer Science area called the Advisory Subcommittee for Computer Science. It's a committee of computer science wheels who get together from time to time in Washington to advise the person who's in charge of giving out money for computer science. His name is Kent Curtis. In other words, this committee reports to Kent Curtis. I was on it for several years. And this is minutes of the meeting of December 7th and 8th, 1978 with a list of all the people who are on this committee. That's what transpired at the NSF Advisory Committee meeting.

RN: So they've - they're advising him on what's - what's happening in the computer world so he's more familiar with the grants (?)?

EF: We're advising him on what are good ways to spend the NSF money. What good programs should there be. And it also had an auditing function in that it reviewed the
reviewing process at NSF for computer science to make sure that the best things were really being funded, to check on the reviewing process. This is a copy of testimony given by Dr. Krumhansel, the Assistant Director of NSF for Mathematical and Physical Sciences in Engineering, testifying before Congress on the need for - in general, more funds for science, but in particular, there is a section in here in which he asks for more funds for computer science. And we thought it was a great breakthrough on our NSF Advisory Committee to get Krumhansel to at least surface a paragraph on us in - in Congress. And that's why this is here -

HL: That would get all (inaudible).

EF: - with that N - NSF thing.

RN: What year was that? That was late '70s?

HL: This is '73 to '79, and the (?) December '78. This - RW2, is that -

EF: Bob Taylor. Yeah. He was on that committee. This document you may not want. It simply gives a - a historical and current - current 1979 information on the budgets that were funding the National Institute of Health Biotechnology Resources. SUMEX, our computer facility was funded through them. And so someone from the NIH, Suzanne Stumer, Director of the program, sent me fiscal information on their program. Do you care about that? It's a state of funds. This relates to my SUMEX activity.

HL: Yeah. That's - I was just looking for the (?)

EF: And here's information from our sponsored projects office on NSF's proposed budget for the year 1979. She sent it to a lot of people, but I don't know if you care about that.

RN: Let's put it (?) with administrative - administrative stuff just because of the importance of the grant. (Inaudible.)

EF: This is Computer Science Department material.

HL: This is the - (?), but not chairman stuff (inaudible).

EF: The researcher report, Hugh Cranes, and in the cover memo he indicates that he just saw me at Charlie's house, and Charlie is Charlie Rosen, after so many years. "Perhaps something interesting might even come out of that venture." That venture is Machine Intelligence Corporation.

HL: Wow.
reviewing process at NSF for computer science to make sure that the best things were really being funded, to check on the reviewing process. This is a copy of testimony given by Dr. Krumhansel, the Assistant Director of NSF for Mathematical and Physical Sciences in Engineering, testifying before Congress on the need for, in general, more funds for science, but in particular, there is a section in here in which he asks for more funds for computer science. And we thought it was a great breakthrough on our NSF Advisory Committee to get Krumhansel to at least surface a paragraph on us in Congress. And that's why this is here -

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HL: Wow.
EF: And it failed - or it almost failed. I mean it's - it's sort of among the living dead. You never hear of it anymore. It - it's still alive but - that was a meeting at Charlie's house - to see who wanted to put up five thousand bucks each to get involved with Machine Intelligence Corporation. And that was the first time I had seen Hugh Cranes for ten years, so - that's what that was about.

HL: (Inaudible) from Machine Intelligence (inaudible).

EF: The - this is - a document from somewhat - somebody in the Office of Science and Technology Policy in the White House to Myndel, which gives information about - some Federal initiative in microelectronics. Some - something - you can look at it.

HL: Yeah.

EF: And now I'm spreading the word to the hinterland, or Ohio State. This - this is interesting. Oh, boy. This is really interesting. This is fascinating. Not for me but for your project. This is - Charlie Bass at Zylog sending a letter to - to Don Knuth's research guy, Luis Repparo about how Zylog is willing to get behind Don Knuth's TEx Project - T-E-X. And Charlie Bass of course was the Charlie Bass of Unger & Bass. He's not (?). Nobody knows that he was at Zylog. Okay. This is interesting. Computer Science Department arranging a joint program with Mills College for Computer Science. Nobody knows that existed. I worked - I worked it out. We've had - we had a - a thing called a joint study with IBM that came to naught in the end. But this is the management plan for that. These are work - this happens to be working notes of one of my Ph.D. students - I'll write it down - Ph.D. student Jonathon King, now at Tech Knowledge. These are working notes toward his thesis.

RN: (Inaudible.)

EF: Do you care about university memos relating to salaries for university people? Do you care about these things, or do you want to get them -

RN: If that's - is - is that just the standard thing that gets handed out to everyone (inaudible)?

EF: It's MOLGEN for that renewal.

HL: (Inaudible.)

RN: The last (inaudible) who knows what.

EF: This is a - this is an important memo. Let me get rid of this stuff here. I have to explain the background. This memo is from Bill Osbourne dated January 14th, 1981, and it's called NSF Petition. "Attached is a copy of the NSF waiver which allows Stanford to copyright MOLGEN, and hence to license the software for commercial activities." The background behind this memo is that the company IntelliGenetics was formed by four of
us in - in the summer and early fall of 1980. The first step was to license from Stanford's Office of Technology Licensing the software that we ourselves had developed. That software happened to have been done under NSF sponsorship. And the NSF grants manual says that therefore it's in the public domain unless a waiver is specifically granted. Well, there was no way that IntelliGenetics as a company was going to license this stuff and pay Stanford if it was in the public domain. So what we asked Stanford to do was to ask for a waiver to get it out of the public domain. Get it out of the public domain, and then Stanford would own it, then IntelliGenetics could license it from Stanford.

RN: Could license it - right.

EF: And therefore, Stanford could receive money and - from IntelliGenetics, and that money could be passed on to my research group - that did it, one-third of it anyway. This is the - Bill Osbourne was working in that office at the time. He was the software guy working in that office. Here's a letter from NSF to Bill Osbourne making reference to his letter, and it grants him the - the waiver. And then there's a copy the relevant part of the grants manual with red lines that indicates what section is being discussed in - in the waiver. This document is a copy of whatever it is gave Stanford the rights to - to license that software. So for us it's either under Commercialization or it's under IntelliGenetics or it's under MOGEN - (?).

HL: Yeah. That was (?) them calling University Industry Relations I guess. That's - I mean that in a broad sense, and it will (inaudible).

EF: Donald Michie, who was an important guy in the history of AI in Britain, asking me to come to a British Journalists seminar at the Sperry UNIVAC Conference Center in Nice and give a talk, which I did.

RN: That's sort of a - that's why we needed that sort of category in our professional - there is one for travel already, but this is slightly different.

HL: (Inaudible.)

RN: Yeah. It's sort of general (?). It probably goes in the general course file.

EF: This is interesting also. This is a 1981 description by Tom Binford of the current - the history and current status of robotics projects in the Stanford Computer Science Department (?) to 1981. Here's a letter from Ed Shaw to all deans and principal university officers telling them what's going to happen as a result of the President's committee on the future of computing in - in the line of networking for Stanford. This is what resulted in SU then.

RN: Yes. (Inaudible.)

HL: The robotics one?
RN: Yeah.

HL: (Inaudible.)

EF: Well, this is Xerox loaning - Xerox loaning some equipment to the Heuristic Program that's out here - from their lab here. This is information on - it's CS - Computer Science Department stuff. Jeff Ullman was an active chairman at the time. This has to do with Computer Science Department matters trying to resolve a very difficult question that had to do with the IBM joint study, or try to resolve it in a general way. There was some difficulties that eventually resulted in that project being terminated. Stanford and IBM could not come to an agreement. This has to do with Computer Science Department involvement in the CIS. You - your file on University Industry Relations, is it general or just Stanford?

HL: General.

EF: Here's - here's one for you then.

HL: Is it - do you (?) Michie or Richie?

EF: Michie. I'm trying to see - this - this might be the same sort of thing. It's Lockheed-Stanford relations. Here's the list of officers, council, chairman, officials, etc. of the AAAI in 1981. Relations with Fujitsu. I'm a fellow of the AAAS. This is the letter that led to it. Okay, now this - there is - there's a thi - there used to exist a committee called The Stanford University Advisory Committee on Computer Science and Computing, one of these blue ribbon visiting committees who used to come every years. This is the agenda for its 1981 meeting. It no longer - no longer exists. The (?) Office cancelled it.

RN: How long did it (?)? (Inaudible?)

EF: (?) - somewhere between ten and fifteen years.

RN: Oh, that's good.

EF: It's quite a surprising that they cancelled it. I still don't know why they cancelled it. Now this very interesting, too. In the year 1981 there was a very large discussion at Stanford as to how Stanford should handle software from a royalty and licensing point of view. The issue actually got up to the CIR, which is the Committee - and C - Committee on Research. CIR? Anyway, it's the - it's the main university Committee on Research, finally got this. The - a policy went up to that for approval, and it was much discussed before that. Here's a memo from Jeff Ullman called Proposed Policy on Software, March 1981. This is a - a memo from Bob Dutton of Del Loe to the CIS Executive Committee on the whole software issue. Dutton was interested in it because of a big piece of software that was very interesting and very much used called SCALD. That had
been preceded by a piece of software - the - SCALD is a - it has to do with a d - design of
elec - electronic circuits, and it was preceded -

RN: How do we - how - how do spell it?

EF: S-C-A-L-D.

RN: A-L-D?

EF: And it was preceded by another Stanford program, whose name I can't remember,
that was done at the Stanford Artificial Intelligence Laboratory, but was widely used both
by Dutton and by Deck. Well, Dutton had an interest in commercializing SCALD. And
that eventually became one of the Silicon Valley companies. I don't know which one but
Dutton could tell you. I - VLSI Logic or one of those. And so he was really interested in
- in that - the whole issue. And I was interested in the issue. And the whole Computer
Science Department was interested in the issue of who owns the software and what would
be the - the right to it that the developers would have if they wanted to commercialize it.
This was part of the development of that.

RN: Was - was there any s - summary policy that came out of this? Do you
remember?

EF: Yes.

RN: And that's what we've got today?

EF: That - that - the - the policy - no. The policy went up to the Committee on
Research. And they approved a - a - a real university policy. Jerry Lieberman was in
charge of formulating the policy, and it - there is an official university policy now.

RN: And that's our policy of today?

EF: Yeah.

RN: Yeah.

[End of Side A]

EF: What is this? The prototypes of the Xerox LISP machine were called Dolphins.
The software system running on Dolphins was called Interlisp. And this is a Xerox
Corporation informal blurb on the technical specs for Dolphin Interlisp. Do you care
about that?

HL: Yeah. I'll have to think about where we'll put it.
RN: (Inaudible.)

HL: (Inaudible.)

RN: That's - that's where it used to be so put it there.

HL: Sure.

RN: (Inaudible.)

EF: This thing here is a report from a subcommittee of the Computer Science Department Chairman. They meet every couple years in Snowbird, Utah - or maybe every year, in Snowbird, Utah in the summer. And a subcommittee (?) were appointed - was appointed - these people here. Denning, myself, Gilmore, Herg, Richie and Traub were appointed to write this document indicating that a funding crisis existed in computer science. *A Discipline in Crisis*, November 21st, 1980. This turned out to be a quite re - important report because it led to some action by the National Science Foundation Computer Science Advisory Committee to advise that there needed to be several more centers of excellence, and large amounts of money poured in to create those.

HL: Oh, this is from Berkeley's - among (?) Berkeley's (?)

EF: Well, that was one of the places. The University of Washington and many other places.

HL: (Inaudible.)

EF: But it - the - the start of all of that was this report. *A Discipline in Crisis*.

HL: So you were there (?)

EF: This comes from the Carnegie Mellon Alumni Newsletter, and it's pictures of the opening of their Robotics Laboratory with Reddy giving the keynote speech, and Allen-Newell's here talking to the president of Westinghouse, and - here, you can have that. Robotics Lab. Program. Remember the Shortliffe thing? Here's a let - a memo from Crowly appointing an ATHOT Committee to review the proposal to establish it.

RN: Oh, good.

HL: So that's (?)

EF: Part of SUMEX is the AIM - A-I-M - AIM in Medicine National Coordinating Committee. There's an executive group of that AIM Coordinating Committee called AIM Exec. And this is some minutes of - of an AIM Exec teleconference (inaudible) interested in how that thing worked.
HL: Sure.

EF: Okay. That - (?) look at this. Nothing here. So that -

HL: Yeah.

EF: (?). The thing about the existence of that box, so we might be able to get (?) running again because it was in LISP. You know what those are? Those are tapes that no one ever sees anymore. They're - they're called Deck Tapes. That's - Deck's format for magnetic tape. When they were - when they first started to produce the mini-computer they were producing mini-computers with a little tape drive like that. Those are called Deck Tapes. And they don't exist anymore. I wonder what that's a Deck Tape of? SUAI is - is the Stanford Artificial Intelligence Laboratory. Oh, it's EPAM, it says. EPAM tapes.

RN: EPAM backup.

EF: So presuming these could be read they would have on them a running version of EPAM. And these cards -

HL: (?). That's what we found - we found these in a lot of different places but they seem to us to all be EPAM.

EF: The Deck Tapes?

RN: Every - I guess this whole batch. Right?

HL: Everything that's on there. Yeah.

EF: Okay.

HL: So - I think the thing to do is just to go through it and talk about it a little bit.

EF: Yeah. Okay. The - I don't know what's on these tapes, and I don't know if EPAM was ever up and running on the Stanford AI Lab computer, but that's what this indicates, and here are the cards for EPAM and LISP. What happened was when I got here at Stanford I was teaching courses in Information Processing Psychology, and one of the students, as a project, wanted to re-implement EPAM in the LISP language. It had not been done and had been done in - in the processing language, IPL5. And so with my supervision he went ahead and implemented it in LISP, and we actually got it running. And that's what these cards are.

HL: Is that - okay. That's EPAM and LISP.
EF: EPAM and LISP. And that presumably was a LISP called - it was either LISP 1.5 for the PDP-6 at the Stanford AI Laboratory, or it was LISP 1.6 that was running at the Stanford Computer Center. A variation on LISP 1.5.

HL: Do you remember the name of the student?

EF: No. Maybe I can find it. Here it is. No-well, maybe not. I'm returning these (inaudible). It says Peter Arnold, and I don't know if Peter Arnold is a student or someone who worked at the Computer Center. Oh - oh. Probably the Computer Center, because this is dated 1970, so these must have been almost lost somewhere, and somebody named Peter Arnold sent them back to me. But it - it could be that the header cards on this give the name of the student involved. Like what's the header card say?

HL: Looks like it says (?).

EF: Punch. E. Punch.

HL: E. Punch. Okay.

EF: So that's not it. Let's do (inaudible). So this is the program and that's the data.

HL: And the three? Is that - it's the version?

EF: Yeah. Three is the third version of EPAM which is the - the last version of EPAM before Simon or I quit doing this - in 1964. EPAM-3 - there was an EPAM-1, which was a very early thing Simon and I did. There was an EPAM-2, which my Ph.D. thesis, and there was an EPAM-3 which contained a series of revision that Simon and I from - from the 19- period 1960 through '64 to make EPAM more powerful in general. And then I didn't do any more on it. Simon did a little bit on it. And EPAM kind of passed down to history. Except for the resurrection of this and a few things that Simon did at Carnegie Mellon. Now this here (inaudible) a very large program thesis. This is kind of the EPAM monument. I was going to say the EPAM coffin, but - okay. Now we have the names the students who worked on that box here. Richard Russell, Wayne Wilner, and Steve Levine - or Leven. They did it in 1967 in the spring quarter. A report on the current status of the LISP version of EPAM-3. This goes along then with this LISP version here. Now this is the EPAM listing in IPL-5. IPL-5 is the precursor language to LISP. And - well, what can I say about it? It's - this is the - this is the program that I wrote. This is - it's EPAM-3. This listing was made at the Rand Corporation where I was doing some work, and it's a real historical artifact because I don't think - there - there probab - probably - Newell, Simon and myself are the only other people in the world who would still have copies of IPL-5 programs, what they looked like. This is pre-LISP.

HL: Is it read - is it readable? (Inaudible.)

EF: No, not LISP. You have to know IPL-5.
HL: Yeah. It's - it's not - that was - it's not a - what would you call it - downward migrat - it's -

EF: No, not al all from -

HL: This has nothing in common with the (?).

EF: Under - underlying it it has everything in common. But at the language level it has nothing in common.

HL: So the Syntax is (?).

EF: Completely different. Okay. Now that's this listing. Now we come to these pages, and the pages are EPAM-2. So this is my thesis. Thi - this is the program the lead to my thesis. This isn't the thesis. But this is the EPAM-2 code. This one is dated August 1961. And this is everything. I mean now I could probably resurrect how EPAM worked just by looking at all the subroutine of this code. This is a giant program for its time. This is - in - especially in AI. I mean this was one of the largest programs in AI in existence at the time. So this is what evolved from - from about '57 to '61, including the point of my thesis. Then this changed into this. EPAM-2 became EPAM-3. So I kept them together.

HL: So (?) evolution. (Inaudible.)

EF: If you want to - if you want to look at what EPAM-2 is you'll have to look in the Anthology Computers and Thought, is what I did in '62. And there's an article there on EPAM-2. And EPAM-3, there were - there were several important articles on that. Simon and I actually had to go back to the code for EPAM-3 to settle an argument that was started in - in the Journal Cognitive Science by a Stanford graduate student and Gordon Bower. Together they wrote a piece which was simply wrong about EPAM-3. And Simon got really agitated and wrote a draft article re - as a rebuttal, and I had to bolster the draft article by going back to that document and unscrambling the code and saying this is exactly how it was done.

RN: Why don't you just put it back in -

HL: Put it right back - in the drawer.

RN: - in the drawer, and all these - (inaudible) storage boxes open.

HL: Okay.

RN: And - re-packing (?). That's - that (inaudible) boxes (inaudible).
EF: People in other places tried to replicate EPAM, do it for themselves. One of those people was Zenin Futeiefl from the University of Western Ontario, and he did EPAM in four-track. That's what this is, a report. In the Operator's Manual - Operating Manual for EPAM in four-track - he sent to me. This is some - this is George Ernst, formerly a student of Newell's, who references EPAN in here. These lantern slides - I haven't seen these in twenty years. There was a time when people would actually go around the country to fact things like this. This is - this was a common mode instead of thirty-five millimeter slides. These are EPAM slides from the - my days in Berkeley when I was - I had just finished my thesis and I was going around the country and - these slide, for example, that I'm looking at now show growing discrimination treaties, discrimination nets as we call them in EPAM. This shows pieces of program. Now these are just illustrative slides for EPAM that I would carry around with a - as I gave lectures on this around the country. They - they appear to be - yes, all of them appear to be EPAM slides. I guess that was the only thing I had to talk about in those days. Maybe not. No. Some of them are - are - some of them are slides about - AI problem solving. And - they're not all about EPAM. Some have to do with - a little more general view of AI. I'm looking at slides of the logic theorist, I'm looking at a slide that talks about satisficing, all of these were - the sort of active concepts of the time. Heuristic power, the - the general problem solver, heuristic search. This was the meat of - of AI at the time. Very early days. Okay, now, this is the EPAM - remember I - I said - referred you to Computers in Thought for the best article on EPAM-2? This is the best article on EPAM-3. This reprint - it - it came out first - in the proceedings of the fifth Berkeley Symposium Mathematical Statistics and Probably, Volume IV, Biology and Health, which is listed here in the footnote, but it was reprinted in a more readable place, Models of Human Memory, a book. The article's called Information Processing in Memory. Okay. Now - here's - the - this is a variety of Feigenbaum materials. This article I wrote when I was Director of the Stanford Computation Center, and it gives these - what I wrote it for is on the bottom. It's for the Stanford University Annual Financial Report.

HL: So that just crept for chronology - due to chronology? Does it - we added that -

EF: No. (Inaudible). This article is my first (inaudible) written with two young professors at Carnegie Tech in the Graduate School of Industrial Administration. I was a graduate student. I was taking a course on Microeconomics from Assistant Professor Richard N. Cyert. He's now president at Carnegie Mellon. I got bored with microeconomics, but I got intrigued by applying Simon's Theory of Decision Making with the new technology of computer simulation that we were using to problems of decision making in firms, because that's what Cyert was taking about in the class. And so I approached Cyert, and Cyert approached his colleague, March, and the three of us did what we thought at the time was the first computer simulation in economics. And in fact the article that resulted from it, which is this one, was rejected by The Journal of the American Economics Association as being odd - and strange. It was published by The Journal of Behavior Science, and it became the first article in what's called The Behavioral Theory of the Firm, which eventually led to a book called The Behavioral Theory in the Firm edited by Siced and March. So this was - this - however, this turned out not to be the first computer simulation ever done. Apparently, the second. There's
one we didn't know about at the time by Austin Haugetto. However, this was a real seminal paper and it was my first public paper.

**HL:** This was in graduate school, though.

**EF:** Yeah. And they actually let me give the presentation form of the paper at the American Economics Association meeting in 1958 in the Christmas meetings. So that was my first presentation of a paper at a conference. Cyert and March said, "Why don't you go ahead and give it?" So I did. March of course is the same Jim March that's here.

**RN:** I was just going to ask if that (?).

**EF:** Yeah. And we've - we've been very good friends since - since that time. They knew about organization theory and decision making in firms. I knew about computer simulation technologies. So that's - that's where we fit in. This is the precursor paper I told you about on Information Processing and Memory, the fifth Berkeley Symposium on Mathematical Statistics and Probability. That's the first version on EPAM-3.

**RN:** On this one?

**EF:** That's it. There's two different versions of the same thing. Here's another EPAM-3 paper that Simon and I published in the Journal of Verbal Learning and Verbal Behavior. And here are two DENDRAL papers.

**HL:** They did - so now these early EPAM papers so far, have there - has - there hasn't really been computer science type journals (?) pretty much behavioral science (?). Those kinds of things. Is that where - was that the whole - the audience illogical (?) at the time?

**EF:** No. The EPAM-2 paper that was reprinted in Computers and Thought was delivered at the Fall Joint Computer Conference, 1961. They were being published in both (?). But they related so much to psychology that psychologists were interested in publishing material about that. Okay. Now - as I said, I give a lot of lectures, and I always write out my notes by hand. So as you know from looking at the other notes I mix and match pieces of lectures. So one piece of note could find its way into ten different lectures in different places. And this is a collection of those notes that have to do with Models of Human Memory. It starts out with notes about EPAM, and you can never tell what's going to end where because - because of the mixing and matching. Some of them are dated. Like here's - 1972 date. It describes a lot more than just EPAM. I see here HAM, which stands for the memory model by Gordon Bower and John Anderson, Human Associate of Memory - HAM. This down here is the thesis by - by John Anderson. SAL, which was done as a thesis by - can't remember - another Psychology Department thesis. And some other people - Ronald Dean Norman - these are all models of - various people's models of how memory might be handled. But somewhere I gave a talk on human memory and put these all together.

**HL:** You - would it have been a class note? Or - or a lecture?
RN: They would - lecture - they're lecture notes.

HL: Lecture?

EF: Yes. Could have been. Could easily have been. Could easily have been class note, but yeah. So it's on EPAM and other models of memory. See, EPAM - EPAM was a model of memory, but it was a model of a particular kind of memory, and as the years went on people developed broader models. This is material - this is material sent to me by George Ernst, the same fellow I mentioned before, talking about some work he did which was similar to EPAM. And you can see that EPAM begins to be mentioned immediately. The program is called Concept EPAM, or CE, to distinguish it from other versions of EPAM. And I must have read it at the time. It's made no impact on my life, my work, or my consciousness. But here it is. It's EPAM related. The name of the guy who did SAL that I couldn't remember a minute ago is here. Douglas Hinsman. Doug Hinsman did a version of EPAM called SAL here at Stanford, and it won the prize for the best piece of work done by a graduate student in Psychology in that year.

HL: And he was partly one of your graduate students?

EF: Yeah. Yes, he was. He started this project as a graduate student working in the course I was - doing work in the course I was teaching. And his - his main advisor was Gordon Bower. The connection to EPAM is described in the introductory section of this article. The word "discrimination net" was invented by me for my Ph.D. thesis. So when they talk about a discrimination net model of (2) sensor learning, that's just what EPAM was. He - he did another version of it. This is yet - yet another description of SAL. Okay. Now we come to another book that never got written - never got done. Herb Simon and I decided at one point to put together a - an - a carefully edited collection of readings of EPAM and EPAM-like models. I met with Herb in Pittsburgh and we worked out the plausible contents of such a book. And then I dropped the ball. I said I would do the next step and I dropped the ball. So the book never got done. And instead Simon collected portions of it in - portions of EPAM in a book that he did for his own writing called Models of Memory from - Models of Thought, excuse me, not Models of Memory, Models of Thought. And the - these are notes relating to that book which never got done. The first and last that was ever heard about this book. Simon went on to do additional work on EPAM, and published that work with Lee Greg, a psychologist at Carnegie Institute of Technology, now Carnegie Mellon. Greg died several years ago. They published that additional work on EPAM in this paper, Information and Processing Exclamation of (?) Trial and Incremental Learning. So that's an EPAM derivative done by Simon himself. Then Simon continued to think about EPAM as he was considering how expert chess players recognize situations on chessboards. And he wrote this article which is related to EPAM on Perception in Chess Playing Programs. So if you read this there are EPAM-like mechanisms in here - in this program. And that's why I - I was collecting it. Because if we ever did that book I would need to put this paper in. EPAM is mentioned here as a venerable simulation program first devised by
Feigenbaum to explain. So - oh, here's another - here is the - is another article along the same line called -

[End Feigenbaum 8-21-86 #1]
EF: Okay. Now here is - lots of people were doing their own variations of - of EPAM, and I would help them out. Either they were doing it as students of mine or students of somebody else in someplace, and I would talk to them and give them a clear idea of what EPAM did and they could go on to then expand it in any direction they chose. One of those developments was called EPAM, and I think EPAM stood for Long-term EPAM, but I'm not sure. Let me see where it -

EF: This is - this material with this - in an envelope - it's in a yellow envelope. It's not indicated where it comes from, so I'll put on the front of it "From Dr. (Inaudible), Pacific Medical Center," represents exchange of material relating to the onset and growth of the PUFF Project. You'll have to make the decision about whether you want things where people are sending me things to read because they think - they want to bring them to my attention. And so it's other people's work.

RN: But it's not necessarily something you thought was -

EF: No.

RN: - was important enough to (?) away.

EF: Correct. I put it in a file here to read later.

RN: All of these in a file labeled - never (?)

EF: Well, this is a very interesting file here.

RN: But not to be (?). Is it - if it's clear from the letter what - what the article is or what the item is -

HL: But it's a (?) to publishing (inaudible).

RN: I think that's fine. (Inaudible).

EF: This is a (inaudible). You have to be exceedingly careful because we will violate Stanford rules if we do it wrong. This is the actual original material of the Terry Winograd tenure case -

RN: Oh, my gosh. All right.

EF: - with all the letters in it that people wrote about tenure. I don't know what you want to do with that. This is - I - I was the chairman so I was organizing the Winograd case. And I never threw away the file. I never gave it back to Betty Scott.

RN: What year is that?
EF: Seventy - seventy - (?). I was writing the statement in '77. 5-31-77. Statements applicable, Sections 3-A and 2-T prepared by me to, you know, upgrade Winograd. This is the Winograd Tenure Case.

RN: Who gets in the chairman's file to put this on it? We may want to have a very small restricted - okay. We can do the standard -

EF: I - you know, (inaudible) you violate Stanford rules is because Stanford promised the people that these letters would be confidential.

RN: Right.

EF: That they were.

RN: We can do the standard confidentiality university records restriction on those. So we'll keep those separate from all the rest of your Chairman files.

EF: (?) that pile.

EF: - more of those setters that people wanting to visit Stanford. (?) Department Chairman (?) . Do you - what - we - we have a doc - a document preparation system which is the one that was in broad view before SCRIBES or TEX was developed. It was called PUB. The first - the first real document programming system ever. So everyone used PUB. PUB was it for ten years. And this was my PUB manual. Do you need the PUB manual or -

RN: Okay. Let's keep that because we've got so much of the development stuff that it would be nice to have that somewhere.

EF: Okay. So PUB. It was an important system in the history of (inaudible) of word processing.

RN: We have a man-section on manuals that you have under publications. You know what I mean?

HL: Under publications. Oh, there's the (?).

EF: This is an article by Buchanan and two students at the time here, Tom Mitchell and Reed Smith, which is an entry into the Encyclopedia of Computer Science and Technology, and I happen to have a copy of it here that is undoubtedly for me to read, but I didn't write it. Those guys wrote it. Do you want it?

RN: Well, if it's something you wouldn't have -
EF: This is a list up through the middle of 1977 of the HPP memos. In fact it - wait -
wait. Don't - don't - don't go away yet. HPP memos and Stanford AI memos list. You
can have the whole file, the whole - that's what this file is.

HL: Oh, okay.

EF: List of these. This is a - this is correspondence relating to the theft of some
terminals from our offices. Do you want that?

HL: (Inaudible).

RN: It would go in the Administrative stuff (?).

EF: For HPP. (Inaudible) - theft of HPP terminals. This admission on May 28th, 1982
of a renewal proposal to DARPA. This proposal was joint with Jeff Ullman, and to -
expired - I mean it's over now, so we're into yet another period. But this was the period
just before the one we're in now. The proposal to DARPA.

HL: Would have been for -

EF: Heuristic Programming Project. So DARPA basically (inaudible). Do you have a
whole - let - let's just check to see if you can have the whole thing here because I think
there's other material here that I don't want to give you - (?) no sense in keeping a
duplicate. This looks like some miscellaneous stuff.

HL: (?) revised (inaudible) page 82, 83, and then I have the Part II.

EF: Okay. Okay. Got it. That's the - this is what I copied.

HL: (Inaudible). Yeah.

EF: Throw this away - copy away?

HL: Yeah.

RN: Yeah.

EF: - and it has the complete listing for the EPAM-2 - right in here. Because Simon
and I both believed that the theory was the program. All the words in the world you
could write would not tell you what the thing did except the program. So we - so I
included the complete program. And this is it.

HL: Se we have a pretty com - (?) Stanford a complete bunch of the emergence.

EF: Yeah. You have the world's best. Simon had to come to me to get the
information we needed to combat Bower last year. Okay. Now - remember the Cyert-
March paper I gave you? Which was different from EPAM? It goes in this file. This is a thing - this is a kind of thing which doesn't exist anymore. It's a - DITTO. And this DITTO actually has a code but the - the computer for that - that backed up that article. I would dare say that this is the last copy in the world of that, of the computer code that backs up that article.

RN: (?) closer to (?)

EF: And it may very well fade.

RN: Yeah. That - maybe we shouldn't - put a little sticky on there saying to do another reproduction of it. Higher contrast.

HL: (Inaudible.)

RN: The dissertation.

EF: It's what - the kind of paper is called ozalid paper.

RN: Oh, yes. So it's (?)

EF: O-Z-A-L-I-D.

EF: The - the paper is a Cyert, Feigenbaum, March. The Behavioral Theory of the Firm.

HL: Oh, okay. (Inaudible.)

RN: Yeah. That's right.

EF: It's not EPAM. It's something else.

HL: (Inaudible.) That was the grad - the paper you did (?)

EF: Yeah. A graduate student named - where they let them get the paper. So you can stick this material in there if you want.

RN: Put - put this in there. Yeah. Well, put the whole thing in there for now.

EF: Ready for the next batch?

HL: Sure.

RN: Yep.

HL: And these duplicates -
RN: Well, yeah. (?) make sure that'll -

EF: Simon's papers are collected in the Archives at Carnegie Mellon. So he will have his own collection of EPAM things.

RN: Okay. And are there copies of the ones you - you're an author and co-author. Are there copies of these in your reprints?

EF: I don't know.

RN: I think we'll hang on to them just for - to double check them.

HL: (?), DENDRAL is (?).

EF: Do you have anything smaller than that?

HL: That's the - smaller than (?).

EF: DENDRAL's a huge one.

HL: Yeah.

RN: Yeah. How about - what's - what's the general file (?)?

HL: Well, this is - here we have all notebooks, mostly correspondence, these blue notebooks I used. In fact the whole thing is just filled with it.

RN: I think the conference -

HL: General memos since '60s and '70s. Correspondence. Here, I'll check (?). So that's a pretty big one.

EF: Do you - do you want me to go over what's in those things with you? In any kind -

HL: That would be one possibility. Anoth - if - actually - one that might take about five minutes, and to go through (inaudible) actual file (?) mostly these reports.

EF: (?). Now the - Stanford, for years, had this wonderful Artificial Intelligence Laboratory. They produced these memos called "AIM Memos." And I tried to keep a collection of the Stanford AIM Memos. And that's what it looks like these things are. These things are reddish (?) binding - mmm, they're not all that, but there are massive amounts of these AIM Memos. What would you like me to do about them? Do you want me to make comments on the different one? Why they were important, or -
HL: Yeah. They're also (?). What I was hoping was that there won't be a few odds things in here. The AIM memos I - they can put - put aside in that category. Because anything in the box - if that's (inaudible) too much time with it. Just - anything in the box that may be odd or unusual.

EF: Yeah. There is. All right. The - the Computer Science Department it - itself produced each year, and I think it still does, a thing called Research Report, What's every professor doing in research. This is the 1976 one. This is a - a very - in my view a very important paper by Allan Newell published in a rather obscure place, which was this International Information Processing Society proceedings. And I happen to have an original reprint of that, but it shouldn't be in the Newell file.

HL: Yeah. That's what -

RN: Yeah.

RN: Why don't you just start a file (?) - of ones that are to - to be filed in. (?).

EF: Here's another - here's another EPAM-like project by a student. I don't know why this is so - this is a very odd collection of things. It's really not a five-minute things because it's - it has so many odd things in it. And I don't know why they collected in one place like this. Very - very strange.

HL: We haven't even gotten into these three (?) here.

EF: HPP-75-6 is a notation that we began to use to this - to give our own numbers to papers that were AIM memos. AIM memo doesn't tell you anything. This tells you it was done in 1975 and it was the sixth that the HPP did in 1975. This is the same - thing. (?) stuck in the - it was in the library. This is a Newell thing. This is the basis - I don't know where - okay. If you were to - I think I'll use this (?). If you were to look around in Expert System software that's available in the world now you'd find some of them called Induction Tools, Induction Software. They're all based on - oh, for example, a name of one is Expert Ease. It's all based on Ross Quinlin's work which he - he did here when he was a visitor from Australia, and this is - these are the original papers (?).

HL: These would all be by him?

EF: This list - this lists all the Computer Science Department technical reports from its founding until 1971. This is a document which was produced by the people engaged in the DARPA sponsored National Speech Understanding Project trying to get a follow-on to that. They had done five years and they waned another five years, and they wrote this document, and - this was the time of Dr. Heilmeyer's skepticism about AI, and he said, "Well, where have you gotten in five years? No, I don't think that's enough. No you can't have the money." So this was - this lead to the termination of the National Speech Understanding Project. So there's plenty of stuff here but I don't know what - what to tell you about them because they're - they're things from other places. Like - these are
substantial papers by Newell and others from Carnegie. They're technical reports I got. I
was holding on to them, but they're - they're neither Stanford nor do they relate to my
career.

HL: (Inaudible). They're just your reprints (?).

EF: Yeah. I mean I don't know what - what to tell you about them. They're - this is when Herb Simon won the Nobel Prize. Last thing I can give you is this thing. The biggest event in Artificial Intelligence in Britain in the 1970s was a publication of a report critical of the work by Lighthill, the so-called Lighthill Report. This was the Lighthill Report with rejoinders by various people - comment and rejoinders. This is the official document that came out of Britain about (?) with the Lighthill Report. This report essentially killed Artificial Intelligence in Britain for ten years, and it was only revived in the new Aiby Program under the - under the term Intelligent Knowledge Based System, IKBS. They can't even use the term Artificial Intelligence, even now, because of this report. So that ought to be labeled Lighthill Report commentary. And the rest is other people's stuff. (Inaudible) but this is (inaudible) Heuristic Programming Project, HPP78-16. Ventilator Damaging. But mostly this other people's work.

HL: (Inaudible.)

EF: Oh, okay. I see what I did here. Somebody asked me to - this is the Federation of American Society for (?) Biology. Someone asked me to write in it, but - I guess I did. I don't even remember that I did this but - but this is a Feigenbaum piece.

HL: And this is connected with -

EF: The Association of Biological Societies. These societies get together once a year for a giant conference called The Federation Meeting. And somebody put together a panel on Computer Applications, and they asked me to be chairman of it and write a (?) intro to this.

HL: (Inaudible.)

RN: We've been - we've been toying around the preservation issue. Mag tapes versus paper. And the future researcher a hundred and fifty years down the line who may not able to read the tapes but will probably be able to read the papers even though the storage is larger for the paper, it would be equally large if you had both the mag tapes and all the program and information. Another king of thing that would be needed - the Rosetta Stone so to speak in order for us the (inaudible). So I think the lesser of all evils is just to get (inaudible).

HL: Yeah. Is it - there's (?) I think it'd be done, but off the headers I suppose that's been all chronological - that's probably the way to organize (inaudible). But at least you could never (?).
EF: No, I don't (?

HL: But then with you've saved let's fill the (?) in chronological order. So it could be just printed out. That it un - unless you just - you think there are things that (?)

EF: You know, it'd be interesting because there may be. There may be confidential things in there, but to find them would be so much work that it's worth just taking the risk of getting it all in there. I mean that historian years from now might find some really odd things in there.

RN: And what one can do too is put a very short trend (?) restriction on it, confidentiality restriction on it. Actually, it probably long ago enough now that -

HL: Well, see, there's a second reason for preserving that even in a - say a (?) form which is - the - just shine how it was used at a relatively early stage in development. Okay? There're - if we - if we - as an example, we're trying to get the journal as (?) ARC Project - in other words (?) on his computer everybody knows he has (?) interactive (?). And what (?) I think I put in the same category because viewed from (?) a hundred years now, with where it just - very beginning of technology. So to have some -

RN: But there's an interesting controversy attached to that because when people are using electronic mail (?), just as when people use telephones they don't expect to be bugged on a telephone any more than they expect their electronic mail to be read by a scholar a hundred years later. So we having one of the main issues is the legal issue of must we inform all these people that we have this. Or never - we - we haven't dealt with that.

HL: Is that (?)

EF: I was confronted in a lawsuit recently, I was an expert witness and I was confronted with some electronic mail I had sent someone, but the company had - had magnetically recorded, and in defending themselves in this suit, they went through all their archives and pulled out my messages. And - and at the deposition the lawyer said can you please explain to me what this meant at the time? I didn't know that.

RN: When you sent it you had no idea that would be (?)

EF: Yeah.

RN: But I think in time - yeah. Well, no. Letters form - assumes that a letter could conceivably be maintained by the person you send it to. People at least initially, the first ten years of electronic mail aren't necessarily conceptualizing that there will be a paper copy saved somewhere. It's like a telephone conversation.

EF: It should be thought more like a telegraph.
RN: Yeah.

EF: Can telegrams be saved? I guess so.

RN: Yeah, they can. They're usually printed on such rotten paper that they rot faster than (inaudible).

HL: Yeah. Yeah. I mean that they're (?) taped onto the (?)

RN: Yeah.

HL: Yeah. Yeah. It's interesting - I mean I - I - there's a distinction between an individual like yourself (?) electronic mail and say a computing center saving everything.

RN: Saying here's everyone's - here's the whole department of (?)

HL: And then -

RN: And everybody's used (?)

HL: That would be like to me (?) the post office. (?) here's all the mail we have lying around. Whereas I see no problem with the fact that you're not - I - it's how we'd draw the analogy (?) correspondence (?). If you give them letters the people don't know that (?)

EF: The easiest thing obviously is to get to (?) tape. The second easiest thing is to move it from mag tape to paper. And the third would - would be to move it from mag tape to microfiche. Still requires some work on our part because we have figure out - (?) consult with people who do microfiche from tape. But microfiche, you get it on film. The film might deteriorate.

HL: The historian (inaudible).

EF: But paper, (?) a lot of paper.

RN: If there's some way that they've - the next technology transfer will be from (inaudible). But it is true. I mean the - especially if you use both of us (?) research on microfilm I - I just hate to - it may be a boom to records managers, but (inaudible).

[End Side A]

RN: Departmental correspondence? Is that right?
EF: Yeah. I - no. Just a mixed thing. This is various materials relating to SUMEX, and the management of - of SUMEX. And the affiliation with the - affiliation with the biomedical community. So that's all SUMEX stuff. This - this may not be relevant for the long-term. This is a - some raw material for the - the examination of the question of whether - the Rules and Regulations of the Government can be put into the form of rules that could be used in an expert system. This happens to be Rules and Regulations for Supplemental Security Income for the Aged, Blind and Disabled. Part A determination of benefits. Could you codify this and put it in an expert system? Do you care about that?

HL: Well, actually -

EF: I'll throw it over here.

RN: You can never win anywhere.

EF: (Inaudible) go - no go decision.

RN: Go?

HL: Yeah. I think (?)?

EF: Throw. Throw. Okay. This is a paper from Professor Findler at Buffalo that I guess I thought I once wanted to read and probably never did. Yeah. This is material - this is - this has to do with - nah. I don't think this is relevant, but it's McGraw - I was consulting out of the McGraw-Hill Computer Science series. And this is a bunch of stuff that came from McGraw-Hill for me to review, book proposals.

HL: Are there any comments that you wrote about the proposals in there?

EF: No. MOLGEN. Department Administration on a foul-up. A foul-up of Gio Wiederhold's (?). This is a SUMEX site visit, 1977. This is more SUMEX material but this relates to the site visit.

HL: Okay. Not -

EF: (?) Shu was on the site visit. (?)

RN: Put it in there.

HL: Well, I have a SUMEX file.

RN: Okay. I'm sure - you know more than I know.

HL: Yeah. (Inaudible).
RN: Thing for SUMEX. Oh, yes. Wait, wait, wait. I thought there was one.

HL: There is, but we didn't find enough before to have an actual special (?).

EF: This is Pat Suppes - Pat Suppes proposing that there be a - an electronic typesetter on campus. This is probably the first proposal of that sort that ever gets mentioned. Electronic typesetter.

RN: What years was that?

EF: '77. This is the Feigenbaum entry into Department - a certain review - what - what the professor are doing. And that's also '77. And this was the HPP final report for DARPA in '77. This one is the - the draft of the Stanford AI Lab. Oh, you remember we were talking about, you know, the other day DARPA trying to pull people together? I think this was the first attempt to pull people together. This is a draft proposal to DARPA from the Stanford Artificial Intelligence Laboratory, but it involved an attempt to pull people together. Somebody coming here on an NSF fellowship. I don't remember.

HL: Well, how did you (?)

EF: SUMEX. This (inaudible). This is all SUMEX stuff.

RN: Who are you putting -

EF: Yeah. We should have more paperclips, shouldn't we?

RN: (?) that file. We can just start using (?) together.

EF: (Inaudible). You know the thing I just gave you which was an input to the research report for the department? Here's two more of them. See, it's kind of self-explanatory in that little memo.

HL: Oh, right.

RN: Are you putting the SUMEX stuff in the Administrative File? Is that what you meant?

HL: Yeah. And the Administrative File's put in this little file. That's why (inaudible). DENDRAL. SUMEX.

EF: MYSIN. SUMEX. HPP - Laboratory. (?) it's all relating to - okay. Now this file here with a lot of papers are computer output papers with the name "King" on it, and the title of the file happens to say "NSF," - excuse me. I'll - I'll - I need to get that. But I'll -
EF: This file with the name "King" is for a National Science Foundation proposal related to the Computer Science Department's attempt to get more computer equipment for the department. There's a separate item in here which I can't imagine is related. It - this other item looks like budgetary material for NSF relating to the salaries of Bob Engelmore and somebody named P. Alpenheimer, and some other expenses of some grant. And that would - would have been either the Chrysalis Grant or the MOLGEN Grant. Probably the Chrysalis Grant because Engelmore's salary is on it. So it's - it's probably - it's unrelated to the to this other proposal. Now just a word about who King is, King is Jonathan King who was a graduate student here from many years, finally got his Ph.D., now works for Technology Incorporated. He was hired by me on a one-year leave of absence from his Ph.D. work to - in - in my - what was really my first full year, maybe at the beginning of my second full year as Department Chairman, in order to help me do fundraising for the department. He was in charge of actually writing the proposals on sketches laid out by me. He would whomp them together and we'd get equipment for that. He worked for one at that. That's why he's the author of these documents.

HL: So these should have (?) files.

EF: I -

HL: This was probably done in the (?).

EF: I-I-I think we ought to stick this one in the Chrysalis File, and I think this would be Departmental Chairmanship type thing. (Inaudible.) There. I'm looking - part of this is an example of the little contributions that various people made to the AI Handbook. This was someone named Mehashwan, one of the students around here, and he did some basically information gathering for the AI Handbook. There must be massive amounts of that (inaudible) in there.

RN: Pull - if you pull that one out.

EF: This file here labeled ARPA just documents the - essentially the business part of dealing with the ARPA contracts. In particular, memos with a quaint recalcitrant and quaint recalcitrant contract officer, Resident at Stanford name Phil Surra - S-U-R-R-A - and there's a lot of things that Surra made us do, that we've jumped through hoops that we wouldn't ordinarily have to jump through hoops.

HL: This was as -

RN: He was in a sponsored project aspect or whatever it was at that time?
EF: No. Phil Surra wasn't a Stanford person. Phil Surra was a government contract officer working for the ONR Office on campus.

RN: Oh, all right. All right.

EF: And I don't remember under what auspices I collected these, whether they had to do with the department or whether they had to do with ARPA projects. Can't tell you. Probably with my ARPA projects at the department. Okay. This is - the person who was in the ARPA Director of Information Processing Techniques job - the - in between Lukasik in the period of surrounding the Lukasik-Heilmeyer Directorship here, Lukasik (?) Heilmeyer, the guy in the - in the one level down in the Computer Research Grants Office was Nt#Jeider - J.C.R. Niddleider. This is 1974. Niddleider's calling together a meeting of the major principal investigators of his projects, Feigenbaum, McCarthy, Marvin Minsky of MIT, Allan Newell of Carnegie Mellon, Keith Uncapher of Information Science Institute, and others, and these are notes from Niddleider's briefing. Now - I don't know that - you may want to keep this. I don't know if you want to keep it or not. This is - this is called Travel, and it's just a bunch of letters - forms and letters requesting reimbursement for travel to different things, but it does document where I was, where I went because I'm asking for reimbursement. Do you want it or not?

HL: We have a travel folder (inaudible).

RN: If you can - if you can stick it with that. That mass there. Otherwise it doesn't -

EF: (Inaudible.) Funny how we can clean that - this is a never-ending problem. We've just gone through a major salary survey for programmers for our group because we think we're underpaying them. We have to convince personnel of that. And here's exactly the same thing. September 1st, 1976. This is a - from - it's a memo from Ed Shaw. "Special Salary Adjustment for Computer Programmers." Now he's a Department Chairman. Departmental Chairmanship (?). Someone beginning a - an electronic correspondence with the ARPANET principal investigators, or users actually. At the time you could send this message to all network users and it wasn't so - and it wasn't didn't (inaudible). You'd use it. The next generation of an ARPA-like telecommunication network is being contemplated, so if you want some response to - or she - Elizabeth Finam - wants a response to a - well, by God, it's two o'clock.

HL: Who is in ARPANET probably searched (inaudible).

EF: Yeah. ARPANET. These are ARPANET file on ARPANET. The official notice of Winograd's theme to work (?). DENDRAL. Some - somebody - some newspaper person wanted to interview me, trying to convince me to - these are all SUMEX-AIM stuff. And it's starting a robotics center at Stanford. We still don't have it. The closest thing we have now is SEMA but - but that's was the first - the first pass at it.

HL: Did this happen while - while you were chairman (inaudible) or -
EF: Yeah. Sure. All of these things are (?) ’77. They're all in that. I would say some are here (inaudible). But yes. It would be around ’77. All these papers are around then. ’77 - ’78.

RN: Put a sticky on that (inaudible).

EF: This is a - this has to do with the Computer Science Department business. Says we're not doing well on Affirmative Action for women.

HL: Did - these - these are all pretty much departmental chairman files.

EF: No. I think it's - no, they're not. They're not. This one, for example, is some (inaudible). Here's another - this is interesting, too. This is something which never actually came into existence. So it's one of those - interesting because it's one of those ideas that gets talked about a lot, you spend a lot of time on it, and then it's ahead of its time and it never happens. This is the - what's called the Inter-University Satellite File.

High band with communications among a bunch of universities. Today a representative at Carnegie Mellon, IBM, (?), Satellite Business Systems, Stanford, and MIT met to discuss the prospect of an Inter-University link by satellite. That - these are memos on that. And then it just never happened, and we could never figure out quite why it doesn't happen, but that's the file on it. Anyways, those are the most interesting things. To see what people were thinking about.

RN: Well, especially when maybe twenty years ago it comes up again. People thinking (?) in the day. And it does (inaudible).

EF: Yeah. These - this is the remnants - you - you probably don't want to keep all five copies of this. Well, six - five copies. This is the remnants of a pile of Addenda to the book *Computers and Thought* that I had mimeographed sometime after the book came out. We - we were never really going to do a second edition of the book. That didn't make sense. But to everyone - more of my students who bought the book, and anyone else I could figure out who'd had the book I would send one of these things to. It would give expansions and corrections to the book. So I probably handed out hundreds of these, and this is the last five. Maybe I ought to keep one for my shelf. Stick it in the - inside the book itself, and (?). The - the others are identical. These - do you want all of them, or just one copy?

RN: Keep - keep all three just in case. Okay. Because actually -

HL: (Inaudible) right there.

EF: These are two.

HL: Oh, I was - because you (inaudible) in the red book you - you -

EF: No. No. (Inaudible).
RN:  (Inaudible.)

EF:  This is SUMEX - AIM. Departmental Chairman stuff, requests to visit us. This is departmental stuff having to do with - oh, all right. This - this - this particular one has - I don't think you want this. Oh, yeah. Yeah, yeah, (?). This is something I have forgotten completely. There - there was an organization called the Mathematical Social Science Board, MSSB. And I was on it. I think - I think it was supported by the Social Science Research Council, or spun out of the Social Science Research Conference. And for a period of time I was on it. This was administered by the Center for Advanced Study in the Behavioral Sciences - up here on the left. The list of people on this Mathematical Social Science Board is given here, and it includes me. And this was a proposal to the National Science Foundation to continue granting money to keep this board in existence. Newell was on this board, Simon was on this board, Susie Van Peters (?) here, and many other big names.

HL:  Do you not remember it because, you know, not - not much happened? Or -

EF:  Correct. Not - not that much happened. All this material has to do with the efforts to raise money for the Computer Science Department.

[End Feigenbaum 8-21-86 #2]
RN: - of Department of Computer Science in his office. Today's date is September 25th - is that right - 1986. Third interview.

(Inaudible)

EF: Have you folks seen Carolyn Cadde's book -

RN: Yes. *Silicon Valley Portraits*. What are you thinking of?

EF: Beautiful.

RN: Great topic.

HL: Is - the book is actually out in (?)?

RN: Just (Inaudible). What did you think of the text?

EF: I enjoyed it. I really enjoyed it. She - I loved her impressions of people. I went to visit him and blah, blah, blah. (?).

HL: Did you know she's giving - a November 9th (inaudible) Yosemite. She's giving a talk here. Library Associates Response (?) Exhibit with a lot of new photographs in the main library.

EF: What's the date?

HL: I think it's November 9th.

RN: I think it's November 9th.

EF: Oh, yeah. I heard about that. Sure.

HL: She's going to have a talk about the making of - yeah.

EF: That's the date. Okay. I was wondering what the date was. I - I get - (inaudible).

HL: Yeah. Yeah.

EF: Okay. But - but they never told me what date.

HL: It was November 9th?

RN: I think so because the 16th was the next -

HL: I'm almost positive. That's a Sunday, and then - and - sure.
EF: Yeah. And is it going - is that the day that there's going to be the reception?

RN: Yes.

EF: Oh, God. November 9th I think I'll be in Europe - on November 9th. Yeah, I leave on the - I think - that's right. That's the weekend I'll be in England because I have a talk in Germany on the 6th, and another one in Paris after that. So -

RN: We should check on it and make sure -

EF: Too bad.

RN: - it's the one before the 16th and not the -

EF: It just sounds right though.

HL: Yeah. It does. Okay. (Inaudible.)

EF: Okay. It's - it's been a while since we did this. Remind me again what we were doing. What - what my job was.

HL: Just to go through things. If - if it's fairly obvious what something is and that it's in the right place you needn't say very much. (Inaudible)

RN: Unless it's an interesting thing that might have an interesting story behind it.

HL: If it belongs somewhere else in the files tell us so that we put in the right place. And then any comments about - you know, that might be useful to somebody organizing the material like - just series. Like you'd explained once or twice how the Computer Science reports series are (?). You have in the - how the sub-series within sub-series and that sort of thing. That's useful to somebody organizing it. (?). And also things you think are - you might want back. I don't know if you would want these back. Or on occasion you saw some things that you felt were worthless.

RN: (Inaudible.)

EF: This photograph is the - the photograph that was - oh, it - it says here. It was in Pamela McCorduck's book. And this photograph was taken - well, this office that I'm in here is the office in Sara House, and we were there in the - approximately in 1970. So it's a - approximately a 1970 picture of me. This - all right, and - in fact I'm going to need - I'll take these back with me, but I'll give them back to you.

HL: Okay.

HL: Oh, yeah. (Inaudible.)

EF: Yeah. That'd be - (inaudible).

RN: Copies would be available to (inaudible). So if you need to use that photograph actually, (inaudible).

EF: The - let me say something about the terminology. Is that thing on?

RN: Mm-mm.
Investigator since he was playing such an important role. This is completely nothing. Whatever it is is - has nothing whatever to do with anything. Looking here at a thing called *Domains in Experimental and Cognitive Psychology of Potential Relevance to Artificial Intelligence.* It has very few notes on it. The notes relate to some - some references to people's work that are missing from this outline. And the question is for whom and for what - by whom and for what purpose was this outline created? From the words at the top, which say "Done. Irrelevant. Needed. Selected. Modified. Relevant but postponed," I can only assume that this outline was part of the beginnings, the thrashing around of the beginnings of *The Handbook of Artificial Intelligence,* asking around pe - asking people what stuff they thought should be in this handbook, what was the relevant work, trying to collect ideas for how the field itself was organized. And that's - it - this is somebody's version of that.

**HL:** Should this be in a file of the things having to do with the *Handbook of Artificial Intelligence?*

**EF:** I think so. I think so. That's what it appears to me to be. There's no other identification on it, except the words up at the top which give me the - a clue that that - because it says "Done" meaning one of these articles is already done or irrelevant, or "Needed" means we have to go get one, that sort of thing. That's - that's my guess as to where this has gone.

**HL:** And that's not a continuation of the (?) here, but pertaining to a -

**RN:** (Inaudible.)

**HL:** (Inaudible.)

**EF:** So, somebody, one of the students perhaps prepared this outline of things we should be interested in and concerned with. I would guess it's for the handbook. Okay. This is the same thing. So this gives me more suspicion to the handbook. This is for the Heuristic Search Chapter of the handbook, and the date is right. That's the - this is the beginnings time for the handbook work. And here are some more notes that relate to the same thing. And I think these asterisks mean these are articles that were either selected to be done or were done by this - by the time this - this is sort of a tracking outline saying this is what we're going to do. Yeah, there's this thing called *Overview of Heuristic Search,* which finds its way into the handbook. So, yeah, these things are all handbook materials. And here's some more handbook. See, here's the SUMEX file. This is the Directory AI handbook. The file is AI Handbook-Outline. So we - that's the time we're working on outlines. Then there's the - the 1 - it says "listings of dot done," means that the various articles in the handbook would have a name like "Heuristic-Search." And when it was finished, the version of the finished one would be filed under "dot done." And so this said ma - this is a note to myself to make listings of the "dot done" articles so I could read them. And this says - this is really interesting. These are the people that we were contacting with the outline to ask if the outline was adequate. These were our friends that we were - see, we were - we're online, and we're kind of doing a national
debugging of this idea for *The Handbook of AI*. And here, it says, "Send outline to Amarel, Newell, Bledsoe, Terry Winograd," that's TW, "Bob Rowe, Nilsson, McCarthy, Buchanan, Thordyke." These are people we were consulting. Now - here's some notes for CS-225, which was an AI course I was teaching at the time, dated October 9th, 1975, and it - (?) there's a draft here called *Feigenbaum's Proposed Structuring of AI*. Now I don't know exactly why I put this together. It could be because I needed one for CS-225, for the students. After all, that would be a reasonable thing for a professor to do. Also, I had been engaged, as you know from the last time we met, since 1970 or '71, in doing a whole track of those things as we were trying to stabilize DARPA's interest in AI. Remember that?

**HL:** Yeah.

**EF:** So this was sort of one more of those. It was a continuing way of thinking out what the field was all about and where it was going. And it may have had something to do with the gelling idea for *The Handbook of AI*. But it comes together with the CS-225 dot Biblio. And this - this is the I - this is an interesting thing because it's what a professor at one of the leading schools in AI in the world was telling his class to read in 1975. That's part - that's important. You might say this is the hot material. Okay. This is - HAI - we don't use that abbreviation anymore, but that stands for *Handbook of AI*. And this is an outline done by Alvin Barr. It - it's a handout for a meeting we were having. We had these continuous meetings with the group that was trying to formulate this idea. Barr was a key player and eventually became the first-named editor on Volumes I and II. (?) his notes at that time. You see the date on that is May something or other.

**HL:** '76.

**EF:** '76. Here's a - an electronic message dated May 8th from a person named Woockin Shregier, whom I no longer remember, but - oh, I see. I think this is not an important message. This just says it couldn't - he couldn't get to work on my - on what I wanted him to do. I don't think that's important. Shall we chuck that? Just says - it just says I can't do it.

**HL:** Okay.

**EF:** This is a - an *AI Handbook* outline, so this is what we were developing in those meetings, trying to get the plan together. And this is it at some - some date, which is not listed here, but - you know, here it comes, little by little. (?) developed (?) - see, if you look - that's - I'm looking at a random page here, pages 11 and 12 let's say. "Human Problem Solving Summary," and then it lists the things, and then at the side it said "We need this article or it's done." See? Need done, need done, etc.

**RN:** What are the - and what are the notes (?)?
Empty Page
EF: I'm not sure. (?) I'm not sure what they are. I don't know. This also gives - oh, it says "Coding used in this outline." See?

RN: Oh, there it is.

EF: Yeah. You can read it. Whatever it means it's here. See, the notation "Need with a number. Follows the proposed focus of the article where number is a number of the interval zero to ten. Low numbers indicate little expected difficulty with the article, whereas high numbers indicate a potentially difficult article." So - I had forgotten that but that was quite important. A "need 7" would - would say that's going to be a fairly hard article to do, and - and the overview of vision was going to be even harder. So that means how fast it would - for example, *Overview of Memory Models and Representation* was a need 10. Very hard. We were going to give that to our best people, and wouldn't expect it for a while. This thing also contains - what?

HL: What were the easy topics that (?)?


HL: I see. (?) mechanical one.

EF: No. It - yeah. Where it had been worked out. Here's some ones. *Q-lisp, Safe, Planner, Conniver*. You know, we know those cold. Write 'em up. And this also gives - in the introduction, who the audience for the handbook was supposed to be, and the suggested style of an article. So from the very beginning we were keeping in mind who we were writing this for. And it never changed. That - that was it. And that was - that's - so - the marketing direction so to speak. That's who we were aiming at. And the selected style for articles we - were really trying to enforce a uniformity and a discipline to the extent that we could.

RN: Okay. That's very interesting.

EF: And then in the end - in the end we couldn't, of course, enforce it because people do write differently. So in the end it was an extraordinary editing job of homogenizing the presentation stuff, and that was primarily done by Ajjijjifii Barr and Dianne Kanerva. Dianne Kanerva just died a few weeks ago. I don't know if you knew her. We're going to dedicate Volume IV of the handbook to the memory of Dianne. She was so important to this project. I'm afraid that history will overlook that. That's why I want to make sure it's on the tape. Oh, here's another copy of it.

HL: (Inaudible.)

EF: So here's a - an electronic message from Larry Fagan who was one of the students at the time. Larry Fagan is now Dr. Fagan, Ph.D., M.D., and he's the - he's Ted Shortliffe's Chief Lieutenant at the Medical Computer Science Branch of the KSL over in
the Medical Sciences - Medical School Office Building. Larry was a student at the time. He was enlisted to do some of these articles. He sent me these comments. He had read some stuff - some early articles. He's pointing out some real problems and saying, "I just hope I don't fall into any of these traps while writing my article." He was writing articles on Speech (?). And here's Allan Newell from Pittsburgh sending - sending in his comments. And of course those were critical because we pay a lot of attention to what Newell says. So - Newell writes a fairly lengthy review of some of the first - oh, this is the outline. "Received the outline today. It does indeed look like a worthwhile project." And then he goes on to give details. And we commented on this with some notes on the side here. He says he'd "like to be kept informed for obvious reasons since it is a good foil for my thinking bout the AI book." He must have been thinking about his own book about AI, which never - there was - there is no such thing. He never did it but - I just want to point that we - we were - when an - when a message from Newell would come in like that we would pay very serious attention to that. That's like a message from God coming down from Mt. Sinai.

RN: We've got to Xerox this.

HL: Yeah. I think that's - there might be a reference to -

EF: This is SUMEX, not HPP. This is a SUMEX Annual Report, one of a series. This is - it - it's all marked as to what it - exactly it is, and it's SUMEX.

RN: (?) SUMEX (inaudible).

EF: Here's another one. Here's another one while you're at it. This is the '70 - this is May '76. And that's a later one.

RN: I thought we had a SUMEX (?)

HL: Yeah, we do. These - and we have a folder. So I'll put these -

EF: Are you in luck.

HL: Is that more?

EF: Yeah. Look at this. Oh, this is (?). So now we - we actually go look at the developing AI handbook in some detail. Here - well, here's a random thing that someone pulled out of something I guess. They were going to use it as a figure, but - here's a - a computer listing from October '75. Remember those things we were looking at in May '76? Well, this is a good deal earlier, and it's the group that was meeting all the time, with all their home phone numbers and their office phones. These were people who were all gathering. These were students, and we were all thrashing around working on these articles. Doug Leonard. Of course, he's quite a famous figure in AI right now. He was there. Peter Friedland - my laboratory.
RN: Doug Hofstadter?

EF: Oh, Doug Hofstadter. Of course. Doug Hofstadter wrote the - wrote the articles on AI in Music, which we never used. Couldn't - couldn't cut - quite cope with Doug's material. But this was when Doug was still a student. He was a post-ops student with Pat Suppes. So that was the first batch of people who worked on it. The emerging outline, 19 - see, those other outlines? That was much later. Here are the early ones. 19th of October, 1975. Very early outline. We would sit there and we'd discuss what ought to be in there and what the sources are, and we'd write it down like this. Different subjects. This was on AI Languages, in Intelligence Augmentation, whatever that meant. Understanding Natural Language. This is - Doug Hofstadter wrote up this thing. Some other students wrote up their own topics. Okay. These are just different student outlines - proposals for things.

HL: Not all of the proposals - I guess you mentioned Hofstadter, actually became articles.

EF: Right. Some became articles and didn't get into the book. Like Hofstadter's articles on - on - on music. This is - this looks like it's - here's a - - oh, this is why Feigenbaum did Feigenbaum's Proposed Structure in the AI Field. Remember we asked that question? 14th of October. Same time as the other one - has to do with the handbook. It has to do with the handbook. Here's Leonard's, here's Feigenbaum's, here's Nilsson's, here's Dave Wilkins' thing, another student, called Breakdown of Artificial Intelligence. I guess this is - Dave Wilkins's editing of some emerging thing. Look at this enormously detailed breakdown. Goes on for - look how many pages it goes down - through. When I look at all of this stuff, I'm reminded once again of what an enormous amount of intellectual work it took to do this Handbook of AI. I once told someone that was - it was the most difficult professional thing I'd ever done in my life. And I can now see why I said that. How much went into this.

RN: So many people on (?). I'm very surprised. (?) there was the bibliography.

EF: Yeah. I noticed that. Remember that guy, Thorndyke, that showed up on my other list? That's Perry Thorndyke. He works as - he's head of the AI Group at FMC right now. He was a student at the time in psychology. And apparently he's the guy who wrote that thing we couldn't identify called Domains. Remember the first thing I picked up called Domains in Experimental and Cognitive Psychology of Potential Relevance, Artificial Intelligence? That's from Perry Thorndyke. He did that. And it's here. And then here are some notes from the course I was teaching at the time. Computer Science 225. And that's where all the students got recruited, from that course. This note here that says, "Ask Newell re: Merlin's Structure of AI." Merlin is not a person. Merlin is a computer program done by AI Newell. And it had - apparently I had it in mind that Merlin had a certain structure of AI built into the way it was doing whatever it was supposed to do. I can't remember the details now, but Merlin is a - is a program name - computer program name, not a person. Don't get confused. Jackson Text means Phil Jackson, a former student here who wrote a - an early textbook on AI around this time.
Several years earlier, but - MI series means *Machine Intelligence*. The series of books put out by Donald Michie in Edinburgh - at University of Edinburgh. Okay. Now - Top ten. Top Ten was a - another cut at trying to put together the material on AI. I mean one - one way you can do it is to go through all the different topics and say these are - this is what people have done. Another way to do it is to say what are the ten biggest things ever done in AI? What's the most im - what is - what's "it"? What's the top ten "it"? And so I started to ask people to do that, to - so that we could highlight what was the most important stuff. We'd take the intersection of a lot of different people's views of what the Top Ten - that's what this section is. Top Ten. John Gaschnig, SRI, Artificial Intelligence Lab. John was a student of Al Newell's in - at Carnegie Mellon. John came to SRI and died of cancer there sometime in around 1980. Very smart young kid. And so - well, for example, here's Hans Berliner's - he's another researcher at Carnegie Mellon, his view.

RN:  (Inaudible.)

EF:  Yeah. Newell - here's - here's how this Top Ten idea - see, now it's - it's coming through here. Here's how the Top Ten idea happened. Newell was serving on an - on a committee that was putting together a massive report for the National Science Foundation. The committee was called COSERS. The Committee on - SE is Scientific and Engineering - R-S is - I don't know, Research of Science, or something like that. COSERS had a meaning. And the COSERS committee came out with a book eventually. It's a couple inches thick, and at its time - for its time it was the statement about what computer -

[End of Side A]

EF:  The book is called something like *Computer Science and Engineering, Where - What Is It - What Is Its Future*, or something like that. Some - I don't remember the exact title. But I - it was - I believe it was edited by Bruce Arden, the Chairman of Electrical Engineering at Princeton. I think it was Arden. So Newell is asking that in order to put together this COSERS report, the part that deals with AI, each of us wrote down what we thought were the top ten scientific results in AI so far. "Why don't you write down your own set of ten and ship them to me by mail. I'll let you see the whole set when I get it on file and after I receive yours to prevent you from (?) - to keep you uncontaminated." And then there's Gaschnig's notes on this. Here's Hans Berliner's list. John Gaschnig is another student of Newell's at Carnegie Mellon, who's now a researcher there. Here's Gaschnig's response, although he gave twelve. This is Elaine Rich, a student of Newell's at the time, subsequently the writer of one of the best selling textbooks in AI. She's at the MCC in Austin, Texas, Microelectronics Computer Technology Corporation. Here's some more notes by John Gaschnig, on more - more of a call for opinion. Then we started to write down the top ten failures of AI. Don't know what's brought that up, but - this - this didn't - this doesn't say (inaudible). This is Reed.
Smith. He was a student in 225. He also notice the students now were working on this as a problem, and - because it's listed at CS-225. And Rees Smith is now a lead AI researcher for Schlumberger's AI efforts. Miscellaneous Material. Here's an early draft of the article on *Serum Proving*. Here's an early draft on - oh, this is just a - some ref- notes on *Natural Language* Chapter. Induction. A bibliography we put together on Knowledge Representation to - somebody. I don't know who put this together, but it was sort of the state of the art around - around the mid-70's on *Knowledge Representation*. '72 and '73 are the latest dates I see here, so. Okay. Newell sent me some material to help us. Part of it was a brief statement of AI goals and results that he took from the - that he wrote for the 1975-76 ARPA Project renewal at Carnegie Mellon. And the other is from this COSERS AI panel. So he sent this material. Newell's material is extremely thoughtful. So my advice to future historians is pay a lot of attention to these notes that Newell sent. He really knew what it was all - what - what it's all about. I mean like I say, it's kind of God's view. Then - then we have a similar thing from MIT somebody got for me. I don't know who got it for me, but it's proposal material where - where you try to structure - the reason proposal stuff is interesting for this handbook effort is because he - proposals try to s - to structure work, and that's what people were doing at the time. These are the tasks (inaudible). This is what the MIT AI lab was telling ARPA that it was going to be doing. General objective to make machines smarter, to make machines more useful, to understand intelligence, and then they list the details for that. Recent Progress. This is MIT stuff.

**HL:** So you had students do proposals that - were they real proposals, or were they (?)?

**EF:** No. No. These proposals were sent to me by others. Like that stuff from Newell he wrote that - the beginning of that. And this material must have been written by Pat Winston for an MIT proposal. It's included under -

**HL:** Or just - oh, I see. One (inaudible) irrelevant material.

**EF:** Yeah. It's included in the - in this AI handbook things. And it was also - notice, it was also included as part of CS-225. Remember I told you about this COSERS book? Well, Azriel Rosenfeld, a major researcher in the field in Pattern Recognition - Visual Pattern Recognition, wrote it - a section on Computer Vision for the COSERS book, and we included this in here - as - as additional reference material, because we were going to have to write on Computer Vision, so we needed it. Handbook.

**HL:** All the chapters, by the way, the drafts are in this drawer.

**EF:** That's terrific.

**RN:** (Inaudible).

**EF:** (?) - this - this allows you to interpret books labeled *ARPA Contractors Meeting* when you see any of these. I see two of them right here in front of me. The people who sponsored us at DARPA all these years held annual contractors meetings at that time.
"Contractors" meaning us and all of our friends who accepted ARPA money. We would all go down there for a two or three-day meeting once a year. We'd bring write-ups of what we had done in the recent year so that we - people could know each other's results. But we wouldn't get up and give a lecture from that paper. That was the preliminary material. You know, like if it's in here we don't have to talk about it. And then we would spend the time talking about the really interesting stuff. "How do you put this all together? Where is it going next? What is this thing called ARPANET? Why should we pay any attention to it?" All you - all you're trying to do is drain off our programmer's time. Why don't you let us do important things instead of this silly network stuff? You know, how wrong can you be? But - that's what this is all about. This is the material that we would be given when we got down there, and we'd read some other time. But this is extraordinarily valuable material. This is really it. This is not just Stanford stuff; this is - what is the great stuff being done around the country as it's unfolding and as the people are talking about it, while they're doing it - to their colleagues. Not - and this is not published papers. And who - who are these people? Like, I'm just looking at the second name on the list of the 1974 meeting. Saul Amarel, Rutgers University, Department of Computer Science. He now is head of the whole DARPA program. And some of these names are extraordinary. What they - what became of them, who they are, what they're doing. Each one - each one of these people here have their own story associated with the - so -

**HL:** This - it's still a - it seems to me it belongs in the HPP file since you went there in your capacity as Principal Investigator, right?

**EF:** Correct. Unless you have a special place for DARPA.

**RN:** (Inaudible.)

**HL:** Yeah. You're thinking of - (inaudible) could be all this sub - sub heading with them -

**RN:** HPP?

**HL:** - HPP, and then - and bring the other stuff back in the - in fact, I know what is right.

**RN:** Okay. Yeah. As long as you know where it is (inaudible). So, (inaudible)?

**EF:** Yeah. There's nothing extraordinary about this pile. This particular technical report, CS-178, would be of special interest because it's the - it's what you might call the brochure - the research brochure of the department for that year - 1970. This tells what everyone was doing in 1970 in our department. Everyone was asked to write up something. And then all the theses. This was almost like - in a company you'd call it their annual report. That - well, this was like that.

**HL:** But these are just computer science. These are (?).
EF: Yeah.

HL: These are just computer science. These aren't (?)

EF: Yeah. Right. This one in particular we used for video, and the rest is just stuff.

HL: (Inaudible.)

EF: This is Niklaus Wirth, a student of mine at Berkley. He got his degree there, transitioned down here at the same time I did, was an Assistant Professor here, started a development in different programming languages of which this was one paper in that series, ended up being the Language Pascal that everyone uses.

HL: He was a - he was a student in the United States.

EF: Yeah. He was a student at Berkley. The thesis - his thesis advisor was Harry Husky, and I was his other thesis advisor. There were two of us on - three of us. And then he came down here to teach at - what - at the start of the department.

HL: He is Swiss though, isn't he?

EF: Yeah. He's Swiss.

HL: So he went back to Switzerland (?)?

EF: Right after he left here he went back to Switzerland.

HL: Oh, I see. I hadn't realized that.

EF: I think for - for the - for the historical record I ought to say that we - we had a very extraordinary collection of young assistant professors. During the time when computer science was emerging from the woods and becoming a discipline, George Forsythe recognized the appropriate timing and started our department as essentially the first, although there's some argument about who's exactly the first. But if it wasn't the first it was one of the first three - two departments. And at - so at the time that computer science was coming into its own we had an extraordinary collection of young people. Klaus was one of them. He couldn't - I mean how can you tell at the time other than he was very bright, but then he turns out to be one of the major figures in the history of the field. Rag Reddy was another one. The Director of the Robotics Lab at Carnegie Mellon, and a truly prestigious and extraordinary computer scientist. Joyce Friedmann, currently at the University of Michigan, another one. In fact one of the few female faculty members that we ever had. We ran into a - a tough problem with these young people. The field was bursting out. It was like a baby grows very fast at the beginning of - of life. So you had computer science area was bursting out, growing very fast. We had people who two or three years into their assistant professor career were being offered tenure jobs.
elsewhere. There was no way Stanford could cope with that. Stanford simply can't cope with the idea of a - promoting someone to tenure after two to three years. So George Forsythe kept telling these people hang in there. We'll try to accelerate it early, but accelerating means you accelerate it one year early around Stanford. Well, that wasn't good enough for these aggressive young people, and one by one they just took these other offers and left. We - we lost that collection of young people. Of course we replaced them, but you look back on that.

RN: (?) go to the same place? I mean was it - was it the same kind of Univers - like Carnegie Mellon, that was attracting them? Or -

EF: No. Well, more or less.

RN: (Inaudible) scattered all over?

EF: I mean - Rag went to Carnegie Mellon because that was clearly another great place. But Joyce Friedman went to Michigan, and that was a place which was waning at the time, and waned significantly more afterward. And Klaus went back to an - a no place, which was - a - ETH in Zurich, because he wanted to get back to Switzerland and they offered a - and they were s - they wanted him to help get it started.

RN: Right.

EF: Knowledge-based Consultation Systems, A Proposal. Buchanan is the main investigator, I'm the sub-investigator. Oh, this is much later. '79 through '81. And a very small amount of money. And there's an NSF one. It's just one of our NSF proposals. It just is a minor piece of a jigsaw puzzle. We're just asking for a little bit of money; don't ask me why we asked for that small amount. The project PUFF and VM. It always was supported in a kind of niggling way by the NIH. Never really supported - well, we kind of almost bootlegged it into existence. But we did run out of money. We did get to the point where more money would have made a big difference, and we wrote a thing called A PUFF-VM Supplement VM is Ventilator Manager; PUFF is the Pulmonary Function Diagnosis System. It was sent out from the Pacific Medical Center, their research arm called Institute of Medical Sciences, because that's where the key medical players were. We were doing a collaboration with them, so we said to them, "Look, you guys apply for this money." And they did, and I don't think we got this. I think we may have gotten a good review and not got funded, or whatever. But at least this proposal is significant because at a certain point in time, which is - what's the date of this thing? End of January, 1979 - 1979, this laid out the state of the PUFF-VM Project. That's what you have to do when you write a proposal. That's - so that's historically valuable for that reason. Now, this was an - a training - we - we were looking for a training rep. The National Library of Medicine had gotten convinced that AI was going to become important to libraries in the future. Therefore, they decided to do some funding. But they did funding not directly for the research, but for a training program that would generate more people to do this kind of research. And I don't know why they picked that kind of a route. And - and we said, okay, we're the best in this business, we ought to be
getting a training rep. Let's - let's put together a giant proposal. This is what NIH proposals used to have to be in order to get money. And now it's worse.

**HL:** What any (?) proposals.

**EF:** So this is a - since this is trying to make the best possible case for us getting this large training grant program - I think it was large. Let me just take a look. The total for the entire proposed budget period, close to one point four million dollars. So it was large for its time. And therefore, we needed an extraordinary justification. That means that this is a very valuable document to tell historians where we felt we stood in Medical AI, in - at this period of time, 1976. This was the best case we could make for us in Medical AI. Why we were great, and how we proposed to train people.

**RN:** (Inaudible)

**EF:** I don't think so. Possibly. That - we'd have to check on that with - the - the person who would know it right off is Ted Shortliffe, whether we were funded or not. But we could also look in the - the files of grants received. Stanford has that stuff. Now this is a proposal. About each couple years, depending on the mood of ARPA, whether it was a two-year period or three-year period, we'd have to write a proposal to continue the HPP, the - the main DARPA line of funding over the years. And so these proposals are also extraordinarily valuable from the same perspective. What did we think we were doing? And what were we proposing to do next? This gives you the main vector of - of the HPP. And by budgets, of course, who was on the project at the time.

**RN:** That was 19 - that was 1970 -

**EF:** What - what's the date on that one?

**HL:** That was '77, early '77.

**EF:** This is a DARPA Progress Report for the period July '73 to July '74, which accommodated not just HPP work listed as Feigenbaum and Lederberg work, but also McCarthy's AI Project, and these Network Protocol Project. These were several ARPA projects which were aggregated into one annual report which was sent to ARPA, and then published as a CS report so that we could send it around. Les Earnest, who's listed here as the editor, is currently Associate Chairman of the Computer Science Department, he's also the founder of Imaging Corporation. After this but before he came back to being Associate Chairman and is - it would be an extraordinary source for historical information. He was really the managing director under McCarthy. He kept things running.

**HL:** Yeah, we've talked - we've talked to him a little bit, and he has some stuff I guess which we're trying to get together.
EF: Okay. This one labeled Description of HPP Projects is not dated. But I'll tell you what it was put together for. I could tell by the projects listed here that it's - that it's the late-ish '70s. Not the absolutely late '70s, but more like '77-'78. I can just tell by what's on here. It was put together so that we could have a document to hand visitors when they came. So we didn't have to go over everything, and they could leave with a piece of paper in their hands. That's what this was all about. So you better date it about 1977, plus or minus a year. This is an early expert system that created quite a - an excitement in the field when it came out. It's now dead and no one ever refers to it. But at the time - this is called SACON - S-A-C-O-N. It was one of the first - maybe the first move of AI out of chemistry and medicine into engineering. This has to do with structural engineering. Advising a structural engineer. And so it created quite a wave of excitement. It showed how we could use the MYCIN-like ideas for medicine and translate them into engineering, and help engineers. SACON. Remember my story about the stream of proposals to ARPA?

HL: Mm-mmm.

EF: Well, here's one dated April '79, so obviously we were on a two-year cycle at the time because the other one was '77, this is '79. Now this is - this is an historically very important document. This is Doug Leonard's thesis. And when the history of AI is written it will have in it certain landmark theses that - that ch - changed the way the field was. This is one of them. And this was the best thesis that I ever supervised, and this is a - this is a treasure. This is an immensely important document in my view for the history of AI. Another important thesis that was done from the project, but not as important as Leonard's, was done by Mark Stefik, now the Director of Knowledge Engineering for Xerox, Palo Alto Research Center. Mark's thesis was on AI Applied to the Planning of Experiments in Molecular Biology. Helping Genetic Engineers Plan Recombinant DNA Gene Cloning Experiments. He would come to see me and he'd bring notes, and we'd talk about them, and I would file them away in a binder called Mark Stefik's Thesis. And this is the unfolding of Mark Stefik's thesis as seen by the supervisor.

HL: Oh, I see. Not actually the thesis, but your -

EF: It's what he would bring to me, and I would write notes on it. It kind of gives a view of how a student works through the ideas in a thesis and what kind of feedback a student gets from the advisor.

HL: This is appropriately placed in the HPP -

EF: Well, it was one of the HPP theses. MOLGEN is what it is. You have a MOLGEN file? A special MOL - remember when we were talking about things like DENDRAL and (?)?

HL: Yeah.

RN: Yeah.
EF: That is MOLGEN.

HL: We would have it outlined as - we'll put - have some of those things like PUF and MOLGEN and stuff, but just ordered within HPP, this -

EF: Well, maybe - but do you need a sticker on that thing to remind you that that's MOLGEN?

HL: Yeah. Yeah.

EF: Because how would you remember?

RN: (?) - there is something else related to MOLGEN (?)

EF: Yeah. I remember from last time.


RN: (?) I'm glad. Some people would consider (inaudible), but we think it's fun. There's - there's no way that - that - in the transfer to an archive unless someone had exactly the same knowledge as (?). We could transfer this information to a researcher twenty years from now.

EF: No way.

RN: (?) without doing this. It's just wonderful.

EF: Are these - are these tapes going to be transcribed?

RN: Well that's what I haven't figured - quite figured out yet. What I might do is go through them and at least take out -

EF: Take notes?

RN: Yeah. And take - sort of check my notes and take down the things that I think are really - explain something.

HL: Well, it would be useful for somebody working in the material. I mean this may be a - a -

RN: Yeah. Just to listen to them alone, someone's going to have to - whoever processes the collection, just listen to the tape as they go through it. But I think I'll still probably go through and transcribe.
EF: And put -

RN: Selection is the very least -

HL: Thinking in terms of the guide to the collection that would be useful for research for a lot of – it's like sometimes when you - when you make sort of a note - you know, a mental - a - a note for the - for the record, or you talk about a certain specific thing, just to have that bit transcribed and actually placed into the relevant section of the guide to the collection.

RN: Collective (?) about (inaudible).

HL: Mm-mmm. Instead of having, you know, somebody else write a description, that would - you'd just do a cut and paste what you say about the thesis. And then it's up to the researcher from that point, but a - and tell them that - that capsulizes it as well as anybody else could.

EF: The - did we run across a thesis last time we were working by Donald Waterman? Does that name ring a bell?

HL: The name doesn't ring a bell. And not - the thesis doesn't ring a bell. There's still plenty of this - the HPP we've made (?) -

EF: Well, let me go over this. Let me - let me (?) -

HL: - go through a - a quarter of it.

EF: Let me tell you some more about - I have a pile here. Henry, why don't I finish these.

HL: Okay.

EF: Okay. Monty Collero. Notice that this is a very early thesis. December '67. Don Waterman's was around the same time. One of the first students around here. Monty was an Air force officer who was here as a Ph.D. student, and that's quite rare to have that. He was in the Operations Research Department and got intrigued with AI and learning machines, and wanted to do an AI thesis out of that department. Now he - he was put in contact with me by Jerry Lieberman, and did his - even though he was an OR student he did his thesis under me, and it was a learning program. See, it says an adaptive command and control system. That's the clue that, A, you're talking about learning because it's adaptive - oh, he says utilizing heuristic learning processes. Command and control is a military term, right?

RN: I was going to say, that it - that sounds very -
EF: So - so what he was doing was a military missile targeting system, or attack system, or something like that, which was also very strange for a university. Universities don't sort of do that sort of thing. But that's what he knew best. And so he did his thesis on that.

RN: That's not classified or anything like that?

EF: No. No, it isn't. The overall objective of the defense system considered is the model - in the model is to minimize total loss and target value. You know, that's a real military thing. Post-attack data files. As the attack develops - now that - really an extraordinary thing. Here - here, look at these are missile assignments to targets.

HL: That's really interesting because the - it reminds me of the really early work that was done in the early '50s having to do with flight control and radar - you know, radar guidance systems. You know, with - with anti-aircraft missiles (?). There is a - I suppose a tradition there, but probably that becomes less central as computer science develops, you know, at the beginning of voluntary (?) were involved with some of these kinds of problems.

EF: It doesn't become less central. The reason is that as the years went on, particularly after the Mansfield Amendment during the Vietnam War, the DARPA sponsors of all of this stuff for the ONR sponsors and whatever became more military mission oriented. And so if you - for example, you look - 1986, the work we're doing in the HPP now on parallel computing for AI, has an application which is electronic intelligence, and another one is tracking airplanes - radar tracking of airplanes. It's still - it's a military orientation.

[End of Feigenbaum 9-25-86, Tape #1]
EF: I did not look at this, and now look at the acknowledgements of this thesis. Remember I told you Lieberman put him in contact with me?

RN: Yeah.

EF: Now that's twenty years later. How did I remember the - Lieberman?

RN: That's interesting. That whole - there it is.

EF: Okay. This is a Lederberg book. This is what Josh Lederberg was doing in Structural Chemistry on a computer before he met me. He did a book published by Holden-Day on computing the molecular formulas from some mass spectral data. That was pre-DENDRAL. A little bit of pre-DENDRAL. A bunch of tables that Lederberg generated using BALGOL Programs on the Stanford - oh, no, I'm sorry. Yeah. The sub-AI monitor on the IBM 7090 at Stanford University. That's (inaudible).

HL: So this tells you what the state of the art was before the (?)?

EF: Before DENDRAL.

HL: Before? Okay.

EF: Right. Just before DENDRAL. One year before DENDRAL. HPP 64-2 - there was no HPP at the time, of course, but this is later. We had a numbering system where that's the year and that's the - the item number within the year. So this is identified as 1964 work. But of course I didn't get to Stanford until '65, and there wasn't a DENDRAL project in '65. But -

HL: So it's retro - it's retrospectively - that's something to watch out for.

EF: That's right.

HL: So that could be a pitfall.

EF: That's why I was telling you about it. The copyright date on this is '64. Pre-DENDRAL. Oh, wow. Okay. Then Lederberg - there were two streams of work in DENDRAL. There was the - what you might call the pure Computational Stream, which had to do with systematic enumeration of chemical structures. And then there was the Heuristic Stream. And that's why the stuff that - that I was involved with we named Heuristic DENDRAL to distinguish it from the other stream which was DENDRAL OI J -U which stood for Dendrite Algorithm, meaning it's a pure algorithm just exfoliating these chemical structures in a systematic way. Now Lederberg was the person solely concerned with pure DENDRAL. We were implementing versions of pure DENDRAL for him. But in terms of who wanted to that kind of work, that was - Lederberg's driving love at the time was to do that. And there came a time when he wanted to write that all up - I guess, and he actually put it all - just he wanted to get it down on paper and it - and
he wrote a big series of articles. Here - Part I through Part V. **DENDRAL, A System for Computer Construction Enumeration and Notation for Organic Molecules**, as tree structures and super graphs. Doesn't say anything about AI. This was one of - this is Part III of Lederberg's series. 19 - see, it says here March 13, 1968, but this is Lederberg's work of 1964. Don't know why it says '68. That's very confusing. And this is - he may have written it at the time but we think of it as 1964 work, and we've dated it as '64.

**HL:** So this (?) goes with this kind of (?)?

**EF:** Yeah. That's why it's there. Here's Part II. Here's Part I. And it all goes together with that. That's all DENDRAL stuff. Ah, don't go away. We followed up on - let me - let me give you a little bit of history. The problem of enumerating non-cyclic molecules was much, much, much (?) easier intellectually than the problem of enumerating cyclic molecules. The latter became or was tied up with some of the most sophisticated problems in graph theory at - of the time, for which there were no theorems. That means that although we did not think of ourselves as mathematical graph theorists, we were at the cutting edge of mathematical graph theory trying to prove new theorems to apply this stuff. We were - we weren't the only ones. Other computer scientists were trying to do that too, but not related to chemistry. Like a young person in this department who's now at Princeton, **Bob Tarjan**, was an expert on that, Donald Knuth was interested in exactly those kinds of algorithms. Well, one way to make progress on that if you're stymied, if you're a geneticist like Lederberg who's brilliant but not a specialist, or if you're a computer scientist like myself who's not a specialist in graph theory, is to hire someone who is. Knuth had a visitor here at - during one year. Sabbatical visitor from Ohio State Math Department named Harold Brown. And Harold suddenly found as we began to talk about these problems, Harold suddenly found people who were interested in what he knew how to do, people who loved his work, and that's extraordinary. No - most of the time nobody loves mathematician's work. They - nobody pays any attention. If you were - people who really wanted the stuff and they had a focused need for it. So Harold got attracted to us and we to him because of what he knew. And he worked on our problem, and then he never left, never went back to Ohio State. He became a researcher on the DENDRAL Project, produced some extraordinary work of which this is one, this paper. **HPP74-7, Molecular Structure, Elucidation III**, one of a series of - of things on cyclic graph structures. Notice how mathematical it is compared to any of the other stuff. These are the real proofs, and the algorithms for how to do it. Extraordinary. And he left here for a time and worked at NASA Ames, and then he came back and he's one of the key scientists on the HPP Net. Harold Brown.

**HL:** Is he - is he a faculty member as well, or -

**EF:** No. No. He's a Senior Research Associate. But he gave up a tenure job at Ohio State to do - to do that. And prior to Harold's grabbing hold of the problem, we had some of our own people try to work on it, and there's some papers here, some DENDRAL papers here. For - for example, they - this guy, Larry Masinter, who's named on these two papers, was a - a math graduate student at the time who came over to work with us on these problems. Solved some very difficult problems for us, got his Ph.D., left, and is
a Key Researcher for Xerox Palo Alto Research Center. You might say he's the Chief Developer of the Xerox LISP Machine. Larry Masinter. So these are more - more of the important DENDRAL articles.

HL: These all go under the mathematical graph.

EF: You can either store them under the HPP Paper Series, or you can store them under DENDRAL. The - these are papers in the HPP Series. Here's a paper that Bruce Buchanan put together on the work we were doing for a conference run by NATO in the summer in France. NATO's - NATO's summer - what's called an Advanced Study Institute. Here's one that Bruce Buchanan put together with Donald Michie of Edinburgh, a joint paper on - on Heuristic DENDRAL. I don't know why - oh, Michie was a visitor here. That's right. So somehow Michie wanted to see a survey paper done on what we were doing in DENDRAL and got together with Buchanan and they wrote a paper. A lot of these papers came together in a writing project called The DENDRAL Book. The DENDRAL Book eventually came out. It was edited or brought together into a complete fabric by Robert Lindsay of the University of Michigan who was here on Sabbatical, and he took on this as a sabbatical project to get this book together. And in honor of that we made him lead author on that book. So it's Lindsay, Buchanan, Feigenbaum, Lederberg. Applications of Artificial Intelligence to Organic Chemistry: The DENDRAL Project. That's the book published by McGraw-Hill.

RN: And Lindsay is L-I-N-


HL: You know, we have - (?), we have another file of DENDRAL because I remember the story about him coming from Michigan.

EF: Now we - we found a computer science student who knew a lot about programs dealing with organic chemical molecules. He was doing a thesis on that. His name was Sridharan, an Indian, and we hired him as a researcher after he got his Ph.D. His thesis was in the area of organic chemical synthesis, not analysis. So he wrote a paper on what his thesis research is all about, but don't get this confused in the historical records with anything we were doing here. It's just that he was here, but this was his thesis work. It's HPP73-9.

HL: So it's still - even though - though it wasn't directly related to the rest of the project it would still go under HPP?

EF: That's normal. It's normal when you hire someone and they've done their work somewhere else, when they write up that work they publish it in your series. That's - remember I was talking about the generation of those cyclic molecules? The systematic generation of it? Here's - this is the DENDRAL Series 12 paper, Exhaustive Generation of Cyclic and Acyclic Isomers, and it has these people I've been telling you about. Masinter, Sridharan - Harold Brown is not named on this one. Lederberg, and Dennis
Smith is the main chemist on this program. This is the - a DENDRAL paper which has a computer science number, it has an HPP number, and it has a Stanford AI memo number, which we continued to do at the time. A216. So we were integrated in with several series because they have different mailing lists.

**HL:** The N-series by the way is available on microfilm. (??).

**EF:** This - this is not a DENDRAL paper. This is an HPP paper. It's the review by Buchanan of the controversial book by Dreyfus attacking Artificial Intelligence. This - what I'm looking at here dated in '72 through '76 and so on, but these are all various aspects - these are all DENDRAL papers. Not always chemistry. These I'm looking here are chemistry. But this one is a view by a group of people working on our project of the extraordinary opportunity and effect that computer networking had on the development of a project like DENDRAL. This was a time when - when the rest of the world didn't know about this. They didn't know that electronic mail and cross-use of files and programs was going to revolutionize this, so we had to write about it. And there was a conference called Computer Networking in Chemistry. And so our team wrote a paper called *Networking and a Collaborative Research Community*, a case study using the DENDRAL Program. Interesting. Hadn't even remembered that. All DENDRAL stuff. And finally we get to those papers I was telling you by Harold Brown, *Constructive Graph Labeling Using Double Cocsets*. Double Cocsets is a mathematical term. So there - here was the mathematics coming into DENDRAL. And the journal was discreet mathematics. Not AI, not - not Association for Computing Machinery, but the Math Journal.

**HL:** Was that when - was he came in was there a gap in - let's say an understanding between the regular - the people in the project and the mathematician? In other words, was everything it - if - when you saw what he wrote was it, ah-hah, it was immediately intuitive? Or it really required (?)?

**EF:** No. No. He was - the - the whole idea of double cocsets was really far out. I didn't know anything about that. That was - it - a giant gap. Harold's work filled a critical need. It gave us a mathematical proof that the underpinnings of DENDRAL were sound. That if we proceeded by - by the means that his mathematics told us, then we would have a computer program underneath that would generate all the legal structural isomers of a given chemical formula, and it would not miss any, and it would not generate any redundantly. We had to have that proof. Otherwise you couldn't tell whether DENDRAL was doing the right job or not. It could be inadvertently missing some possibilities. We needed that mathematical proof underneath. Or put another way, we just didn't feel comfortable until we had it. It was a nagging thing. We just had to get it. Here is the computer algorithm that emerged from the mathematics. *The Algorithm for the Construction of Graph of Organic Molecules* by Brown and Masinter, these people I've been telling you about. Masinter was a math student. This one, again, anytime you see the word "synthesis" it means Stritttera's thesis. Herbert Stritttera was Stritttera's thesis advisor somewhere else. State University of New York, actually.
HL: What we basically have here is just a complete -

EF: Collection of DENDRAL papers. That's DENDRAL. Okay. Now I'm ready for more. Now this is HPP recent rem - recent (?) since it was 1979. What is it? Okay. So what these basically are is just simply early versions and graphs of, or papers I would want to refer to at that time for some reason. And some of them come out in other forms. Like we've already seen this one before in another form. This is a Paper but it's called a draft here. Similarly these other ones. This paper by Mark Stefik called An Examination of a Frame Structured Representation System is a key - a key early paper on a piece of software we did that had a very big impact in the world called The Units Package. It says here, "Abstract: The Unit Package is." The Unit Package is a big deal here. Eventually it was licensed by Stanford to IntelliGenetics, was developed by IntelliGenetics into the commercial system called KEE, K-E-E, Knowledge Engineering Environment, which is a main product of Intellicorp. The last paper in here is one further attempt by Lederberg to organize his ideas on the impact of electronic network (?). And this is a very well known paper. This was a special issue of the IEEE. He wrote this on invitation. And even as - as recently as - as recently as last weekend in the electronic mail where I was Lederberg writing up something for an Office of Technology Assessment Study online. We were doing it online. We were doing it as a - a national group of people helping OTA get this report together. Lederberg referenced this article in his comment, and referenced the term "Graph" as the thing you send in electronic mail. You send a Graph instead of an electronic message or something like that.

HL: So it's - his - his analogy is to a telegram or telegraphy.

RN: Yeah.

EF: Okay. That's that. This just says that we have to send reports to ARPA, and this is a semi-annual report that the contract called for. That's all it is. It's 1977's semi-annual report. Now this - this, and some of the material we just looked at, was part of a project which never quite came to fruition. I wanted for the permanent record to do library style bindings of the entire HPP work in series and keep them on my bookshelf, instead of loose things like this. And I gave the project to some secretary to do and -

RN: And that's it right there.

EF: - it never happened. Here's a note. And because I didn't track it right -

RN: That's great. (Inaudible.)

EF: So this is a kind of a worksheet from which whoever was doing this working. It's the HPP Project Memo since 1964.

HL: That's probably when all of these little labels were put on? Was that -
EF: Yeah. Yeah.

HL: Okay.

RN: So they're - we don't know if there is a complete set of these.

EF: Oh. This was complete - we did get it all together at the time that we were preparing to do this binding project. And it never quite came together. So up until that moment this was complete. But if it isn't, I mean we know where to get the papers. We can make a complete set.

RN: I think that might be worth it.

HL: Yeah. We have a lot - lot more in there.

EF: And so when you look at -

HL: There is a whole section in here by the way, which is just each one would - in a folder like this with a number, and I don't know what the red dot means. There were - some are red and some are orange.

EF: I don't either. It probably had something to do with the binding project that -

HL: But it looks pretty - I don't see any gaps here (?).

EF: Here you go. A bibliography of our papers. But then a - it's not complete. Because number one here is something starts with HPP-72.

RN: Yeah.

EF: (Inaudible.) Don't know what it was put together for. Now - oh, these - and this is the papers labeled by what project they belong to, what they are.

RN: (?) when it's - when does the list start? (Inaudible.)

HL: '64. There's a '62, too, in here.

RN: That's - this is - this is really (inaudible).

HL: Does it go back to '62 and disappears? The -

EF: The - the first paper here is HPP64-1.

HL: Oh, I see.

EF: It's one of those Lederberg papers.
HL: But there were more added after that list was done because here's HPP62-2.

EF: Oh, really. Oh, okay. No, I didn't - I don't know what a 62 is. It wasn't -

HL: This is the one that's 62-2. It's the very earliest one in here.

EF: Okay.

HL: So that's - the - went - went back and got (?)

EF: That's very interesting because it tells you how early on Lederberg was thinking of this problem. Way, way before I ever got to Stanford he was thinking about.

HL: It's interesting because the thing is dated '66, but somebody must have -

EF: But - but we wanted to be more accurate concerning when it was done, not when it was written up.

HL: Oh, I see. So there was a real effort made to really track these things down to figure out when people (?)

EF: Yeah. These are all of the same sort. They're all bibliographies and things. I mean not that we are - they're listings of HPP notes and (?). Now, then here we get to just more of these papers. They say where they're from. They're copies of everything. I don't need to make special comments on these because it - this is - this is a systematic technical paper collection of all the work that was being done in our lab. This one I'll make a special comment on. The thesis by Stephon Persson, P-E-R-S-S-O-N, dated September 26, 1966, AI Memo Number 44. That's a special case because Stephon Persson was not a Stanford student. He was a Berkeley student, hadn't finished up his work at Berkeley by the - when I moved. And so I was supervising his thesis sort of long distance. But when it actually got printed up, it got printed up as a memo of us here, in my project.

HL: And this was - mmm. I wonder if this should be in the HPP file.

EF: Yeah. It should be.

HL: It should be?

EF: Yeah. It's - it was HPP stuff by a student who wasn't a Stanford student but was a Berkeley student.

HL: Now, everything else in the HPP with the exception -

EF: Henry, you missed one. This is the collection of -
HL: Oh, that's the main - yeah, one of (inaudible) -

EF: - the collection of all these different listings.

HL: (Inaudible) - requires some more explanation.

EF: (Inaudible.) The project decided in 1979 maybe. Remember I showed you that handout before that I - we'd give to visitors? Well, by this time we were becoming really big shots in the world. The world was really paying attention because we had gone - we had invented expert systems, knowledge engineering, we were the world's leading laboratory in that, we were the focus of everyone's attentions, the darling, etc., etc. We getting a lot of visitors and we were proud of ourselves, and - this was a stand up and be seen document. We were going to produce the - the loveliest brochure that anyone had ever seen. And we produced - and - and this the - these are the people - not everyone, but these were - and - (?) for example, we were talking about here. (?). These are so - pictures of a lot of the people. This was a - done by an artist that we had helped get started in AI (?) modeling of how - of how drawing is done. Harold Cowen at the University of California, San Diego. This was a mural he did for the San Francisco Museum of Modern Art. And we got the picture of that. It's AI related. And we printed up enough of these so we could give one to each attendee of the first AAAI National Conference held at Stanford in the summer of 1980. I mean if we were going to be proud of ourselves and be a big deal and all that, we were going to give one of these to everyone. (?) - this was a party favor. And it went over extremely well. This is - this was one of the hot items in AI for - for several years. People wanted these. We've now done another one called Heuristic Programming Project, 198 - no - Knowledge Systems Laboratory, 1985, incorporating Heuristic Programming Project. It's over there in the lab.

[End of Side A]

EF: And - this is a listing of - of the - the stuff that has AI-M numbers, inclu - that includes some of our stuff because we were trying to integrate with a - remember? Stanford AI Lab? Here's another one of those.

HL: I'll give you - do you want one for - there are two here. Do you want one just for your reference section? Or -

RN: Yes.

EF: All right. Now - this is HPP Administrative stuff with the DARPA contract. You know, we got - we got this contract but this is dated '77, and it says what we have to do. And - this shows Gio Wiederhold, one of our Assistant Professors who's still on the faculty here, being part of our project. I think - I think he was incorporated in this project...
for a time by - for - at DARPA's convenience, not for our reasons. Gives salaries of people. This - (?) as we're having a party and there are a lot of names associated with going to this party, but I don't think that matters. It - but it does give a list of who's on the project. This is -

HL:  (Inaudible.)

EF:  Yeah. These are just the names of - names of people.

RN:  Well, that could be useful. Are they dated?

HL:  (Inaudible.)

EF:  '76. (?). This is all the same. You only need one of these. Oh, this is more management stuff related to the contracts with DARPA. And this is just people here. HPP people around that time. Seven - these lists are dated '76 and '77, fall and winter. See these dates here?

HL:  Mm-mmm.

EF:  These are individuals. This is project management stuff having to do with a segment of HPP work called GUIDON. One of the project - GUIDON Administration. And then this is more project administration. This is the kind of thing that administrative assistants do around here - Stanford forms and -

RN:  Yep. Lists.

EF:  - projections of budget. CONGEN is DENDRAL. CONGEN is just a later name for a particular part of DENDRAL, stands for Constrained Generator. The explanation of it for the historians who want to know about it is in that DENDRAL book. And this is CONGEN Feasibility Study, CONGEN Manual, but it really goes with DENDRAL. This is all the same. Copies. This is more CONGEN. Okay. Henry, these things with numbers, 1FCZ, those are Stanford accounting numbers. These are Stanford accounting reports on our various things. I don't see anything in them.

HL:  Uh-oh.

EF:  Well, these two are empty.


EF:  Yeah. Here's an example of a - do you want to keep only the ones that have items in them?

RN:  Yeah.
HL: Well, actually I'd like to keep this file folder just because of the mention of Slumberger as a - if we might - if we can't find anything else about it, ah-hah

EF: No. There's more about it than that. That's just one piece. They ended up giving us a lot of money, and that was just a minor piece.

RN: (Inaudible.)

HL: Mmm?

EF: Here's another gift. That's a personal gift I think. (Inaudible.) This is more - more project management stuff. This is the DARPA VSLI Systems Research Contract. It's sort of self evident what it is underneath (?). Administrative. All these things with these funny numbers are administrative. All of that is HPP Administrative Business. This one here, Administrative Files Related to Chrysalis. Chrysalis is a project sponsored by the National Science Foundation. And it had a 2-XCZ number, but it had another N-NSF number as well. That's what those - those mean. Henry, this is a very interesting - this is not an important paper, it's just an early paper, and seminal in the sense that it - if you're going to track back a line of thinking, it would start at this place. This is Artificial Intelligence Techniques and Legal Problem Solving. AI and the Law. This was based on some - Stanford ran a conference on (?) Computer Applications to Legal Research and Analysis in 1972, and Bruce and I and - and some other people - Tom Hedrick of the Law School, and who was a student here, made some presentations, and they were collected up into this pamphlet here. Like Buchanan's paper, The Current Status of Artificial Intelligence Research as it Applies to Legal Reasoning. So it's - for that reason it's important. Now AI and Legal Reasoning never really took off, so the whole thing isn't all that important, but some day it will be, and this will be tracked back. It'll be an important paper. And this - these are more DENDRAL things. This is an official paper. That's a working note. And this - this isn't labeled as to who wrote it. That's Lederberg. Oh, yeah. It is labeled. I'm sorry. It is labeled with Lederberg.

HL: So are we running short of time here?

EF: It's eleven now.

HL: Okay.

EF: When are - oh, we picked the next time.

RN: Yes. (Inaudible.)

HL: (Inaudible.)

[End Feigenbaum 9-25-86 #2]
EF: This - this map labeled Computer Engineering Distribution of Awards is interesting only for one reason. This is National Science Foundation, (?) NSF on it, and it's interesting for only one reason. (Inaudible). The date is 1981 and '82. It's not - it's interesting from my point only for one reason. It's indicative of the fact that it - this is sort of definite proof of the fact that NSF defin - definitely worries about the geographical distribution of awards rather than on (?) to give merit alone. For their Computer Science and Technology Advisory Board of which I was on, they would present the list of awards to us in alphabetical order by states. You know, Arizona, Alabama, that sort of thing. Here's a piece of evidence of that. And this happens to be the awards themselves for that year in case - in case you care. MOLGEN is one of these. That's why I was sent this, I believe. But these are the awards - for the - for those years. Excuse me. Those are the awards for the Computer Engineering Division, not the Computer Science Division. We were supported by Computer Engineering in that time. Excuse me for one -

(There is a break in the recording.)

EF: This material here is a proposal that Buchanan submitted to IBM in support of the work of a person he brought here named Derek Sleeman, a British guy from Leeds University, who's now returned to Aberdeen University, to support work on Artificial Intelligence applied to tutoring and education. What do I do with (?) folders (inaudible).

RN: (Inaudible.)

HL: I'll take them, if you don't mind.

EF: Okay.

RN: (Inaudible.)

EF: Myself sending around a - an article from Science in '82 talking about Federal auditors harassing principal investigators for telling my people to be careful. And this is Jerry Lieberman's memo. Again, similarly, we have to be careful about this - these new government regulations concerning export control. The government trying to define certain scientific things as being technical data which is subject to export control. The university (?) Mr. Lieberman's memo on it. I can see what - that this was all relating to sponsored projects. That's what this is all about. This is a submission letter for research that was going to be supported by the National Library of Medicine. Again 1982. This is National Science Foundation - this list from 1979, and apparently in 1977 and '78 also - yeah. Grants - grants given in the area of Behavioral and Neural Sciences. I was on this list because my work in Artificial Intelligence relates to memory and cognitive processes. So these are grants for memory and cognitive processes.

RN: What's that folder? We should try to keep the folders that have the labels that apply to these (inaudible).

EF: Oh, okay. Sure.
HL: Do they - it's just these grants and contracts.

RN: (Inaudible). Yeah, but rather than taking everything out of any folder and (?) -

EF: Feel free to do whatever you like on that. This is - this says Current Research Support, and what it means is current research support of people in our department or are - are affiliated with - with our department, and current means, well, I can see that for example, it says something about me in 1979. So current - it relates I'm sure to the same period, '77 through '79, because that's what the dates look like on here. But current means our department. Want to mark that? There's no title on it. I don't know why I wrote that up, or why anyone wrote it up, but there it is. The next one is - lists Carl Djerassi as the Principal Investigator, but of course it's the DENDRAL grant, and this is application for continuation of the DENDRAL grant with a budget on here. Budget numbers for various years. People on the project. Lists the dates when the continuation is requested, '78 through '79 I think for this particular year. Here's another copy of that. Oh, you want me to throw it away.

RN: Yeah. Why don't we just (inaudible).

EF: No, the - I - I'm just look at routine administrative papers having to do with contract management. These contracts you see here from SRI are simply of no consequence. They simply involve a transfer from of their projects to one of ours, and it was written in the contract. And Massey's memo about what we had to do about (?) with the government. No, it's all contract administration. Okay. Now I was a member of the National Science Foundation's Computer Science Advisory Board for a while, and here's a file on the NSF Advisory Committee. So agendas and comments and - and so on. Just minutes of those meetings of the NSF Advisory Committee. Yeah, here I am on the subcommittee members. That's what that's all about. NSF. Student Science Programs, so this is just a brochure from NSF about one of their student programs. ONR Proposal, 1980. We got two of our younger people, Ted Shortliffe and Mike Genesereth, to be the Co-principal Investigators of the proposal just to try to give them some of their own support that they could be manager of. That's what this was. They proposed this and did this project for O&R.

HL: It did get funded.

EF: Yeah. Did get funded. Robotics, I don't know why I kept this but it's - looks - (?) a Business Week article about robotics, 1980. VLSI. In 1979 McCarthy wanted to do some kind of project having to do with VLSI design. And I think this was funded also. This is just material that's related to McCarthy's proposal. The VM Project stands for Ventilatory Manager. That was one of the HPP projects. Myself, Larry Emminger, who actually did the work. This is dated 1980, and it's a write up of the Ventilator Manager and a proposal by a student named John Kunz on things he might do for his thesis relating to VM. And there's also a - a reprinted article on VM - from MYCIN to VM. Xerox contract. What is this? Here is the contract. I think this is a personal consulting
contract - yes, that's what it is. A no-cost contract just to allow me to get into Xerox easily without elaborate procedures. Xerox (inaudible). Xerox EOS, Xerox Electrooptical Systems with the part of Xerox that was charged was producing LISP machines, and this was an early correspondence with them, 1981. So that's pretty early about List Machines. We wanted some LISP machines, and this was a kind of a quote. NIH forms (?). This is just how to apply for a grant. Shall I throw that away?

RN: Mm-mmm.

EF: NIH SUMEX. A - an awards statement at Stanford for a certain amount of money. It's a small amount of money and I don't know what it's about. It's just the - one of these things that come through to Stanford. Now I'm looking at another NIH grant. It has to do with SUMEX, and this is a very large amount of money relating to a SUMEX renewal. This is the SUMEX renewal of the period 1978 through - through '86? That can't be right. That's a very long. They don't - they don't renew for that long. But this is the budget period '81 through '82. National Science Foundation cover. Cover of what?

RN: (Inaudible.)

EF: Oh, oh, cover sheets. Oh, yeah. Okay. You're done with those. And budget sheets. You don't want those. And proposal routing forms. You don't want those, do you? National Science - this one's empty. This one's empty. ONR, again, this is grants administration quarterly management reports for various ONR contracts that we had. But they were almost entirely Buchanan's contracts. Ah, yes. Here's another - let me - let me flip through that. That file is listed ONR, and it's mostly contract administration except this sheet is not. This sheet is the list of people who were serving on an ONR sponsored panel called "Panel on Applied Mathematics Research Alternatives for the Navy. And I was on the panel, and so was Jerry Lieberman. Jerry was the one who really got me on that panel. Rog Ready at Carnegie Mellon was on that panel also. This is a list of people who were on that panel. But that's separate from this ONR grants and contract administration. This is more ONR contract management stuff. This is ONR distribution list. Apparently this is the list they wanted us to send our technical reports to in connection with those contracts. Do you care about this list of people?

(Talking over each other.)

EF: Okay. This is - this is a quarterly report. This is - the file is labeled with a grant number VLSI Cad, but it really related to the DARPA basic research contract. And it's a quarterly report dated March 31st, 1980, of the stuff we were doing under - under the Rubric "basic research for ARPA." Here's the MOLGEN Proposal - for - well, it's not - it's not dated on the surface of it, but it looks like the original MOLGEN proposal. These dates you'll have to look up - somewhere about '76, something like that. I don't see the budget in here which might give some - no, the budget isn't in here. So - but assume it's around 19 - oh, yeah. It must be '76, because the NSF grant is MCS76. So it's a '76 MOLGEN grant. And this is the Chrysalis Proposal, '77, which was funded. This is another HPP project. And - wonder if these are the same. Looks like it. Looks like there
are two copies of the Chrysalis proposal. So I think I'll - since you don't need two I'll return this one (inaudible).

**HL:** And (?) is (inaudible).

**RN:** (Inaudible.)

**HL:** Conference. Conferences and some miscellaneous items (inaudible), and you might want to (?) that.

**EF:** That -

**HL:** Just (?) miscellaneous.

**RN:** Yeah.

**EF:** Okay. At a particular point in time The Handbook of Artificial Intelligence, which was not actually to go to the publisher until about 1980 was in a sufficiently a (?) condition that the laser printer output around here - optical printer outfits around here could be organized and bound. We could see what we had as a - as a volume. And for that a few copies were - were custom bound. And this one was mine. It's written up here "To Ed" and signed by, oh, various people who had - not all the people, but the people who had put the major amounts of energy into doing it, all signed it and dated it August 1979. And this was the state of The Handbook of AI, Volumes I and II at that point. All done in output here at - at Stanford. And this is the - we sent a bound copy of this to DARPA because they were sponsoring it as kind of a product. And Avron Barr got one of these, I got one of these, DARPA got one of these, and I'm not sure if there were any others. Now the question is, should I deposit this in the archives? Do you want this?

**RN:** (Inaudible.)

**HL:** Yeah. Sure. (Inaudible).

**RN:** Yeah.

**EF:** Okay. The next item here is labeled "LISP 360 Reference Manual." The 360 means the IBM 360. LISP 360 was done by Stanford for the IBM 360. It was done - it was started while I was director of the Computer Center here at Stanford, and this is a March 1972 manual for it. It's part of the history of LISP. Now Stanford initiated the line of work - as far as I know - now this could be incorrect history, but a far as I know Stanford initiated the work which is now absolutely common and routine called Text Formatting. Now it goes under the rubric of desktop publishing. You format your stuff and you do the right italics and all that on-line. Stanford did a system called PUB - P-U-B, and this is the PUB manual right here. Oops. It says - I'm sorry, says PUB manual. It says PUB manual, and yet the document is labeled SAILON - S-A-I-L-O-N dash seventy. Now I can't reconcile that. Is SAILON a precursor to PUB? It's possible. If - but the
answer to this can easily be found by asking what sort of the - well, it says - you know, it says PUB here actually in the document. It says, for example, PUB solves this problem, etc., etc. So this - this must be the PUB manual. And SAILON must be a name for a general blanket of - oh yeah. PUB, the document compiler. Yeah. This is a PUB manual. This is Stanford AI Project Operating Note Seventy. Interesting that the documented author by Larry Kessler, who was at the AI Lab at the time, and Larry is now one of the big hotshot scientists for Apple. Larry helped to bring the Apple-Macintosh into existence.

HL: That's (inaudible).

EF: Oh, yeah. He was here for a long time. But you can see where he got his experience for the (?) PUB.

HL: So PUB really feeds in - probably into the Macintosh and that kind of desktop publish (inaudible).

EF: Yeah. Publishing early (?). Oh my God. Oh, this is my thesis. This is a blue line version of my thesis. And there were other copies of (inaudible), and this is just one of them. And at the back is the IPF-5-Listing - IPF-5 Computer Listing of my - of EPAM. So this goes with -

HL: Back in with EPAM.

EF: That's - that's EPAM. And this one - here's another one. Here's another. Here's another EPAM thesis.

RN: Was it (?) for your thesis?

EF: Yeah.

HL: (?) think of as (?) anecdote now. (Inaudible), the exception so (?) about (?), and a student under the Ph.D. student.

(Inaudible.)

EF: That's bad, huh?

RN: I'll just (?). Is there a date on that one?

HL: Oh, this is a draft of a dissertation.

EF: Okay. Then they are different. All right. Incidentally, while I think of it, that thing is dated August of '59, and the thesis was finished at the Rand Corporation that summer. It was defended in September of '59, on the day before I was scheduled to go to England on my Fulbright Fellowship. I flew from Pittsburgh to New York to catch the -

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the S.S. United States to go to England on my Fulbright. That means I was in - from my point of view, and from Simon's point of view, I was finished in September of '59. But since Carnegie Institute of Technology did not have a graduation until June of 1960, they think I'm in the class of 1960. Hence, that's why the discrepancy appears on various curriculum detail between me saying that my - I was there from '56 to '59, and Carnegie Mellon saying I was there until 1960. And sometimes I use one date and sometimes I use the other, but it's a - one of these pieces of confusion in my life. Okay. Now, this file is labeled "Computers in Thought II." Julian Feldman and I were preparing a second version of - volume of Computers of Thought that would have come out in the late '60s, and I actually have a massive amount of Xerox's of the papers that would have gone into it over in the other office, which I'll give you. And this is early notes on what we're going to put in. Who's paper should we include. Long lists of possible papers that we should consider for including in Computers and Thought II. The book was never done. See, this one's even labeled "Archive." Okay. Australia. I've only been to Australia once so far in my life, and it was for this conference. At Canberra they were holding a conference on AI. Actually, they were quite interested in AI in Australia at the time. This was - looks - we'll - we'll get the date from here but I believe it was 1972. And shortly thereafter the Lighthill Report was published in Britain. The Australians take seriously whatever was published in Britain, and that killed AI work in Australia for a decade. Now they're quite interested again and I'm going to be there next May to give a talk. Here's a letter from the CSIRO, the Government Bureau Division of Computing Research, and it asks me to do some work on these transcripts. It's dated '74, and that doesn't say when this thing was. It could be '72 or '73. And so here's my work on transcripts. But they're a lot - they're transcripts from - well, maybe they're all just my stuff. I don't know. I edited these transcripts either -

HL: And they take the top and then they transcribe (inaudible).

EF: Yeah. Right. And I think this is - these are transparencies I used at -

[End Side A]

EF: This is 1978 for the Archive. This is the newsletter of the National Computer Conference, 1978, published by ASEP, and it - I'm on The Best Paper Award at the show, and so there's a picture of - of two of the officials of the conference and myself in the presentation of the award, and I have the award over in - in the other office. Apparently this is the year when Bob Noyce and Gordon Moore won the Harry Goode Award of the society because they're picture's here too.

RN: And what is (inaudible).

EF: Big contributions for the field. Here's a - here's a picture. You were asking for pictures? Well, there's one. Oh - oh - oh, wait, I see what this is. This is the program. This is the program of the NCC for '75. This is interesting, historical material, so see
what people were talking about. That's the NCC '7 - 1975. This ACM-76. Here, ACM-76.

RN: It wouldn't say on the back of the newsletter? Look on the back.

EF: These are milestones. These - this is the ARPA basic research contract for the HPP, sometimes called the 6.1 contract. This is dated July '75, but what it gives is a list of dates related to milestones for - for things we have to accomplish in this project. This will give you a list of what we're actually doing at that time - in the HPP - for ARPA. And here's another thing dated the same date, some - some notes on the budget from Bruce Buchanan to me. Now this is a letter dated June of 1975 from a man named Anatoli Napalkov - N-A-P-A-L-K-O-V, and his address is given - stapled on the second page of the letter. He was a what you would - what the Russians called a neurocyberneticist. Sort of neuro-computational models of thinking. I came in contact with him in 1960 in connection with my trip to the Soviet Union, saw him in '64. His wife, Nella Napalkov, is a biologist. She came to Berkeley while I was Berkeley. She spent a year there. And this is a letter from Napalkov in '75 - about something or other. I don't know. This is - this is probably the last letter I've ever gotten from Napalkov. '75, and his wife Nella says "I'm looking forward to seeing Nancy and you in Moscow again," except Nancy was are - and I were already divorced, so - you can see there's been no contact for a long time with these people. ACM -

RN: (Inaudible.)

HL: There's a lot of correspondence (inaudible) notebooks (inaudible).

RN: Put it in general (inaudible).

EF: Okay, now this is from - this letter is from a - a man who just took on the job of editor of computing reviews - Associate Editor of Computing Reviews. And he's not only sending me a form, but he's sending me the classification system for computing reviews. How they're classifying all the items in computing, which is good. I mean that's something important, to see how the field was classifying itself.

RN: Who devised this classification system?

EF: The Editorial Board of Computing Reviews. And this thing here is a kind of current content. Somebody - somebody made Xeroxes of the table of contents of some things having to do with neuroscience and biological computing at the time. Medical computing. I - I'm not exactly sure why I have this, but it 's a sort of current contents of things at that time. Remember that ACM Conference we just talked about in Disneyland Hotel - in '76? These were the - the books that vendors had for display at that show. Apparently we were doing current contents at the time because here's another one. Here's one from a - from Communications of the CAM that - which you have in the library, so I don't know that you need it here.
EF: This is an ar - a letter to the editor from a man named Greg Gibbons. Subsequently I had something to do with Greg Gibbons who worked for me for a while, having to do with production systems - Newell and Simons's productions systems and their use in MYStIN and DENDRAL.

HL: (Inaudible.)

RN: Yeah. (?) under AC - ACM.

HL: Under ACM?

EF: Oh, here's a lot of ACM stuff. When you're heading - no -

HL: Okay.

EF: - heading into that. I was head of the Sigbio - I'm a chair - it says here, CC: Ed Feigenbaum, Chairman of Sigbio. A special interest group for biological computing of the ACM. Dave Brandon was the Chairman of these special interest groups, and he's talking about financial accountability and financial responsibility and a lot of stuff having to do with Sigbio and financial reports. It's a - a time of big hassle for the ACM (?) controlling their (?) I can't identify this one so I'm going to throw it out. Oh, it says from - from Damon Amalky. I don't know who that is. But this is a memo from - J. R. A is John Allen - John Allen, former researcher here and the author of a famous textbook on LISP. John Allen sending a message to Jay Moore at Xerox Park about a thing called Super LISP. So it's in the LISP history.

HL: Okay. (Inaudible.)

EF: Both of these are in LISP history. Oh, here's another one from that - the same fellow. Super LISP. That's also LISP history. John Allen has written this letter to the ACM Editor in Chief called "Curriculum '68 Considered Harmful." I don't know why John Allen - here's a - here's something from Knuth, again having to do with a - Knuth - this - this is a - a John Allen - another John Allen letter to Knuth. It also has to do with LISP - LISP. These are all John Allen letters. I don't know why John gave me all these, but - all of these are John Allen letters.

HL: Yeah, and they're just - they're - they go all over the place and (?)

EF: Yeah. They're all over the place. Here's - this is the financial accounting for Sig Bio that I was just telling you about - dated '75 - August '75. And this is from a newsletter called Sig Act - I don't remember what Act stand for - dated October-November 1974, called Relevant of Theory of Computing to Computer Science, A
Workshop Report. I don't know why I have it. This is the material from the National Computer Conference, 1975, November. Oh, boy. More and more. This - all of - this is file labeled AI Lab Affairs, and it's just a variety of materials that relate to the Stanford AI Lab. And I don't know why I have this field but - there's some ARPA stuff in here, and some notes. (?) like Ted Winograd, his failure to rewrite his proposal lost his money. Ernest - who's still in the department. You can - talk to him.

HL: Could this have been when you were chairman, perhaps?

EF: Yeah, could be. Well, no. May '75. These notes are from '75. So I think became chairman in '76. I'm not sure.

HL: (?) about the file?

EF: Could be. Could be I got the file because of that. Right. Right. From Bob Floyd. Oh, yeah, yeah. The note actually is to R.W.F., which is Floyd. So Floyd gave me this note. You're right. So this was passed on to me from Bob Floyd. Correct. This book I'm holding with Russian Cyrillic script on the cover is the Russian translation of Computers and Thought. Incidentally, for which royalties were never paid. As much as we tried to get them, it's an interesting historical note that all attempts failed. But this is the Russian edition of Computers and Thought. The Japanese of Computers and Thought. This is one of the last remaining of the originals of Computers and Thought. This is a brand new copy, and basically there aren't anymore of these in the world - in this group - in this version.

RN: We should (?)

EF: And this is the Polish edition of Computers and Thought, for which royalties were never paid.

RN: (?) authors autographed the copy.

EF: Which one?

RN: (Inaudible.)

HL: (Inaudible.)

RN: (?) library (?)
EF: But that's an absolutely pristine copy, as you can see. Those things don't exist anymore.

HL: It's interesting what the translation (?). But do you know of them, or -

RN: Well, I think - well, put them - put them (?) and we'll figure which (?) originally (inaudible).

HL: (Inaudible.)

EF: This thing from SRI is just one of those things. Conference report. Workshop on Application of Artificial Intelligence to Electronic Warfare, 1975. If you want to know more about that, Tom Garvey still works at SRI. This is one of the early - the people weren't talking much about application in 1975, so this is one of the earliest such things. And summarizes the - the reason why application ought to be a credible thing (inaudible). This is one of the periodic kinds of things where computer scientists get together to figure out where their profession is going, and this is a panel - shared by Professor Traub. The panel was at Snowbird, Utah, at the bi-annual or - yeah - bi - bi-annual meeting of chairman in Snowbird, Utah. I was Chairman at the time, so - I got it.

HL: These are some more of these ARPA PI meetings, and (inaudible).

EF: That's it. Well, you know what they are, so -

HL: Yeah. Does thing here mean anything in particular? Beyond -

EF: Yeah. These are notes on - one of those meetings. My notes on one of those meetings. At the time the Director of Information Processing Techniques was Larry Roberts, and the Director of DARPA was Steve Lukasik. So that would pinpoint (?) time. And Steve Crocker was the AI Program Manager. So that will tell you that it was sometime in the early '70s. Dated April '77, this is an outline for putting together the SUMEX Renewal Proposal. TCR is the - Tom Rindfleisch, the head of SUMEX. Still is. That's SUMEX (?). I don't know that you need that whole folder. There's a few sheets in there.

RN: Yeah. (?). Leave it in there for now. (Inaudible). Okay.

HL: Okay. I'll take - with (?) this (?) -

EF: You mean everything on - over there?

RN: On the left side.

HL: (Inaudible) left side.

EF: Okay.
RN: (Inaudible.)

HL: Right side is (?). (Inaudible.) All of your correspondence is in these. (?).

EF: Okay. Well, let's head into it. What the heck.

HL: It's been here about a year. Okay. Then that'll (inaudible).

EF: Now, tell me how you want me to handle this. I mean there's obviously a very large number of letters. What would you like me to do?

RN: But there's year - each binder is a different year?

HL: Yeah. Is - is it - maybe you could just make a general remark about the way - about things, that if you think - it's pretty well organized actually. So that's pretty cool that -

RN: (Inaudible.)

HL: Yeah. By (inaudible). Then you have - well, (inaudible) whether it's '61 to '71 by alphabet. And general memos. Daily correspondence is pretty straightforward.

RN: Yeah. What year is this (?)?

HL: (Inaudible.) '75 to '76 section. '72 and '73 section. '73 -

EF: Four. '74.

HL: Yeah. Okay. So that's (?). So maybe there's no - I don't know. Unless you think there's really a need, it looks like to me like that one's pretty straightforward. (Inaudible.) There's one notebook called "General Memo." Maybe - it would - it - was - could skim through that and see if there's anything that requires additional (?) that belongs to a general (?). Beginning with the memos and that. (?).

EF: There - there's a lot of the history of the department in here.

RN: Yeah.

HL: Is it a particular - is just Computation Center, or -

EF: No. No, no. It's all mixed. Everything. University Project Department. Some secretary just decided this was the right format. Here's a 1970 memo relating to the organization that is - SCC is Stanford Computer Center. It's to Bill Miller and Paul Armor. Bill Miller was Association (?) for Computing. Armor was Director of the Computer Center after me. And this is some memo about reorganizing the Computer
Center. This thing, Statement by William F. Miller Accompanying Release of Salary Data. There was pressure from the students during the whole Vietnam War uprising thing to release information about salaries around here. Don't ask me how that arose, but - but Miller - Miller wrote this memo. By that time he must have been Provost - yeah. Right here are all the salaries. So there's a lot of the history of Stanford and me in here. A lot of Computer Center stuff.

EF: (Inaudible.) '69. From me to Ken Pitzer. I never knew I wrote to Pitzer. And I asked Pitzer if he'd like to come sailing with me sometime. Gosh, I never even knew I - I had any relationship with Pitzer at all.

RN: He probably didn't come. (Inaudible.)

HL: (Inaudible.)

RN: It was sitting there behind (?).

EF: Okay. Memories, memories.

HL: Unless you brought this in, I think this is sitting here left over from our last (?).

EF: No, I haven't had - do you want me to go through that?

HL: Yeah. I guess so.

EF: All right.

RN: (Inaudible.)

EF: Okay. CONGEN. This - this says CONGEN Manual. C-O-N-G-E-N. CONGEN is a part of DENDRAL. Stands for Constrained Generator. It's the structure generation part of the latest version of DENDRAL. CONGEN. Or let's just say not the latest but the - the mid-1970 version of DENDRAL. And the - there was a manual for it, and this is the CONGEN manual. So this is strictly DENDRAL material. (?) a MYCIN renewal, which may not have gotten funded because it says "Inactive." The PI on this was Stan Collins, now Chairman of Genetics. But at the time he was Principal Investigator of MYCIN and he was a clinical pharmacologist at the time. (Inaudible.)

HL: (?) a note to file (inaudible).

EF: This is another - here's another MYCIN proposal, also labeled "Inactive Job." It may not have been funded. This is the proposal to continue the DARPA basic research 6.1 contract. February '77th proposal. More proposals. This is another Stan Collins proposal. Again, another MYCIN - another MYCIN proposal. These are multiple copies of the same proposal. Oh, academic council's - that's the Stanford Academic Council
Bill. I guess the secretaries I had at the time just decided this was a neat way to keep stuff relating to the Stanford Academic Council. That's all it is.

HL: You were on it at the time.

EF: No, no, no. No. I was at - Academic - well, yeah. I mean Academic Council is all - all -

HL: Oh, I see. It's like -

EF: - people with -

[End Feigenbaum 10-16-86 #1]
EF: (Inaudible.) Okay. This is - what I just told you is right. What I just told you is right, but this volume confuses the issue. This - in the department we talk about - the various people who can vote on things are Academic Council Members. And so this is - this Roman Numeral II Academic Council relates to the people in the department called Academic Council Members. So this is - this is a departmental file of my stuff related to the department. For example, here are Ph.D. candidates for '71-'72. Ph.D. exams. This is department stuff in this file here. This is '70 through '72, I think. Maybe '71-'72.

HO: (Inaudible.)

[End Feigenbaum 10-16-86 #2]
The first is a file folder which has no number associated with it right now. So Henry, you'll have to put a number on this. This file folder contains the EPAM-3 program in a listing dated July 20th, 1964. This listing with a tremendous amount of hand annotation on it involving de-bugging of the EPAM code is annotated and de-bugged by Herb Simon. All of these writings that you see on here are Herb Simon's writings, and the note here saying, "Lee, I suggest you try it with changes, etc., etc," that is a note from Herb Simon to Lee Greg, a psychologist at CMU who was working with us on the - the psychological, theoretic and experimental side of EPAM-3. Lee Greg died of cancer a few years later. Anyway, this is a Herb Simon listing done at Carnegie Mellon. In - in addition to that there is a - a Xerox sheet here of an actual experiment associated with these runs of the listing here on paired associate learning for a particular list of stimulus response items that we had been doing called The KAGLUK - K-A-G-L-U-K - after the name of the first pair of syllables. And there - there is a - a tree shown on the second page of this which is my own understanding at that time of how EPAM went through and learned this particular list of syllables. That is the - the actual tree that it built in doing this. It - a tree is otherwise known as the - a discrimination net in EPAM. Now the rest of the box consists of a - a large number of my own EPAM listings. Incidentally, on these EPAM listings, both on Simon's and my own, all of the programs are written in a now arcane but historic programming language known as IPL5. So anyone looking at this in the future will have to look up these what's called the IPL5 manual edited by Allan Newell to find out what these symbols mean. So here, for example, is a - an EPAM-3 1964 listing. Anytime the name Zveginzov - Z-V-E-G-I-N-Z-O-V - that's a graduate student of mine at Berkeley. And they're printouts that he made for me. EPAM-3. Here's a listing entitled "Trouble with Gordon Bower's Data." Gordon Bower, a psychologist at Stanford, and we were obviously trying to predict some of his data. And, again, a partial listing followed by a run of the program, and it was in some trouble. Now I'm looking though a large number of other listings here to see if there's anything unique about them. Zveginzov runs, June of '63, December of '60 - oh. Then there's an EPAM-2 dated December of 1962. EPAM-2 was the predecessor of EPAM-3. EPAM-2 is essentially the EPAM that was done for my Ph.D. thesis. And so we were still using a variation of it in 1962. I see a listing here with the name Dan Barbaro, who is now a very well known AI researcher at Xerox Palo Alto Research Center, in 1962 when this is dated, was still a graduate student at MIT. And I don't know how he got a hold of this listing or why - why a listing of mine is under the name of Barbaro, but - I'm not sure why, but - that's what it is. It was probably because he was at Rand for a summer institute or something. These are just all EPAM-2 listings. We - we did a particular experiment with a pattern recognition problem that Herb Simon and I had been working on and suggested by Oliver Selfridge. This was a problem called The Cat. The Cat was a recognition problem in which the - both the "H" of the, and the "A" of cat were degraded so that the "H" had its side slanted to look somewhat like an "A", and the "A" had its top cut off to look somewhat like an "H", and it was a question of how the program could learn to discriminate among those. Would it learn successfully. That's what The Cat was, and there's a thing called The Cat Run-3. There's a - a file - excuse me - a manila envelope here labeled "Zveginzov, University of California Computer Center, Berkeley," and there is - it - it contains an experiment called "POST MEPAM-B" - P-O-S-T-M-E-P-A-M. Now that's a - a variation of EPAM to handle some experiment of Leo
Postman, a psychologist at Berkeley, but don't remember the details of that. I was associated with the Center for Human Learning in Berkeley, and Postman was director, and a - and a very well known psychologist of - of the day. And the experiment is a paired associate experiment of some sort. Then there's a listing here called "Assembly Listing and Successful Reading Test" dated November 17th, 1960. And my guess is that the reading - the so-called reading test refers to work that was later published by Simon and myself called Performance of a Reading Task by an Elementary Perceiver and Memorizer in Behavior Science. Oh, and then there's a - an associated one called Copy of Nearly Successful Run of Reading Task, and it - it lists what the tasks were and that there were some difficulties on the second task. Okay. Then there's a - an EPAM-2 listing here of 1961 dated "Successful SA Run." I don't know what "SA" means anymore. And there's a - a thing labeled "IPL-5 Post Mortem." That's a post mortem dump of some job that - we were doing. I'm noticing a listing here entitled "EPAM Paired Associate Run, 9-16, 1960," so that's some EPAM experiment dealing with paired associates. Notice that September 1960 is after I returned from my Fulbright Scholarship in England. I was in England from - from the day after I took my Ph.D. oral in 1959 when I left for England until the middle - until the summer of 1960. So this was obviously when I got back, because I started work again on EPAM when I got back - because there was no way I could do EPAM work in England at the time. (?) additional listings. Here's another folder from Zveginzov which also contains more of that POST MEPAM. These - these two would go together. I had another folder (inaudible).

HL: Oh, with that - okay.

EF: Then there was another psychologist in the Center for Human Learning named Arthur Melton. Melton and a pair of people named Shepherd and Teksunian from Bell Labs, Roger Shepherd now at Stanford, had run - had done some experiments and published them. And this graduate student, Zveginzov and I were trying to simulate the - the data from those experiments - try to explain those experiments using EPAM. And so this was called EPAMELTON - E-P-A-M-E-L-T-O-N, EPAMELTON. Nothing ever came of POST MEPAM or EPAMELTON. That is there's no published paper. This is EPAM-2, a thing called New Listing, August 18th, 1964. EPAM-2 and EPAM-3 differed quite significantly in detail but not in concepts. There's a notebook here labeled "EPAM3-2." It contains in it a Blue Line document "For Users of EPAM-3," written by this guy Zveginzov, a graduate student. There's an EPAM log in here of the different experiments we were doing. EPAM's vocabulary. IPL's list of basic processes. And a working paper that eventually got published called "Generalization of an Elementary Perceiving and Memorizing Machine." I'm sorry - not eventually. This paper probably preceded all of these notes and was used as a guide for us. And there's a lecture notes here dated April 13th, 1962. This is an - it's basically an experimental notebook. And there are at the back - some thoughts, handwritten items, handwritten procedures, how EPAM really worked, and some IPL5 coding sheets. One of them has printed on it Graduate School of Business, Stanford University, but that's incomprehensible as to why - why it should have that. My own coding sheets are back here, too, in the green. I wri - apparently I saved some of these initial programs. Not sure why. But these are the actual coding sheets and a lot of notes. Now I'm back into computer listings. Oh, here are -
again, here are some photocopies of coding sheets and some actual code - in a listing
dated April 1964. This is by a student named Max Allen who did a thesis on a variation
of EPAM called FREEPAM - Free Recall EPAM, I believe - was what Max Allen's work
was. It was a Ph.D. thesis in the Psychology Department (?) Berkeley. And I think I just
kept it as a historical document because it was a - was a different kind of EPAM. So I
think this one should have a special number associated with it or a rubber band put
around it to distinguish it from the other that was Feigenbaum, and is graduate student.
This is another graduate student of mine, Max Allen, but - his thesis work. And here's
just another EPAM-3 listing dated June of 1963. And finally, last but not least, we come
to something dated 1961, August 22nd. EPAM vocabulary list, EPAM inverse list, and
this was something which was very important in programming at the time with all these
funny symbols that we using, non-pneumonic symbols. We had to know not only what
each symbol meant in terms of our own understanding of this program - what the D's
meant, what the E's meant, what the S's meant, what each nonsense syllable was, and so
on - but we also had to have it printed in inverse order as well so that when we looked at
something in the code we can then go back and find out what that really meant. So this
was both a vocabulary list and an inverse sorted list to find things in the code. This is a
very important working document. And there's a loose sheet which apparently has pulled
out from here, so - the question is how to bind that in or hold it in, or it's going to fall out.
It's the first sheet of this thing. What do we do about that? Do you want to stop the tape?

HL: Yeah. Okay. That was the end of the box.

(There is a break in the recording.)

HL: This is the second batch of boxes.

18th, 1972." It's a table of contents for a proposed book called Computers and Thought
II done approximately ten years after Computers and Thought I was done. So this
represents a first cut at what might be a - a list of papers - excuse me - what might be a - a
final table of contents for - for that volume. Now there are many more paper listed here
that could possibly go into Computers and Thought II. So the purpose was to leave big
spaces after each one for a comment, and I sent this - sent this document out to quite a
number of my friends in the field asking them to comment so that I could choose from
among these papers which one - which ones would be the - the winners so to speak for
this book. Nothing ever came of Computers and Thought II. It was a great idea, it was
already to go. The next item here is a - what do you call this, Henry? Some kind of an
envelope.

HL: Accordion - accordion folder.

EF: Accordion - accordion folder containing Xeroxed copies of virtually everything
that's on this list with the exception of a few things I might have pulled out over the years
because I needed the paper to - to reference. But - the - this thing is labeled Feigenbaum
and Feldman, Computers and Thought Volume II Source Material. Feldman is Julian
Feldman, my co-author on *Computers and Thought*, University of California, Irvine now. He and I were young assistant professors together at Berkeley and graduate students at Carnegie Mellon - Carnegie Tech at the time. Well, all of these papers are in this manila envelope. *Computers and Thought II* aborted because I took responsibility for it and then never gave it a high enough priority to actually get it done. July 1972, right in the middle of this, was almost at the crux of turmoil in my personal life, having to do with my first marriage, and I just didn't focus enough attention on this thing to get it done. So it's an aborted volume. Would have been very valuable at the time, and I'm very sorry it didn't get done.

HL: What's in the - what's in the folder here represents a version of what the book would have looked like though.

EF: It represents a super set of the book.

HL: Super set. Okay. So it hadn't been edited down.

EF: Hadn't been edited down. Now here are two document, one is entitled Rational Decision-Making in Business Organizations by Herbert Simon. That's Simon's Nobel Prize lecture. And the only thing - the only reason for keeping this as opposed to getting it out of the *Journal* where it appeared - I don't - doesn't say what journal it appeared in. Oh, *American Economic Review*. The only reason is that Herb annotated this, "To Ed, with regards," so that makes it valuable. This is a copy of it. And then there's a copy of an article here called Progress in Brain Research, an article by Bill Merrin, M. E. Merrin, on Cybernetics Information Processing and Thinking. Merrin is now a Library Researcher at the University of California, Berkeley Campus Library. Library student - School of Library Sciences. And - but at that time he was a - an Information Science Researcher at the Rand Corporation, and a friend of mine. And I kept this article because it discusses the work of a scientist named Ryle - well, maybe Ryle's a - a newer physiologist. I'm not sure. But anyways, it's a question of how thinking takes place and how the brain works, and that was a particularly interesting series to - to me so I've kept it over the years. Next, a batch of papers. I gave testimony in CDC's lawsuit against IBM. This was different from the lawsuit of the Federal Government against IBM, which was eventually dropped. This is a - a private lawsuit for damages. And my testimony and all kinds of notes relating to it are bound up here. This is a note from Harold Hall of Xerox who asks me to comment on a proposal relating to Experimental Computer Science at the Eames Lab. This is a Computer Science Department piece of history having to do with one of our research professors, Gio Wiederhold - now a research professor, then an assistant professor - writing to Associate Dean of Humanities and Sciences, Jim Ross, concerning his appointment. Ross is now Provost. There is a pink folder labeled GEO-Memo #1. GEO is the name of a program that I was done by myself and Penny Nii, while the two of us were on sabbatical at Schlumberger Research - Schlumberger-Engineering Laboratory in - outside of Paris in Clamart - C-L-A-M-A-R-T - Clamart. And there are also - the - these are the notes from that entire visit, including some lecture notes for some general lectures I gave on AI and about Computer Science in universities in the United States and so on. There are some people mentioned
here, Jay Harry - H-A-R-R-Y - is our Geology Expert for this program. And J. C. Picard was the Vice President for Engineering and head of that laboratory. We wrote a note here called "Any Mid-course Maneuvers," that is, should we change it all - what we were doing. Here's an example run. Handouts for a talk that we gave. U-Graphs. An example run for the - for a test well that we were looking at - a well that was drilled in Syria. There was a run here of the knowledge base for geology, December 1st, 1980, and it happens to be - the name associated with it is - is Friedland, but that may be just simply because Peter Friedland may have printed this out for us at Stanford and mailed it to us, because he certainly was not involved with it at all. Then there is a folder here with U-Graphs for which the name Tech Knowledge, 1982 appears. It's called "Executive Briefing on Knowledge Engineering, Making Knowledge Work." In October of 1981, the company Tech Knowledge, formed by several Stanford people including myself, started giving industrial seminars in Palo Alto. And it prepared - we prepared view graphs for these industrial seminars, and these are the view graphs for the first of those industrial seminars. In fact, as far as I know, the first industrial seminar ever given about knowledge engineering in expert systems. So that's the very first executive briefing. Of course now there are dozens of those. They take place almost every week somewhere around the country. Next is a pile of papers here of which I have actually many more. Here's one called "Appendix 'A'." What is it Appendix 'A' to? It's Appendix 'A' of Computers and Thought I. Sorry. Let me - let me revise that. Sorry. Marvin Minsky wrote a paper which was very influential early in Artificial Intelligence history called Steps Toward Artificial Intelligence. That paper was reprinted in Computers and Thought I. But three years or more had elapsed between the publication of Minsky's original article and its reprinting in Computers and Thought I. Now it turns out, Minsky himself had prepared addenda to that original article. And he gave me a copy of the addenda called Appendix 'A', which I was then to hand out to all the people I know who had bought Computer and Thought I, including a lot of my students because we used to use it every time I taught this in those years. And so this is Minsky's own Appendix 'A', which would - which was then handed out. I - Henry, I have a - apparently I have a massive amount of these - of I don't know what to do with.

HL: What - what are they?

EF: These Appendix 'A'.

HL: Oh. Multiple copies of it.

EF: Yeah. Because like I say, I was handing them out to everyone in sight. So I guess you don't - you're not interested in that obviously.

HL: No, we don't need the - all the extra copies.

EF: Okay. Okay, here it is - the - here's that one. Then here are two papers, DENDRAL-64 Part I, and DENDRAL-64 Part II. They are authored by Joshua Lederberg. They're NASA reports from Lederberg's NASA project in the Department of Genetics. They're dated December 15th, 1964, and they deal with the computer
enumeration of organic molecules as tree structures and cyclic graphs. Now these papers were written before I arrived at Stanford and before Lederberg and I began our collaboration on the very well known AI program called Heuristic DENDRAL, or DENDRAL for short. Now this is Lederberg's - Lederberg invented the term DENDRAL, and this is the work he had done on DENDRAL before I got here. The document here called - it's - the name is Rindfleisch, so that's Tom Rindfleisch, the Director of SUMEX, research highlights Doc TXT, 3rd of February, 1977. That has to do with research highlights concerning the use of our SUMEX - what's called the Stanford SUMEX AIM Resource in preparation, I suppose, for an annual report. But it - it shows you where we were in - in all these various projects of our around the middle of 1977 - early 1977. Then here are two boxes called "Slides." These are - as I would have many, many lectures at various times I would produce these overhead projector materials. And the question actually here is since each one of those relates to some different topic, Henry, do you want to - what - what - maybe you better shut that off and just decide what you want -

(There is a break in the recording.)

HL: Okay. So we're starting with view graph slides with number one.

EF: Number one, keto-andrastain Rules. What's significant about this is, this is a - this is the information that ultimately went into a paper representing knowledge induced by META-DENDRAL about fragmentations of chemical molecules. META-DENDRAL was a - another very well known program in AI, perhaps up through the '70s the best learning program that had ever been done. And this was producing new knowledge of chemistry. And this happens to be some keto-andrastain Rules that were induced by META-DENDRAL, Rules M-4, M-5 and M-6. I could - I don't want to go into the details about what the rules mean because you can always look up the META-DENDRAL paper to get that. That's number one. Number two is MOLGEN, MOLGEN's DNA structure editor. It shows some of the activity of the structure editor. Number three is a continuation of that. Number four shows some of the interaction capabilities of MYCIN in - in which the - in which MYCIN is being asked - well, in one case MYCIN is - is asking a question. A portion of this - scratch all of that. It says here, this is a portion of a consultation session which demonstrates the "why" option that doctors could ask during a MYCIN interaction.

HL: What number was that?

EF: Four.

HL: That was number four.

EF: Okay. Number five is an example out of Randy Davis's TEIRESIAS thesis on a thing called a META-RULE. A rule that indicates how other rules should be used. That was the first time that META-RULES had been used in AI. Number six gives essentially a gross flowchart of how META-DENDRAL works. Number seven shows a META-
DENDRAL rule-generating tree. Eight gives the form of Mass Spectrometry rules in DENDRAL. Nine is a similar thing. Those were innovations at the time. That was the beginning of what's called rule-based knowledge, or AI programs. Ten is a giant flowchart of - a very general flowchart of how the Heuristic DENDRAL program worked, and it - it shows that at the time we were doing this we - so this is the late '60s, we were already separating the knowledge base from the inference procedure, which is here, called Processes for Generation and Evaluation of Candidates. It's not called Inference Engine. But we were already separating knowledge base from inference processes. What number was that?

HL: That was number ten.

EF: Here's eleven which is a - a flowchart - another kind of flowchart showing the DENDRAL system and how it worked. Twelve is - twelve shows the general problem that was on our mind. It doesn't say DENDRAL at all, it just says the data from a measurement processes input and output is one or more hypotheses constituting best explanations. It shows what - what was on our minds. Twelve is a bunch of mass spectra - show an audience what we - twelve and thirteen - to show an audience what we mean by mass spectra.

HL: Okay. But this one is fifteen. Because this was thirteen and fourteen you were just talking about. So the one that you have in your hand is fifteen.

EF: Fifteen. Right. Fifteen shows how the META-DENDRAL program coordinates with the DENDRAL program. And then - what number am I at?

HL: Sixteen.

EF: Okay. Sixteen and seventeen are examples of questions that MYCIN is able to answer. Eighteen relates to an evaluation of MYCIN's performance - eighteen. Is this eighteen?

HL: Yeah.

EF: Eighteen and nineteen both. Twenty shows a very simple example of an expert putting knowledge into MYCIN. Twenty-one discusses experiment planning in MOLGEN. Twenty-two and twenty-three show results of DENDRAL solving problems on ketones and thioesters. Now these are different compounds that were given to DENDRAL. The important thing here is to - in these charts is to indicate how much selectivity you have in DENDRAL moving away from the very large number of group forms alternatives into the smaller number of plausible alternatives. Now where are we?

HL: The next one is twenty-four.

EF: Twenty-four shows an example of the operation of the META-DENDRAL program INTSUM - I-N-T-S-U-M - on a particular structure. Next number is what?
Twenty-five relates to the expert system CRYSTALIS, and shows the different - what - what we call "blackboards." These are three different blackboards that relate to inferring from the crystallographic data and the other chemical data what the structure of the protein in the crystal was. This is what?

Twenty-six shows the - this is a very gross rendition of the entire MetaDENDRAL program. Twenty-seven is a piece of sample dialogue for MYCIN. Twenty-eight is just a flowchart of META-DENDRAL. Twenty-nine and thirty - twenty-nine and thirty relate to the structure generator of DENDRAL in the mid 1970s. It had been much modified. What number is this?

Thirty-one is an example of rule generation in META-DENDRAL. Thirty-two are two rules for MYCIN. Thirty-three is a "how" explanation for MYCIN. How did you arrive at a conclusion. What number was that.

The next one will be thirty-four.

Thirty-four shows - we're back to CRYSTALIS now - shows actually how those multiple blackboards in CRYSTALIS got used. This is thirty-six?

Thirty-five, this one is.

Thirty-five and thirty-six are textual and graphical illustrations of how RULE-GEN worked. Thirty-six shows that one has to stop somewhere short of complete enumeration of molecule - of molecular structure in order to get interesting rules for DENDRAL to use. Thirty-seven gives in words what the different pieces of RULE-MOD part of META-DENDRAL was all about. Thirty-eight shows more about RULE-MOD and how it actually works. Thirty-nine tries to explain a piece of chemistry to the audience, Esters and Skeleton. Forty and forty-one are more results from the original DENDRAL program. Ethers, alcohols, andamines. What were those numbers?

Those were forty and forty-one. The next is forty-two.
EF: Okay. Forty-two shows - it - it tries to give an illustration of how MYCIN works. This is forty-two?

HL: Yeah.

EF: Forty-three shows the beginning of a consultation. Forty-four shows a rule and how it's represented inside the machine. Forty-two, forty-three, forty-four. Forty-five, we're back to CRYsalis and how it uses the multiple blackboards. Forty-six, forty-seven, forty-eight, all relate to that MYCIN consultation that started a few - a few graphs ago. These are mixed up. Forty-nine gives various examples of how learning might take place. This is a - this is a rather far reaching slide because we're still nowhere near being able to do any of those - or do that very much. Back to DENDRAL. What number am I at?

HL: Fifty.

EF: Fifty and fifty-one summarize some of those results that I told you about before DENDRAL's work, on kestones, amines and estrogens. Now we're into what? Fifty-

HL: Fifty-two.

EF: Fifty-two is describing to people how the SUMEX system organization and networking is arranged. Fifty-three?

HL: Mm-mmm.

EF: Shows how MYCIN can answer questions about its consultation. That was what? Fifty-three?

HL: That was fifty-three.

EF: Fifty-four, fifty-five are the same. Fifty-six, fifty-seven are more sample dialogue for MYCIN. What number are we at?

HL: Fifty-eight.

EF: Fifty-eight is simply a batch of these slides that have to do with sample dialogue for MYCIN. (?) use this box to put them in.

HL: Yeah. And I'm also going to flip the tape over.

[End Side A]

HL: Okay. So we're starting with the folder again.
EF: Yeah. We're back to a manila envelope. The - these - this manila envelope contains a few graphs from various projects and they're labeled. There's a package of Graphs - two packages of U-Graphs related to DENDRAL, one related to PUFF, the pulmonary function diagnosis system that we did. And a whole bunch of U-Graphs related to the work of Doug Lenat, partly to his thesis work under me at Stanford called AM, and partly to his follow-up work at Carnegie Mellon called BRISCO when he - he was an assistant professor there. They're all in a - in a manila envelope. Do you want to give the manila envelope a - a name?

HL: Yeah. I - I have been - I have numbered one-ten.

EF: Okay. Then the next thing here is the original manuscript - the actual original, original manuscript of the invited lecture I gave at the International Joint Conference on Artificial Intelligence in 1977 called "The Art of Artificial Intelligence, Themes and Case Studies of Knowledge Engineering." This was also given at the 1978 National Computer Conference. This manuscript - this talk won the Best Paper Award of the 1978 National Computer Conference. The document here is the one that actually is the one I used while lecturing it. Shows what I actually chose to include in the public lecture and where the slides would come in and so on. The only other thing to say about this is that there is a portion of this called Epilogue, which is the portion that I never got around to writing because the paper itself got too long. And it says that I'm going to write a Part II of this. That's why this is Roman Numeral I. And of course, as usual, the best intentions, etc., etc. There never was a Part II. The next file folder says Miscellaneous Slides that I can identify. I don't remember the number we're at.

HL: (?) sixty.

EF: No. It couldn't be. Is that where we were? Sixty?

HL: We were in the fifties. But I'll start at a - a new digit.

EF: Okay. Sixty shows a - a system diagram for how the HASP program worked. HASP was a sonar surveillance program that was done by myself and Penny Nii in the period 1972 -1973 through '75. Then - what is our next number?

HL: Sixty-one.

EF: Sixty-one will be a package of slides that have to do with a portion of - of Randy Davis's thesis, TEIRESIAS. TEIRESIAS - this portion of TEIRESIAS is one called "Interactive Transfer of Expertise." And it - it is a - this is a - an actual consultation session with an expert in which the program is going through the knowledge base with the expert trying to find out the reason why the MYCIN program is giving the wrong answer to something that - (?) where the expert thinks the MYCIN program is giving the wrong answer. That exported program, together as collaborators, worked through knowledge base looking for the part that would be incorrect. And then when that is
identified the expert gives the correct piece of knowledge, and then TEIRESIAS
criticizes the expert's knowledge. What's the next number?

HL: Sixty-two.

EF: Sixty-two is a - the activity of the DENDRAL program working on a problem
taken out of the journal, (?) letters. Sixty-three is a package of slides showing some
examples of the various kinds of questions that MYCIN can answer, not only about its
consultation with the user but also about its knowledge base. Way back - the - the - what
is the next number?

HL: Sixty-four.

EF: Sixty-four is two slides that are quite interesting. Way back when - after we had
done DENDRAL, but before really there was anything else, even MYCIN, in talks I
would give around the country people would ask me how do know - how did you pick
DENDRAL? What's a good application? How do we know what's a good one? And so
at one point, at Carnegie Mellon when I was on a visit, I formulated a - a list of things -
criteria so to speak, and I called it the Nature of an Application of Heuristic Programming
Techniques. Problem formulation, knowledge base, and problem difficulty were the
main parts of it. And I apparently made up slides to talk about this. This has
subsequently given rise to many articles that people now write about - now that it's a big
commercial thing. How do I find a good one in my company? How do I know what a
good application of knowledge engineering is? This is the very first one, even before the
term "knowledge engineering" was invented. It's not even - doesn't even use the word
"knowledge engineering." The Nature of an Application of Heuristic Programming
Techniques. Probably 1970. This next number, whatever it is, sixty -

HL: Sixty-five.

EF: - sixty-five is another example of a META-RULE from Davis's TEIRESIAS
thesis. Sixty-six describes the function of the generating part of DENDRAL called
CONGEN. And - what's the next one?

HL: Sixty-seven.

EF: Sixty-seven is a slide about Rules. They're called here Knowledge Based Rules.
But again, the terminology is so odd that it must have been very, very early. Must have
been - oh, I see. It talks about the problems list. Okay. This is a slide that we put
together in connection with ex - expository lectures on the HASP system, because the
word "problems list" is unique to the HASP project, so. Now we're into a - a package of
slides in a folder - well - I'm sorting through these and - and discarding duplicates.
What's the next number?

HL: Sixty-eight.
EF: Sixty-eight is a slide that shows MYCIN's therapy recommendations, and answering the question about therapy. What's the next one?

HL: Sixty-nine.

EF: Sixty-nine shows a portion of an interaction with a program called GUIDON that was done by Bill Clancey as his Ph.D. thesis in this lab teaching the knowledge of MYCIN to medical students. The same thing is relevant to the next one, whatever the seventieth is.

HL: Seventy.

EF: Seventy. And seventy-one. Seventy - oh, I'm sorry. Now (?) to another manila envelope, and looks like the other manila envelope is contains more material on these Executive Seminars, except this is a revised version. This is not the original version, but one done perhaps six months later. That is so - somewhere in 1982. The original Executive Briefing was revised. And there's a note in front of it from a lady named Jody that has something to do with Technology copyright on these, but I wouldn't pay any attention to that by now. Then the next packet of slides is labeled "HPP Material," it's in a manila envelope, and it just talks about what is the HPP as a laboratory. And it must be relatively recent because the faculty members are listed as including not only me and Buchanan, but Genesereth, Lenat and Shortliffe, so it was - this would have been in the '80s. We already had our VAX Computer and the Xerox 2060. So we're talking about somewhere in the '80s. Talks about the blackboard framework in here, and it also talks about some HPP, what I call MEGA-TRENDS, where we're really going to go over the long run. Would be interesting for the people who see this later, find out whether we went there. Here are transparencies made for a meeting of the Board of Trustees, March 7, 1983, when they asked me to come and give a talk on what the laboratory does. So it's really a talk about the work of the laboratory and our problems. Who we are, what we do. Next one is - represents the work of Larry Fagan, a Ph.D. student of the HPP in the '70s. Larry went on to get his M.D. and returned to Stanford as the Associate Director of the Medical Computer Science Lab of the Knowledge Systems Laboratory - MCS Project. This next one, next case of paper is Knowledge from - some of the systems around here. One from SACON, one from GUIDON, and here's some more documentation about GUIDON from Bill Clancy. Concise summary of the GUIDON project. Transfer of rule based expertise through a tutorial dialogue. Here's a work by - do we have the next number? The slides?

HL: The slides? Seventy-two.

EF: Seventy-two shows graphically what happens when a patient does a pulmonary breathing test, and is - which is interpreted by the PUFF system. And then there's a paper by Fagan on his thesis project Ventilator Manager, and some view graphs related to the Ventilator Manager - VM. Now there's a pile of material - written material and view graphs relating to DENDRAL and - and its generator, CONGEN, all dated from the mid 1970's. Notes from a person call Ray Carhart, who was a scientist on the project at the
time, and who now works for a company called IntelliGenetics. There's a document called "Introduction to CONGEN." And many notes about CONGEN. There's some documentation here from the University of Missouri on a system called CLOT, an expert system relating to blood clotting. The reason I have this is that we got involved at a very early stage in - in helping Don Lindberg at the University of Missouri formulate his application to coagulation. And now, just some notes about - Lindberg is now Director of the National Library of Medicine, and the person, Ueno - U-E-N-O - who was a graduate - a post-doc working for Lindberg and who's paper appears here - who's notes appear here, Ueno is back in Japan as a professor in one of the universities there and is one of the best known AI specialists in Japan. It all got started here with this project. The next thing is a reprint, one of the many, many papers that the DENDRAL team put together. DENDRAL paper. The next are the graphics originals for that 1977 paper. Do you want this? Is there a reason to hold these graphics originals - on PUFF? They would - they appeared in that paper.

HL: They were actually with the paper also, right?

EF: I believe so. Or else these were used to make up the slides. (?) perhaps, no. These actually were the - this is the - the graphics for the slides that went along with the paper.

HL: And we have this - those were slides that we had - had earlier?

EF: No. These are thirty-five millimeter slides that were made to show along with that paper. But the material is the same as what's in the paper. (?) chuck it.

HL: I guess so. Yeah.

EF: Okay. MOLGEN - Peter Friedland's - there were two theses on MOLGEN. One was the thesis of Friedland, and one was the thesis of Stefik. This file folder is labeled "Friedland's Work." Yes. This is a - these are view graphs relating to Friedland's work on experiment planning in MOLGEN - experiment planning of - of molecular biology experiments. And this next folder is view graph material on the GUIDON project. And the next package here called "More MOLGEN Slides" are the MOLGEN slides - these were prepared for me by Mark Stefik based on his experiment-planning thesis in MOLGEN. It was different from Friedland's. That's Mark Stefik material. Here's some additional MOLGEN material from Stefik. This is a combination of both the Stefik material and the Friedland material. Here's another folder called "MOLGEN-Stefik's Work," and it contains a draft of his thesis, plus various slides relating to his thesis. And there's yet another folder of Stefik work on just the same subjects, more of the same. Here's a slide in a folder labeled "EMYCIN." This is the one and only slide that I've yet found here in EMYCIN. EMYCIN was of course was a historic development. That was / the first of the expert system SHELLS, or development of (inaudible) now, which there are dozens, big commercial activity. Many, many, many millions of dollars a year are paid for SHELLS. Now, next we have here two folders called "AI Notes" and A - "Ed's AI Notes," "Feigenbaum's Notes." Why don't you shut it off.
EF: - that lead to that -

HL: Computers and Thought (?).

EF: - thing. This is my original page.

HL: It says First Outline at the top of this.

EF: Yeah. I'm going to hold on to this, the A -

(There is a break in the recording.)

EF: - thing is a - an AI syllabus that was prepared by Terry Winograd in 1975 for use - the students used this to prepare for the qualifying exam. And it would then show what the faculty here considered to be the relevant literature that a student should know in 1975. Okay. The next thing is in 1976, thereabouts, AI wa - as usual was still having a hard time at ARPA, even though ARPA - it was always a - a very difficult parent-child relationship with ARPA. ARPA would supply the money and - and act like the parent, and then it would withhold money and it would get stern, and you know, you guys have got to produce results and - and all that, while it was nurturing this science. And always it would require going back to Washington and giving presentations, or people in Washington giving presentations. And this is one of the presentations given in Washington, October 1st, 1976. I'm not sure by whom, but it was given to the Director's Office at DARPA. And similarly there was a session given about DARPA's speech understanding work, October 15th, 1976. Why don't' you turn it off for a minute

(There is a break in the recording.)

EF: This is a package of Xeroxed copies of view graphs from someone at SRI on the Prospector System, which was a derivative - a derivative and a variant of MYCIN done for mineral exploration by Heart, Duda, Nilsson, et al in SRI. Done about mid 19 - mid to late 1970s. Okay. (?). ^r

HL: Turn it off?

EF: This relates to the filed folder #128. It contains a lot of material on a report that I was producing with the help of many people in the AI community, local and - national community. On the subject of Artificial Intelligence Research, What Is It, What Has It Achieved, Where is It Going. This is part of that continuing dialogue with DARPA on what we're all about, and getting our funding assured and straightened out. We're no better in 1987 in that regard than we were in - in 1973-74, the timing of these things. It's all (?) - all the same. Just continue to replay history. Well, there's a thing here called - dated November 9th, '73, Plan for Finishing AI Report, What's the Minimum
We Can Do, What Additional Things Should Be Done. There are various drafts of this report as it was emerging, commented on by different people. There's interaction with a man named Steve Crocker who was a program manager for DARPA for Artificial Intelligence at the time to various people. And a letter to me from Saul Amarel at Rutgers commenting on all of this. And Saul of - ironically, he's now the Director of Information Processing Techniques at DARPA, right at this very moment, 1987. Historically I think that's very important.

HL: Yeah.

EF: Then we have several miscellaneous pieces of paper here. A - here's a note to me from Randy Davis. It says, "Ed, this is a draft of our NSF proposal. Do you have any comments?" So this was some kind of NSF proposal that Randy and Bruce Buchanan were putting together. Here's some notes to me from Mark Stefik, which apparently had something to do with ARPA or an ARPA proposal, but it's about Knowledge acquisition, explanation and META level schemata. Also about the same time, fall 1976, A Nils Nilsson bibliography for a course that he was teaching here at Stanford, although he was a researcher at SRI. And a similar list of references - I can't really say how I got this, but it's about the same time, 1975, for the field. I imagine these are (inaudible). And I think maybe we should shut that off.

HL: Oh, right.

(There is a break in the recording.)

HL: - be the fourth box.

EF: There's a volume of papers here called The Fifth Generation, Dawn of the Second Computer Age, held in London by a company - who ran this? SPL International. The Japanese Fifth Generation Project was announced in October of '81. I was a keynote speaker at that conference. The British got all excited about this project thinking it was a major threat to them and wanting to use it to stimulate British research in AI. And they ran this conference on Fifth Generation. What is it, and where is it going, and what can we do about? And they invited me to speak at it. These are the - this is what was handed out to all the participants. Either papers or their renditions of the view graphs that were done at the conference. See if there's any correspondence in here. Oh, there's a list of all the people who attended the conference. Participants list at the front, which would be very interesting. This document here - this volume here is the - it's called The First USA-Japan Computer Conference Proceedings, October 1972. And you can sort of date the interest that Americans - the first time Americans had woken up to the fact that there was anything at all interesting in Japan in computer science and technology. The Information Processing Society of Japan and the American Federation of Information Processing Societies got together to have a joint conference, run it every two yours. And I don't know if it still exists. I had - I haven't heard of it in a long time so maybe it doesn't exist anymore. As - as Japan grew up in the computer arena it wasn't novel to go to Japan, or to have joint conferences. This was the first time I was in Japan, October 1972 at this
conference. Now, there was a major workshop held in the Expert System area, just called Expert System Workshop. And it eventually became a book called *Building Expert Systems*. That is perhaps the most influential book of the Expert System's commercialization (?). The book is edited by Waterman, Lenat and Hayes-Roth. And this is the workshop material that was handed out to everyone at the time. So it's kind of a historic document in that respect.

**HL:** This said - the Xerox (?) volumes? Are those the ones that -

**EF:** No.

**HL:** - the blue and white ones? Or is that the same thing? Okay.

**EF:** No. No. No, there's a book called *Building Expert Systems*. Oh, there's - there's a piece of that - there's a piece of that - that book that was -

**HL:** (?) I'm thinking of a thin - there it - that's it.

**EF:** Yeah. There's a piece of that that was transformed into this -

**HL:** Right.

**EF:** - by these people. Do you want that in there?

**HL:** Yeah. Why not.

**EF:** That's a - the document from Xerox Palo Alto Research Center which is taking one piece of the Building Expert Systems Workshop and turning it into another kind of document. Okay. Here's a book labeled *ARPA Contractor's Meeting*, Monterey, California, April 21st-22nd, 1980. It used to be a habit of ARPA's to get its contractors together once a year, or maybe once every two years sometimes, to disseminate information, what everyone is doing. And this book - there - there's a tab in here for everyone, everybody's project is tabbed in here with a few pages of what they're doing. And everyone would - would give a verbal presentation of this, plus a list of all the attendees. So this is a history of where the ARPA Computer Science community was in the middle of 1980. A volume called LISP Machine Manual. This is a manual for the original MIT LISP Machine that gave rise to two companies, Symbolics and LMI Incorporated, but this is an MIT report, I believe. And this volume entitled *Reading in Artificial Intelligence* was done in connection with Computer Science and Psychology Joint Course 224, at that time being taught by Cordell Green and one of his teaching assistants. And he put together this volume of the papers he wanted his students to read at the time. So that was another kind of "where does the field stand" view of the - of that time. I would - I would regard that as significant. This is a - no - this next book is a - a rather historical little book. Very early in the history of the LISP language a man named Edmond Berkley, who had written a very famous book about computers in the early days called *Giant Brains*, was doing consulting for a company called Information
International Incorporated and produced this little textbook on LISP long before the world had recognized how important LISP was. It was published by this company itself in March of 1964, and is a historic little book on early LISP. I'll bet there's hardly anyone in the world who has a copy of this book. McCarthy probably threw his away years ago. This is probably the first book that there ever was on LISP other than the LISP manual itself. This notebook here labeled "AI List," I got to tell you what AI List is. AI List is a - an electronic journal of little notes that people send each other, or references from bulletin boards, or - just - it's a - it's one of these electronic communication media. This happens to be targeted at a large AI community. And from time to time I would print out AI List because it would be too hard to read online and I'd want to look at something in hard copy. And so this is a collection of those. I see some dated 1985. This is - looks like all - all around the middle of 1985. And you can have them all. Then - let's see what this one is here.

HL: And that would just about fill up the box.

EF: Okay. Then in - in -

(There is a break in the recording.)

EF: - the material from SUMEX labeled "SUMEX Annual Report, 1980. SUMEX Renewal Application, 1980." This would give you an idea of where the SUMEX project was at that time. Now in addition to that I have here similar material for SUMEX in other years. For example, I can give you the annual reports for '81, '82, '84, and the SUMEX Renewal Proposal of 1980.

HL: Okay. (?) - I can - I've reached the - I can take the - a couple. Do - maybe if I (?) -

EF: Do you want to take these '80, yeah. Can you fit in that much?

HL: Yeah.

EF: Okay. Then I'll hold back on the 1980 proposal and give that to you later.

HL: Okay. And that will fill me - fill -

[End of Feigenbaum 2-19-87 #1]