

Transcript of Rubin oral history

CAF: All right. This is January 28, 2016. Present: Carol Fowler, Donald Shankweiler and Phil Rubin. We're going to take an oral history from Phil Rubin. Why don't you conduct the questioning, Donald.

DPS: All right. Well, so we wanted to know what you can tell us about your childhood and early years that might have prepared you for your future life, your life as a science researcher and leader.

PER: Sure. I was born in 1949 in Newark, New Jersey to an Orthodox Jewish family.

CAF: Oh, I didn't realize that.

PER: And my father was a pharmacist and my mother had a degree in accounting and ended up in the long run working as my father's bookkeeper for his pharmacy. I had four siblings. One passed away fairly rapidly and I was the middle child. My grandmother was a Rothschild, Fanny Rothschild, and she left the country where she got in kind of...Poland actually; there was a branch of the family there. And came to this country when she was 16 chasing a man who she ended up getting married to. So she was disinherited by the family. As was my mother, twice, because she was the heir. So the reason I bring that up is because, atypically for a Jewish person of that era, we didn't lose anybody in the Holocaust. Nobody. Everybody was here. People had come over. And so it was a slightly different background. And we grew up very poor even though my grandmother was a Rothschild, because she was disinherited. And in general at that time, Jewish parents, particularly in urban areas, pushed their children to get educated. So education was a priority for my parents. My mother's older sister, a woman named Cecilia Auerbach [sp?], was a mathematician and was Macy's first vice president. And she was very smart. And she basically raised me, because my mother and father worked, and my aunt raised me in the sense of, if there were things like cultural occasions and doing things like that, she would take me, you know, go listen to classical music in New York City, and things like that. So, at that time, because I lived in Newark, I pretty much started being self-educated. And spent a lot of time at the Newark Library, doing my own reading. School in Newark was fairly violent, which was amusing to me. And I was in a street gang, ended up getting stabbed.

CAF: Oh my god!

PER: Have a lovely scar on my leg. But I was unaware that I got stabbed. And my job was to talk to the teachers. That kept the animals around me free from having to interact. And the teachers were just delighted. So they all liked me. One of them in particular nurtured me in the area of science. He was my physics teacher. And I did very well in science. Particularly in stuff like physics and biology. But after a while, as I got towards high school, I pretty much stopped going to school after my freshman year. Because I was in a band and it was like the sixties, the early [...] sixties. And my mother covered for me. And I didn't have much of a high school education. I actually didn't officially graduate, because I mistakenly showed up one day to see my class rank---at the bottom of the class by the way---because I wasn't there. And the junior principal threw me down the stairs, because he saw my hair. And that was just great, because I basically said: "Well, you'll be hearing from our

attorney.” And he did, and we reached a settlement. I didn’t have to finish school. I got my diploma. And we got some cash, so it was nice. So in any case...

CAF: What happened to the street gangs?

PER: So the street gangs were at an earlier age, because I was in Newark. So I mean, so I grew up right where the riots were in Newark. I grew up, if you know Newark, it’s near Springfield Avenue. That’s where the tanks rolled down when the riots happened.

DPS: Wow.

PER: And eventually, actually after we were gone. But our house burned down in the riots. And so in the street gang, which was a few years before that, yeah, I was just in a gang. Because I was Jewish, I was the treasurer. You know how those things go.

CAF: Stereotype in there.

PER: Stereotype, right. And I could count. And it was mostly an Italian street gang.

DPS: So what was the ethnic makeup of the gang?

PER: Italian and a couple of Jewish guys.

DPS: Italian mostly?

PER: Mostly Italian.

CAF: Did you have a street name?

PER: Did I have a street name? Yeah, it’s embarrassing. I’m not going to bring it up. I did. No. I didn’t like it.

CAF: It wasn’t Philip.

PER: No, it was not. So the way I got stabbed was odd. Because you kind of knew where all the gang fights were. This stuff isn’t like what people think. It’s like a club, you know, you’re not paying that much attention. And there was like...I knew there was supposed to be a fight, and I decided to take a shortcut home from school. I’m walking right through the fight. Because it wasn’t my gang. The two gangs fighting had nothing to do with me. So no one cared. Everyone knows everybody or you’re wearing something. And they know you, you know, some color or something. I’m some little kid, and I walk home, I get home. And my grandmother, Fanny Rothschild, she’s pretty out of it so she had early onset Alzheimers that wasn’t called that back then, and became a bag woman. So my father was—not his mother, my mother’s mother—his chore was to find her wandering in the parks, bring her home. Then she’d jus sit there, theoretically taking care of us, except that she didn’t speak English and was incoherent. So I came in and I just wasn’t feeling well. I take my pants off and there’s blood everywhere.

CAF: Oh my god.

DPS: Oh!

PER: So I walk down to her and she had enough of at least foresight—you know there was no 911 or that kind of stuff—she called my mother. She knew how to do that.

CAF: Good job.

PER: And spoke in Yiddish, I guess, and just said “Ah, son bleeding.” So my mother sent a car over to bring me to a doctor to sew me up. So clearly what happened, is as I was walking somebody probably had a knife out.

CAF: You probably saved somebody’s life.

PER: I probably did. And you know I walked into it and didn't even notice it. I have a nice little scar. That was actually one of two times I got stabbed. The other time was just in school, just sitting there. And a guy who I was really friendly with, a drummer. I'm just sitting there next to him in music class, and he just turns, he goes BAM! right in my leg. I go: "That really hurt. Don't! What are you doing?" I said: "Why did you do that?" And he goes; "I just wanted to see what it was like."

CAF: Stab your own leg!

PER: And I said: "Ah man, don't you ever do that again" But we'll move on. So childhood was fun. High schools: I moved from Newark to Union after a couple years. And I was in the advanced placement classes and in the truant classes at the same time. Which was fantastic. Loved it.

7:35

And very good cohort. Some very interesting people, small bunch of very talented people. Science was a big deal. And a number of people were *in* science. A few remained by the time they finished college, but kind of migrated afterwards to other areas. So that was the younger days.

DPS: But you said you didn't graduate from high school.

PER: I didn't officially finish the year.

DPS: Yeah, yeah.

PER: I didn't come back after I was assaulted.

DPS: Oh, after you were assaulted.

PER: But we entered into negotiation, got my degree. So it counts as finishing.

DPS: OK. yeah. Right.

CAF: So how did you get to Brandeis? It was those AP courses, not the truancy courses.

PER: That's partly it. So I applied to college, and Brandeis was probably my first choice at that time. It wouldn't be now, but it was then. And I went up for an interview.

[break: visit from Tammy Ursini re Alan, Craig Cooper information]

PER: So I graduated near the bottom of my class, and I tested really well. Very well. And so I went on my interview to Brandeis. I just loved this interview. So I go on the interview with some young guy; he was probably on the job for a month. And we had the interview, goes pretty well, and gets all done. And I said; "OK, it's great. I just need something from you now." And he goes; "Yeah, what's that?" I said: "I need you to pay my hotel bill, and give me a cash stipend." He said; "I'm sorry?" I said: "I need you to pay me." And he goes: "WWWWhat are you talking about?" I said: "Well, it seems to me this is a business arrangement. Otherwise why would I be here?" I said: "So if you're looking to buy my test scores, pay me for them." He said: "I want you out of my office now. Get out. We're never going to talk again." I said: "OK, you know, there's still a chance for you to pay me, but I'm sure I'll be hearing from you again." Of course, I thought I'd never be hearing from him again. Took my little plane back and that was it. Moving into....First day, I'm moving into the dorms...

CAF: Now wait. Why did you get in?

PER: At...Not there. I did not. I'm moving into the dorms at NYU, and I call my mother up to let her know where I am. Because we really weren't that much in

communication. I kind of was independent for the last couple of years, and didn't really interact—no hostility---didn't really interact with my parents. And so I wanted her to at least know where I was in if something came up. Someone keeled over. And I said; "OK, I'm moving into..." And she said: There's an envelope for you, a letter, a very thick letter that has arrived from Brandeis.

CAF: Thick!

PER: I said; "Oh! I knew that would be there. " I said: "Open it up." And it was an acceptance. So I said: "Well, I think I'll go to Brandeis." And the reason was, given the drug scene in New York City, I didn't think it was a healthy environment. And I liked Brandeis at the time. So off I went to Brandeis. They never did pay that stipend.

DPS: So you weren't living at home for a couple of years in high school?

PER: I was in a band, and we traveled around a lot. I was at home sometimes, but my parents worked. I didn't see them much.

CAF: Now, you played the guitar.

PER: Yeah.

DPS: Is that how you supported yourself?

PER: I made a lot of money. I didn't have any trouble. I was in a band that had multiple names back then. When it was founded, it was called the Institution, and we opened for famous people back then. Now they're not famous. So we opened a lot at a place called the Night Owl in Greenwich Village for, like, the Lovin' Spoonful, I don't know if you ever heard of them.

CAF: Yes!

PER: Regularly for them actually. John Sebastian was the lead singer.

CAF: Right!

PER: Was a friend. I saw him recently. He came to visit. And for other bands. The most famous being one performance at some arena for the Who. But they had a thing in their contract saying they don't interact with the opening acts. So anyway.

DPS: What did you play?

PER: What did I play? I played lead guitar.

DPS: OK. Good.

PER: Back then, it was a lot of money. I made a lot of money. My parents didn't pay for my school, college

CAF: Wow!

PER: Because I was divorced, kind of legally separated,,,, well, not legal; it wasn't done legally, but they didn't have the money. So I paid for college, which was not a lot of money back then.

CAF: Right. But still...

PER: And it finally ran out. Senior year, I ran out of money. That's when I met Joette. I was leaching off of her.

CAF: Ah good thing.

DPS: Well. Yeah.

CAF: Very fortuitous.

12:56

DPS: Had you had music lessons as a kid?

PER: I had some music lessons in different instruments. Mostly I was trained in classical piano. And that's what I play now.

DPS: Uhuh. Uhuh

PER: So...

CAF: So how did you get from physics and biology...

PER: Yeah. So I went to Brandeis in part... The reason, one of the reasons I wanted to go there, they had a very strong—still do—program in biophysics. And that's what I was in, *briefly*. I don't think I liked the fellow students that were majoring in that area. Plus there was stuff going on. And some of the shift also you'll see had to do with something that happened later. You know it was the beginning of the cognitive revolution. And Brandeis' Linguistics Department, because of the chair at the time, a guy named Jay Keyser, Samuel Jay Keyser, who was one of my mentors...

CAF: Oh, I know him.

DPS: A very impressive guy.

PER: Yeah, Jay's a great guy, and we're still in touch. And he's a little crazy, but so is everybody. But in any case, there was a very unique program going on at Brandeis, which I'll get to, and there was...but it was more the environment. So you know, you'd be sitting there...And a lot of it was informal. Someone would send, you know, a message around, not via email, but you know, just say: "Oh, Jerry Fodor's going to be here tonight." Or "he's giving a talk." Or "Chomsky's going to be over." You know, it's very close. Or B. F. Skinner. You know, there was the range. And I had a car, because I had money. And I was the driver for people like B. F. Skinner, Abraham Maslow and stuff like that.

CAF: Wow.

PER: So, you know, all this stuff was going on.

DPS: All the money came from your musical activities?

PER: The money came from your musical activities, yeah. There was just a lot more excitement than in the very dry biophysics area. Lots of things going on. So we had a very eclectic program there. It was a very unique program of which I was the second graduate at Brandeis in...a joint program in...it was called like: joint program in Psychology and Linguistics. And on the Linguistics side, the head was Jay Keyser. On the Psychology side, it was a psychologist you probably don't know, a guy named John Fredrickson. So he was a fairly junior guy. But there were other people, supportive people, in the department like Maurice Hershenson and eventually Jim Lackner.

CAF: mmhmm

PER: And people like that.

DPS: Was Jackendoff there then?

PER: No, Ray came right at the end. Right at the end. I was on my way out. I think we overlapped briefly. So it was kind of a dynamic department. I became friendlier with Jackendoff after Brandeis.

DPS: Did you know Edgar Zurif? He was in the Psychology Department.

PER: No. The person who I know who you guys probably don't know. So, in a very strange way, so I forget that you would not know the name of the first person who graduated from the program. It was a guy named D. Green or something like that. I don't know ever what happened to him. But other people who were in the program were myself,

CAF: Remez

PER: Bernstein

CAF: Yes, Lynne Bernstein

PER: Lynne Bernstein. I was not friendly with her at the time. Then..

CAF: Louis Goldstein

PER: Then me, then [Robert] Remez, [Louis] Goldstein, and I think, [Betty] Tuller.

CAF: Tuller, yes.

PER: Then the program ended after that. Jay left. As a matter of fact, he had been...He moved to become chair of the MIT department.

CAF: MIT, right.

PER: Right. And all the time he was the editor of *Linguistic Inquiry*, you know, going on.

DPS He's still alive, isn't he?

PER: Yes, he is.

CAF: He was at Ken Stevens' memorial service.

DPS: OK.

PER: Yes, and he's doing OK, I mean, we occasionally email back and forth. He's retired now. He wrote a book, something to do with the motto of MIT is the title, *Mens et mania*, something like that. [The MIT motto is *Mens et manus* [[mind and hand]]; Keyser and Bacow; *Mens et mania*; The MIT nobody knows] You can just Google Keyser and you'll see it. But he wrote that a couple years ago.

CAF: He taught a course at Brown when I was an undergraduate there, so it would have been the same time [as PER was at Brandeis]; he must have had a sabbatical or something. Or anyway, he drove down and taught a course at Brown, and I took it, and he was a huge inspiration to me as well.

PER: Yeah. He was a huge...The thing that did it for me, for him, was surprisingly, a talk on the poetry of Wallace Stevens. I don't *care* about Wallace Stevens that much.

CAF: He was a phonologist.

PER: Yeah, and it was just stunning. I mean: Whoa! But Jay and I had a really contentious relationship, and, of course, Remez was there. So it was the usual thing. So Remez and I would sit in the back row and harass Jay the entire time. So at the end of the first semester I took...we had some other strange people as part of Linguistics. So at the end of the semester, he said basically: "OK. You flunked." "What do you mean I flunked? I did just fine!" He said: "You know, you and Remez just don't shut up, so I've got to punish you. You're going to have to sit through me again. Nyaa!" Which was fun.

18:04

CAF: He didn't want to lose you.

PER: I think so. He was particularly close with Robert [Remez], because of music. Because, I know Robert...I think they were both trombone players or something.

DPS: Robert is a bassist.

PER: Yeah, but he also played trombone.

DPS: I didn't know that.

PER: And the piano. He plays three instruments. And so they had...And so his main instrument is the piano, bass number two, and trombone a distant third. But they had that in common. And that's a weird group. So in any case, we also had my syntax professor...was Dave Perlmutter, do you know him?

CAF: Yeah, yeah.

PER: And Dave insisted for some reason....there were a lot of things in the air at the time...of teaching the entire semester in a fake Russian accent. It was so annoying. It wasn't until 15 or 20 years later I found out that, prior to coming to Brandeis, he had been a Russian translator at the UN.

CAF: Oh.

PER: But for some reason, he just thought it was funny. In any case, other classmates that were there, not directly part of the program, but we took...we had other things that you would take as part of it, including things like logic. And a person in the class, it was a guy named Ed Witten. So if you're not familiar with Ed Witten, he's in the top five famous American scientists. So he's the guy who basically formulated, like theoretically, string theory. But it's called M theory. He's a mathematician who won the Field Prize. And he's an interesting guy. Ed's an interesting guy. He wasn't the smartest guy in the room though. I thought, and it was guys. There were women too, but not in that particular class. In that particular class, the smartest person in the room, I thought, was Louis Goldstein.

19:42

So it was interesting. But Ed's the one who's...Ed was in...on the Time Magazine just about 10 years ago. A hundred, you know, leading people in America. And the quote about him was: Smarter than Einstein, smarter than Newton. So a number of us who were his friends dived bombed him. He's actually a very sweet, very shy, humble, a little Aspergery guy. And we said: "Ed, we'll take the smarter than Einstein, but we're not going for the smarter than Newton. In any case, it was a fun time at Brandeis, but I was barely there. Because we were on strike the first year, we did sanctuary the second year. I couldn't take it any more.

DPS: What did you do the second year?

PER: First, we gave sanctuary to a deserter from the Navy. And so things were chaotic and not a lot of classes went on that were formal. And I couldn't...I started to do some computational modeling of stuff. I don't even remember what it was on.

DPS: Give us a time frame. Now when...

PER: So I was '67 to '71

DPS: '67 to '71. Yeah, those were kind of tumultuous years.

CAF: Yeah.

PER: The first two in particular were just crazy everywhere. They were crazy. They were crazy all around the country. Brandeis basically shut down the first year. So after a few weeks actually.

DPS: I remember how difficult it was to teach at UConn in the spring of '70, '71.

PER: Teaching was hopeless, very..

DPS: I remember we cancelled exams one semester, and...

PER: Yeah, so I moved to Cambridge, to Porter Square which then was on the bad side of town. And I actually was doing my work, my computer work, over at the computer center at Harvard, because they wouldn't let me do it at Brandeis. Because I wasn't a member of the department. What an annoying place. In any case...And I didn't show up again until my senior. Periodically, I'd check in. I managed to get by by writing a paper for one of the courses called: "The inadequacy of Markovian models to account for finite state grammars."

CAF: Wow.

PER: And you could use that paper in every course. And my goal was: I hope these guys...

CAF: don't talk to each other.

PER: don't talk to each other at the pool or something, right, you know.

CAF: I read the most interesting paper.

PER: And they go: Woops! And that was kind of based on a thing that I actually talked to Morris Halle about. So he's the one who told me to....So somebody put me in touch. Somebody, like Jay or somebody, said: "Oh, there's this guy at University of Pennsylvania. Give him a call." And there were two guys I ended up...I think that's how ...I don't even remember how it worked, or if it was Morris, but somebody said; "Oh, he knows about that area and wrote some paper." So he sent me a bunch of references. Could it have been Morris? Was he at Penn? [No, has been at MIT since 1951]

CAF: I don't think he was at Penn, but...

DPS: He was at MIT.

CAF: Yeah, he's at MIT.

PER: Well, maybe it was MIT. That would make more sense if that's where it was. [...]
But I remember just giving him a call.

DPS: Chomsky was at Penn.

PER: No, it wasn't Chomsky. I didn't get along with him.

So those were,...I mean most of the things...So I'd say the biggest influence was Jay Keyser at the point. But then something happened in the summer of 1969. So at that point, I'm starting to run out of money. And I figured: Oh god. It's time to get like a summer job. So one of my roommates in my very small dorm, a guy named Richard Copely, his dad was one of the vice presidents of IBM. I figured, oh, his dad's well connected, he can get me a job. No such easy luck. But he said: "I know this guy in New York City. You should look him up." Because I was talking about how I was starting to become interested in some area. And his name was Lou Gerstmann.

CAF: hmm

PER: So look him up.

CAF: Ah, ah, the rest is history almost.

PER: The rest is history. My relationship with Lou was...fell apart on one night. But that's OK. Lou..Did you know Lou?

CAF: I didn't, but Donald did.

DPS: I knew him.

PER: So Lou's a bit of a con man. Yeah, I mean, he's a nice guy, smart guy, but he's like running this scam in New York City like you couldn't believe. So what he was doing was consulting. I had never heard about this.

23:56

And he would travel from place to place to place. And he'd sit in a meeting. And they'd pay him a lot of money, and he'd say a few words.

DPS: One of the places he consulted was at NYU's...

PER: That's right That's where I ended up working.

DPS: Institute for Rehabilitation Medicine

PER: That's where I worked.

DPS: I took over after him there.

PER: So it went from one guy to the next. So that's exactly where I worked.

DPS: And Kathy Harris was there too.

PER: I know. So you know this. But he was doing more than just that place. And so I remember meeting him, and I had to go meet him at St. Mark's Place. He lived outside a [...]; I was a hippie and he was the opposite of a hippie, like the straightest looking guy you've ever seen. He's living in the depths of hippie heaven, a street I didn't even want to walk on, disgusting. And I'm: "OK." And he's got some kind of marital issues. He's like running from ex-wives. I'm like "Ay."

DPS: He had many of those.

PER: Many of those. We had other people like that. He's one. And then, he says; "Quick! Get in the car." He's got like this Volkswagen. And I get in. The glove compartment door falls open, and a giant pile of parking tickets pours out. And I said: "What's all this?" He says: "I don't ever pay any of them." So this guy...And then he starts doing something, he actually explains his scam to me. He goes: "You know, there's lots of money to be made. I'm not saying that *you* do this, but *I* do this. And here's what I do." And I said: "Sounds good to me." I said: "Can you get me a job?" He said: "Well, one of the places I do this is a place called the IRM. Institute for Rehabilitational Medicine at NYU at 34th Street over by the East Side.

CAF: This is a place where he perpetrated his scam?

PER: Well, he would say, yeah. Depending on what mood he was in he would say he was perpetrating a scam or that he was providing them with expert consulting on--because they dealt with aphasia for some of the patients--on speech, language statistics and aphasias. Does that sound fair?

DPS: That sounds fair. But he did not leave a lot of love behind when he left.

PER: Oh no, not at all. No, not at all. He was absolutely not beloved. And, did you work for Wayne originally?

DPS: No.

PER: OK. Wayne was gone at that point. In any case, at that point, I had picked up programming skills. And actually, I didn't go back to my high school days, one of my great inspirations was one day when one of the teachers brought in a little kid with, going way back, an early little computer that you just plugged things in. I just thought it was the coolest thing in the world.

CAF: Yeah.

PER: And somehow I just liked computer stuff. So I could program and I was a self-taught programmer. And so I had some expertise and I knew a little statistics back then, knew more later. And so my job was to work at NYU in the psychology group. Mostly the psychology group was to do statistical analyses of the tests they were giving to many aphasic patients who were undergoing rehab. They had people like the artist Adolph Gottlieb. He had a very bad stroke and really could do almost nothing. What they were trying to do...He was famous for doing paintings. I can do a Gottlieb that looked like this; An amorphous circle and a rectangle. That's it. And so what they would do; they would sit him down with a piece of paper and get him to draw. They'd say: "I'd like you to try to draw a circle" And it would be like that, right? Or like this. His wife would come in after every session and impound..

CAF: What he'd done.

PER: She goes; "I don't trust you guys. You're going to sell his work."

CAF: Right.

PER: But meanwhile, batteries of tests were there that you do and a number of things. My job was to deal with the statistical analysis. At the time, we got to put a stack of computer cards into a reader, not a computer; it was a remote reader. Once a week on Wednesdays, we had one hour.

CAF: Wow.

PER: You put the job in. So for a week, I could hang out and do nothing. But it got even better. And we were running a very early version of BMDP, the biomedical data processing program. And I did a few runs. The main computer was down at NYU at the Courant Institute, which is a famous mathematical computer science institute. After a few things, I said: "There's something wrong. There's a bug or something. It's not..." Because I was doing the same analysis by hand. So my boss, this guy Wayne, said: "Well go down to Courant and maybe talk to them about it." So I knocked on the door and, you know, some hippie answers and lets me in. I said: "I can't." He says: "Who are you?" And I said: "I think there's a bug in the BMDP package." And the guy; "There's no bug in the BMDP package"

CAF: Right.

PER: I said: "There's bugs in all software. C'mon let' me show you what's going on." He says; "Sure. " So I showed him the results, and I brought the punch cards with me. I said: "There's got to be something wrong with the code." We went over the code line by line and we found a bug.

CAF: Alright!

PER: Oh, nice! He said: "As a reward you can go back and tell your boss, you guys can have basically 8 hour a day, every day of the week..

CAF: Oh my god.

PER: ...access to the computer So I was golden from that point on.

CAF: Yeah!

PER: And so that was all.

DPS: Who was your boss?

PER: A guy named Wayne somebody, I don't remember his last name.

DPS: And which department was that in.

PER: So this was in the psychology department on the fifth floor.

DPS: Oh yeah.

PER: Right. I don't know...Who did you consult for, a different department?

DPS: Speech

PER: No, I was in the psych department.

DPS: Speech therapy.

PER: But we're dwelling too long on this in any case.

CAF: I just want to stop this...

End of first file

PER: In any case, to summarize all that, the one critical thing is I was talking to Lou. We ended up having a falling out when my car got towed on Christmas Eve and I didn't have any...Tried a lot of people; nobody had any money; you needed money to get it out. And so I went and knocked on his door and he basically never talked to me. He was furious.

CAF: That you asked him for money.

PER: Yeah, right. So but he prior to that, he mentioned Haskins. He wasn't the only one. I had heard about it actually from John Fredrickson and from Jay Keyser. So it was a place I was aware of and I had read some of the papers. And so that migrates a little bit, into probably into question three now, because we've been doing 2. And so the answer to that [Why did you choose UConn for graduate school? What were the most formative influences there?] is maybe a little bit surprising. But there were a couple of papers that...And I just did a quick glance to see if there were....these are the correct ones that I had read that I particularly was caught by. One was a paper, '66, by Shankweiler and Harris on articulation and aphasia.

DPS: Yeah.

PER: The other one was a paper by Lieberman, Klatt and Wilson, 1965, called "Vocal tract limitations on the," essentially, the vowel space of rhesus monkeys and other nonhuman primates. I really didn't care about the animal research, but I liked the vocal tract thing. And then at some pointm Lieberman and Crelin, whatever it was, on the speech of Neanderthal men.

CAF: Right.

PER: I was very familiar with stuff like "Perception of the speech code," knew who Michael Studdert-Kennedy was, knew who Al Liberman was. I didn't care about them at all. That was not the reason I went.

CAF: Hah!

PER: Not even remotely. I mean, not a bit. I'll tell you my first meeting with Al, who, we ended up being very friendly, but I went because...I would say in the main because of Phil Lieberman. That was a big mistake. Please don't say that. Take that out. In any case...

DPS: That's why you went to UConn

CAF: UConn.

PER: To UConn grad school.

DPS: Because of Phil Lieberman.

CAF: But you didn't go to Linguistics.

PER: No. I was in Psychology. So it was a joint program. My degree is in Psychology, in Experimental Psychology.

In both, but I did the joint program [Psychology, Linguistics] And I was not really a linguist. You know, I had a lot of courses by both Brandeis and at UConn in linguistics, but my main...And I had a real falling out, fallings out with some of my linguistics professors over, usually over syntax, over the following little thing:
[drew?]

CAF: Oh, OK. Well good for you!

PER: Thank you.

CAF: You were ahead of your time.

PER: And I really thought Chomsky was misguided in the long run.

CAF: No kidding! He was my hero for a long time.

PER: He was mine when I started.

CAF: Yeah.

PER: But the stuff...My mental departure from him was that...All this stuff that he would discard in his, I think, very well-intentioned thinking about aspects of

language where you're looking for the invariants where your looking for what's universal was not to me what was interesting about speech. What others would call the mess and the slime I thought was absolutely fascinating, particularly in its diversity. I didn't even see it as variability. I saw it as, to me, information. So I just had a different point of view. And I particularly was caught up, even from the earliest days, in terms of, I guess what would be called embodied cognition in a different way now. Not the way it's kind of gone. But the notion of how a couple things happen: How our biology constraints our cognitive abilities and how we are, as a natural entity, moving in a real world. Which is why I ended up really liking Gibson a lot you know. And was very much...so Don actually, though he may not remember was one of my early advisors.

DPS: Oh, I remember you.

PER: Right. But I shifted fairly rapidly to, eventually I went to Peter van Gelder, I think, but then to Michael Turvey. So, in any case, this stuff didn't work for me, so I was putting a star down so you're presented with a sentence: Is this grammatical or ungrammatical. And everytime they'd star something, I'd say: "Looks fine to me."

CAF: "I could say that" Yeah.

PER: And not only that, you know, I think about the language that my friends used. You talk about, oh the stuff when you're talking to your students or your kids.

CAF: Star, star, star, star, star

PER: Yeah, exactly, that's...So language is actually, in certain ways, something different. Not that it can't be both things, actually. It can have...So it was like: That can't be right. And so, we'd sit there in the back and fight with Jay [Keyser] the whole time. Or with Dave. And it was like, we need to teach...Shut up!

CAF: Yeah.

5:01

DPS: Jay supported the star stuff.

PER: Jay wanted to get on with what he needed to do.

CAF: Although he was a phonologist, he taught us the first Chomskian syntax course at Brown that was ever taught, because they were behaviorists, descriptive linguists and I just came away a believer. I thought: "This has to be true." You know we were learning what the transformations were and how they were crucially ordered or not, and it just seemed so beautiful...

PER: I loved that stuff

CAF: It *can't* be not true.

PER: So that was what caught me. Exactly the same thing. And the thin ...what the *Structure of Syntactic...*

CAF: Oh, yeah. *Syntactic structures*.

PER: It was just beautifully written stuff. It's what happened later on that...

DPS: I learned my first Chomsky from Jim Jenkins,

CAF: All right!

DPS: A surprising source, but he taught a seminar in *Syntactic structures* at Minnesota

CAF: Minnesota..when you went out in the seventies?

DPS: The year I was out there.

PER: So the guy ?[probably why?] you mentioned who changed my life and my thinking was Jim Jenkins, and that's something that happened at UConn where he came to do a meeting. It was the first meeting on events.

CAF: Right.

PER: It was number one, and I was just blown away by him, and by that. And so from then on, that's what I was interested in doing was...I was very much interested in how things changed over time, so how things move in time, how things move in space.

DPS: Let's figure out what year that would have been.

PER: So I got to ...in the Fall of '71. That would have been '73.

CAF: '73, oh.

PER: Right.

CAF: So that wasn't the first event conference, because that was late [June, 1981]

PER: Maybe ;74. It was towards the end...

DPS: He had been at Haskins Labs much earlier than that.

PER: I take it back. This could have been '74 or '75.

CAF: Ok, OK.

PER: But it couldn't have been after '75, I don't think.

DPS: Well, he was there before...I went to Minnesota in '72

PER: I'm terrible with years.

DPS: Right, '72-'73 I was there and Jim had already been at Haskins Labs, because that's where I met him.

CAF: Uh huh

DPS: At Haskins

CAF: Yeah. Well, I think of him as a guy who went to a lot of conferences, and he was always asked at the end to stand up and kind of like summarize...

PER: Right.

CAF: the conference. He was so good at that. So he might have done that at that...

PER: Yeah, but at this one, I was actually inspired by him at the meeting, and so we had a...But in any case, you know, I hadn't really thought about event stuff that much and so originally, going back, you know, I had been captured by Phil, and what I liked about Phil Lieberman was kind of the humor and the breadth in the work and what I didn't like about Phil, though we remained friends, was Phil. You know he was going through a lot of stress in his life at that time because of Marcia.

DPS: You couldn't argue with him anyway.

PER: You couldn't talk to him.

DPS: You couldn't argue with him.

PER: He knew everything. And he did know a lot of stuff. You know also was having pretty much a breakdown at that point because of the lawsuit. And so it was difficult.

DPS: Yeah, Marcia was a very...that was a heavy business.

PER: Yeah. So it was a very, very tough time. But in any case, so those were some of the influences that...

DPS: Yeah, OK, so where are we now?

8:08

CAF: I guess 4.

DPS: "How did you get involved at Haskins? And what were your various positions there?"

PER: So I graduated in 1975 from UConn.

DPS: Your degree was in '75.

PER: Yeah. My wife, Joette, was at the UConn Law School at that time, so we kind of wanted to stay in the area. And I was hoping to get a job at Haskins. Prior to that, I had been briefly a research assistant because you asked the question. But mostly I was...Well, I was kind of doing nothing. I'll be quite honest. I was doing nothing.

DPS: Who was your mentor as a research assistant?

PER: That's a great question. It's Haskins. Who the heck was my mentor? Who knows? So I'm sitting there doing nothing. Turvey, you know, got me the thing, but..

DPS: It wasn't me.

CAF: Well, your dissertation, if I remember, was on lexical...top down influences on phoneme perception.

PER: Yeah, but I had lost interest before that was even finished.

CAF: Turvey was your advisor.

PER: Turvey was my advisor. And so Turvey was in essence my mentor, right. But prior to finishing up, you know, I,,Turvey....as an RA, I had originally been an RA before Haskins with Bill Wilson.

CAF: Oh, my goodness.

PER: Doing...we were running a horrible little study on the ultrasonic vocalizations of rats while they were having sex. And it was like...these things were just biting me, and I don't like working with animals. I didn't think animal research is necessary in the main and I didn't want to be involved with it. You know it was like: "Please." And so, Bill could tell that I wasn't interested and he got me involved with a piece of equipment that he needed. Something called an osteodensitometer. That's a thing that measures bone density. And he didn't have the right software. And it was kind of...can you write software for this? So I'm starting to do programming. And the same thing at Haskins. I'd be coming in late at night and just doing a little programming. And it got, you know, a little bit...switched from being an RA for Bill and just being essentially a programmer at Haskins. Doing programming, I was doing a lot of real work. They were doing programming. But mostly I was sitting around.

DPS: So you weren't involved with Ignatius.

PER: No, no. Nope. So you'll hear in a moment. So

DPS: He did a lot of the programming at Haskins.

PER: Yeah. There were a lot of people doing a lot of the programming. So I was sitting around at a little desk, right where Phil Lieberman used to sit in the old Haskins. And across the way where I ended up moving to was a guy named Paul Mermelstein. So that's who became my mentor. And Paul comes up to me and he goes. "You know, I come in every day and you're just sitting there and you don't do anything. I'm pretty sure we're paying you." I said: "Yup." I was like: "I'm not interested." And so he goes back to his desk, comes back with a big pile of punch cards. He says: "I want you to take this and get it running." And that was it.

CAF: And that was his articulatory synthesizer?

PER: Yeah. I didn't work for him, it wasn't like I had any choice. It was like, that was the articulatory synthesizer, or actually was what he had from Bell, which wasn't an articulatory synthesizer. It was a portion of his articulatory model, but it had nothing else. It didn't have any input, didn't have any output, didn't have any movement over time. It didn't have anything. And so I started doing it, and Paul was just wonderful. You know, he could be a little brusque. Some people found him a little...I just thought he was fantastic.

DPS: I admired him.

PER: I just thought the world...Yeah he could a little...very directing...Do this! But also very good with questions. I'd come up, and it was a mess! And I'd say: "What's this and why do you do it?" And he was dead on honest. He said: "That's there, because I'm faking it, because I have no idea what's going on." "Oh, OK." By the way, that became very important. Other things, he said; "Ah, we could use some improvement there. We don't have any way to make any sound"; for example. So, I said: "I don't know how to do that." He'd go: "Figure it out." He wasn't going to tell you what to do. And it turned out we had very good resources there. There were people like Gary Kuhn, there were people like Rod McGuire, if you remember Rod.

CAF: I do.

PER: There were people, you know...On the other end, though, there weren't directly on this, more on sinewave...like Peter Bailey and Quentin Summerfield who weren't programmers so much. But there was a lot of talent. We also had signal processing people, a guy named Steven Davis, who was one of the first guys who worked for the ILS company out in Santa Barbara.

CAF: Yes.

PER: He was very difficult, but he ended up...very difficult, and unpleasant, but he ended up writing portions. So my job was to take this thing and to make it into an actual synthesizer. And to do that, we needed a little signal processing stuff, a way of implementing essentially circuit models. Also getting FFTs in there and mathematical tools. All that stuff was fairly straightforward to me. Fortunately, a little bit later, because I didn't have the expertise, at the higher level, a guy named Charles Marshall came along who had been a physicist at Yale, particle physicist, and then became a signal processor for Schlumberger, an oil company. We hired him at Haskins. He helped on the higher end.

13:39

PER: So we had enough of a team that we got the articulatory synthesizer going. What it was missing, and I [put...]in its entirety was it was about static synthesis. It could do /a/, /i/, /u/. It had a nasal tract so it could do nasals, but it had nothing beyond that. You couldn't do a consonant; you couldn't do a syllable, because it was a static synthesizer.

CAF: Yeah.

PER: And so I came up with a method based on key-frame animation. So if you're Mickey Mouse and you want to draw Mickey Mouse. You draw a frame of Mickey doing this:

CAF: Right.

PER: OK, I'm going to wait til Don looks up. And then you draw another frame of Mickey doing that: And then you have poorly paid staff

CAF: do all the intervening pictures.

PER: Right. They're called in-between pictures, and the guys are called tweeners. They are the in-betweeners. And they draw the in-between frames. So what I did is I came up with a thing where you could specify what the vocal tract looked like at this point in time and at that point in time and then just numerically interpolating. Duh! Take the two endpoints, divide by the number of steps, and you got it. It's just the simplest math out there. Whether or not it's the right thing to do is of course profoundly important and it turned out for what we were doing irrelevant. So that was, you know, the early stages and then Cathe Browman joined us, Louis [Goldstein] was interested, and one of the things we wanted to do and we had a lot of discussions, and Cathe and I, not Louis, created a program called ACE, the Articulatory Control Editor. So, based upon the Jenkins stuff, I was interested in events. Ignatius [Mattingly] at the same time had a different thing that he was doing with regular synthesis, which was influence functions that would shape how stuff moved over time. You basically draw a curve of movement, and, depending upon how you wanted to move, you're basically grading your movement in and out to give you kind of a more natural movement. And then you can control the parameters of that transition. My thing, and I never got there, we never got there, we went in different directions. And eventually they, Browman and Goldstein did it. But in the first iteration, there was stuff that, I guess it was Browman and Goldstein, Saltzman, Rubin and Kelso, I think. You know we were, you know, kicking around some ideas. My idea was to just have events. Their idea was very different, and we ended up going in very, very different directions. And I think they went in a very good direction, but not one I was interested in, because they were...I wanted an unconstrained set of events so you didn't have to commit theoretically to a certain set of things.

CAF: Right.

PER: And actually that's where other models are now going. But at the time, Task Dynamics thing then got merged with it. So they were looking for specific events. I was just looking for, you know: I need to move my tongue, you know. And I want to be able to have lots of different kinds of events. And it could be task dynamic ones, but it could be potentially other ones. Because my difference with them is very simple. I see vocal tract stuff as a whole tract thing. Not as a set of discrete, combinable elements.

CAF: Oh so that sounds to me slightly like the direction that Bryan Gick is going in. Do you keep up with...

PER: Yeah, I'm very familiar with it, right, yeah. I still believe that. I think that...Well we're not going to get to that theoretical stuff right now.

DPS: Why don't we get the history straight. It's my impression a group formed around Louis and Cathe.

PER: Much later.

DPS: Much later?

PER: Yeah. Right, yeah.

CAF: Do you know when Louis came to Yale? [July, 1989] We were trying to figure that out on Tuesday. Was it around 1980, was it earlier than that?

PER: I think it's around then, yeah.

CAF: Yeah.

PER: You know that's probably three or four years into the work. I mean there were different people coming at different times. And you know what happened here is articulatory phonology later on became *the* dominant thing.

CAF: Yeah.

PER: But the articulatory synthesis stuff had mostly been done...

CAF: So your first paper with Mermelstein was, was that '75?

PER: Aha: To answer that, because I have no recall, I wisely printed out a few things for my own notes. So I apologize going to the notes. I can't remember anything anymore. I wonder if I'm looking at the right thing here. So..

CAF: There's one paper that's always cited.

PER: Yeah. Well people either just cite the Mermelstein paper alone which was '67 or they do Rubin, Baer and Mermelstein.

CAF: That's the one I was thinking of.

PER: So Rubin, Baer and Mermelstein...I'm sorry, printer didn't...Oh, here we go...Oh, that's why I can't find it because it's backwards in time. That will always do it. And here's the Browman and Goldstein one that I was telling you about. So that was Browman, Goldstein, Kelso, Rubin and Saltzman, 1984: "Articulatory synthesis from underlying dynamics". But going way back, so the first one that I ever did with Paul [Mermelstein] was not the one that you're talking about. It was Mermelstein and Rubin, '77

CAF: '77, oh!

PER: So that's seven years before the other stuff.

18:44

CAF: Right, right. Yeah. OK

PER: But you know how history goes. And then Rubin, Baer, and Mermelstein work was already a very mature model was '81

CAF: '81

PER: And so the work had been all done by 1980.

DPS: So what year did Mermelstein come, do you remember?

PER: Mermelstein came right when we came up to New York...to New Haven. So '71, '72.

DPS: OK.

PER: He came with the model in hand. It had originally been developed by a team, just the same way there, of whom the team lead was probably—a lot of people contributed but—was Cecil Coker. And then there were people like Ishizaka and Flanigan who had a separate model for the source, which we did not adopt and stuff like that.

CAF: Right.

DPS: This was supported by the ARPA project wasn't it.

PER: Yup.

DPS: I don't know when the beginnings of that were, but...

PER: Well, the beginnings of the ARPA project were shortly after the BITNET thing so that...which was between Columbia and Yale. So, you know, I think we wound down on the DARPA stuff...on ARPA stuff, we ended our contribution to that by around '75. We were done. Because they wanted to go secure. Our main

contribution, which everyone is unaware of, which is a profound invention is---a guy named Rod McGuire, a hippie with hair down to his knees, wrote something called a ZZ protocol. You've never heard of it.

CAF: No.

PER: No one has ever heard of it. Basically, it's what would be called "voice-over IP," which is a giant billion dollar industry at this point.

CAF: Huh! And has he been involved with it?

PER: He's independently wealthy for other reasons.

CAF: Uh huh.

PER: I don't know if you ever heard what happened, but...

CAF: No.

PER: He went off and married some wealthy woman.

CAF: Oh, gee. That's disappointing.

PER: Yeah It is disappointing. And no one ever heard from him again. A little bit like [Peter] Kugler. A little bit like...

CAF: I guess.

PER: Vance Maverick who you didn't know.

CAF: I remember that name.

PER: Right. Same thing.

CAF: He was eccentric, if I remember.

PER: Yes right. So. You know, we could do hours on any of these things.

PER: We need to move.

DPS: We've got to move ahead. So what was your most...what was most memorable about the early years of Haskins. I guess you've been saying that.

PER: I've been saying it. The only other thing I would say, because I haven't mentioned it is; What I loved most about Haskins was a combination of the people in the community and the ideas. You know, there were a lot of people dealing with interesting ideas. And the people were just absolutely fascinating including some of the visitors. So I think back to people like George Scholes to...I, though we didn't get along then, we became very friendly, people like Quentin Summerfield and Peter Bailey when they would come. It was an interesting group of people, and there were many, many, many people like that. We had people who would come and visit and they'd been there before like David Pisoni, and Dave and I didn't hit it off in the beginning, but we became very friendly as time went by. So I liked that little dynamic. But I also liked, it was very much in...and we all view this differently, which was the mission, which you get to in a later question, which as stated---not that I ever read it in our original bylaws---was really about trying to do interdisciplinary work at the cutting edge. And that cuts to a lot of the things I'm going to be getting to. I think we, to a degree, lived and breathed that. That's always a hard thing to do, because you get caught up in one particular thing, and you start to focus on that.

CAF: Exactly, I mean the say I read that mission statement, they wanted to be a catalyst.

PER: Right!

CAF: They wanted to start people doing stuff. And then shift to the next important thing. But they didn't shift.

PER: So do you know why, which is never revealed in there. So it turns out that that Caryl Haskins—this is my guess, not a fact—Caryl Haskins' main gig wasn't Haskins Laboratories. It was the Carnegie Institute of DC.

DPS: Yeah, we know that.

PER: If you go there, their mission is very similar, Except they live to the catalyst thing. And they change it every five years.

CAF: You know, that occurred to me. That occurred to me that that was the right place for him to be if he wanted to do that.

PER: And they just cut it dead. Which can be really painful. So they'll be doing stuff like zoology for five years. And all of a sudden: Well. It's not that it's got a fixed time.

CAF: Yeah.

PER: Somebody, as a group, they have to say: you know, we're not the catalyst anymore. Now, let's bring new things into the mix. And they phase those things out although over a comfortable period of time, a year or two.

DPS: We had a...excuse me, my [...]

PER: You talked to Maxine [Singer]?

DPS: Yeah, we talked to Maxine. And she didn't mention that unless I missed it.

CAF: No, she didn't.

PER: But you can see it there. Just go to the Carnegie thing, and they actually have it posted. There's a big display now that shows how their mission changes over time.

CAF: Really!

PER: Yeah. A chart. Yeah.

DPS: Uh huh

CAF: She was not...she was not Caryl Haskins' biggest fan it turned out.

PER: No, she was not.

DPS: No.

PER: Also, I heard she was doing OK when you talked to her. I had seen her a number of times, prior to that and I tried to dig up... You know, she was losing it a little compared to her earlier days.

CAF: Oh, not when we spoke to her.

PER: Oh, good, yeah.

CAF: She was very..

PER: Some days she was very much on top

CAF: We heard she had some respiratory problems, I think, but she was absolutely sharp.

PER: I've seen her both totally sharp and other times just not feeling that well. She's great tho.

DPS: All right, well.

PER: Next.

DPS: Wait a minute. Remez. I didn't realize that you knew him before UConn.

PER: So we were freshmen at Brandeis, and we met on the first day, freshman year. Actually, I remember meeting Carol as well in graduate school

CAF: Yes.

PER: But we met in...

CAF: I thought he was a year behind. Did he come the same year to UConn that you came? I thought he was one year behind.

PER: No, he was one year behind later. I'll explain why. He took a year off to be a Good Humor man.

CAF: Oh.

PER: So we met first week of freshman chemistry. That was my last week of chemistry.

CAF: I would think so!

PER: Yeah.

DPS: Say no more. Say no more.

PER: I got a D- only because the professor said: "Well you never showed up after the first week, you never took any of the tests, you didn't do anything." And I blamed it all on the teaching assistant. I went into a whole tirade. I can't say what I said, but I was carrying on. He said: "OK, I tell you what, if I give you a D-, will you get out of my office?" "Yeah, I'll take it." In any case, so Robert and I met as undergraduates. Just so you know, we weren't friendly as undergraduates.

DPS: Yeah, yeah, OK.

PER: I wasn't there! The other person who I was...in my class, we became friendly much later on, not there: You would know him: Bennett Bertenthal.

CAF: mmhmm

PER: And again, he was there.

DPS: But as graduate students, you overlapped completely, didn't you?

PER: No. So after we graduated, he took a year off to be a Good Humor man, and make some money.

CAF: In New York City?

PER: In the, like the New Rochelle area where his parents are from.

CAF: Oh.

PER: Yeah.

CAF: [Very funny.]

PER: Goodness only knows. And actually, we talked about UConn. I was trying to encourage him to apply. But, you know, he had been looking for programs. And I had applied, just so you know, I had looked at really three programs: Michigan, probably more than that.

CAF: I looked at Michigan too.

PER: Yeah, and University Oregon to go to work with Mike Posner who is a friend now.

CAF: mmhmm.

PER: In certain ways, probably...I like Mike, I love Mike, not everyone does, but I love Mike. Then again the work was more interesting at UConn. But...And I went to UConn because Joette was in law school there, and it didn't make a lot of sense. Actually when I started, she was actually still at Brandeis.

26:09

CAF: Still an undergraduate

DPS: Well were you doing any research with Robert as a graduate student at UConn? Did you work together at all?

CAF: Definitely talked a lot.

PER: When we started...We talked a lot, but that would be later. So the thing we left out was the sinewave stuff.

DPS: Well that's...I want to know about that. We want to know about that.

PER: Well, lots of people have different points of view. I know exactly from my perspective what happened, but that's my perspective.

CAF: Well, Steve Pinker started the whole thing I think I remember from the *Language Instinct*.

PER: As far as I remember according to Steve Pinker's first book, he invented the whole thing.

CAF: Right.

PER: So like everything, all these things are in the air and are being done. And there had been sinewave synthesis here at Haskins before I did it, but not of the same sort.

DPS: That's right. Steve Pinker had worked with Bregman.

PER: Yeah, with Al. But the work that was at Haskins...

CAF: Don't write down that Steve Pinker started this. He didn't. He claimed to. Only claimed to.

DPS: OK, I won't, I won't

CAF: It's an annoying aspect of that book

PER: This stuff was...Just so you know, this stuff was long done before Steve Pinker ever heard about it.

CAF: Yeah. He was in knee pants.

PER: Just so you know, the earliest stuff at Haskins was stuff that Peter Bailey and Rod McGuire and a little bit of Quentin were doing on very short utterances going up to a CV, and they were just kind of putting things together, but there was no sinewave synthesizer. So here's exactly what happened. It was Al Liberman.

CAF: I thought it was you.

PER: It was Al Liberman, I would say who was the influence. Al said to me...It was a combination of things. Al came up to me one day, and he said: "Ah, we've got an experiment we're doing, need a nonspeech control. Got any ideas?" I said: "What's the experiment?" And he said: "The experiment is a...the experiment with CVs, CVCs. We just need something that sounds like speech, but is not." I said: "I got just the thing for you." I said: "I've been writing a music synthesizer in my spare time at Haskins. So I've been doing a little tone synthesis just to do music." I said, "You know, I'm pretty I could whip up something that would be speech-like but it won't be heard as speech." And he said: "OK!" That was it. So that was the conversation. So I went to Rod McGuire, and I said: "Hey, let's turn this into something." He was, you know kind of a little bit more technically savvy. And so he said: "OK." He wrote the little algorithm that really is the oscillator for the thing. But then the insight actually was accidental. I was too lazy to enter any numbers or do any real work. So I said: "Do we have any numbers for formants around? Because mostly don't forget we [burned] formants. But what did we have that had numbers? We had one package called ILS from Santa Barbara, the Interactive Laboratory System. The difference is that it was not FFT-based, not fast fourier transform. It was linear predictive coding, and, in that, technically, it's a really interesting thing. The way LPC works is if you have a spectrum and you have peaks in the spectrum it does an all pole, all positive model of the curve and matches the peaks only. OK? And you end up picking the peaks off and getting center frequencies for what the formants are. It does this automatically and it had a very arcane language in which

you had a primary and a secondary file, but the bottom line, you get a bunch of number. That's all I wanted was the numbers.

CAF: Right.

PER: So this was really interesting. It all happened in one night. Not bad. I said; "OK." I wrote the code, got the numbers and I said: "OK. I'm going to put these numbers in, and I got, it was actually Arthur Abramson. I asked Arthur to say; "Where were you a year ago?" Because I wanted something where I'd get...

CAF: Continuous.

PER: Continuous. That's all. No other reason. And then I put it through the thing. Arthur was long gone, because I stayed and worked late at night. I ran the numbers through. I had the code that McGuire wrote for the oscillators. So we have just oscillators now at those frequencies. I play it, and it goes: "Where were you a year ago." Now a couple things. I knew what it was already.

CAF: Right.

PER: Critically important.

CAF: Yeah. It's a good thing though. Because, if you were listening, and didn't know what it was, you might have said: "This is the perfect nonspeech control." And never knew.

PER: Exactly.

CAF: You might never have known.

PER: Two other things happened. So I played it over the phone to Joette. She was the first other person to hear it.

CAF: Birds tweeting.

PER: So we were down in the room, not the main computer room, but that long side...the one as you first came down where the tech guys sat to the right?

CAF: Yeah.

PER: Where there were a lot of stations? And there was a telephone on the wall. So you could hear the speakers across? That was important though, because it gives it bandwidth.

CAF: Right.

PER: And so the phones over here at the [side]. I jack up the speakers, and I made another mistake again. And I said to Joette: "What do you hear this thing say?" And she says; "Oh, it says 'Where were you a year ago?'"

CAF: Oh my god.

PER: So then I play it. I say: "OK. It's not just me." So then I call Remez up. And I say: "Robert, I want you to hear something interesting." And his answer was really fascinating. I said: "Listen to this and tell me what you hear it say." Again, I gave the wrong instructions. He says: "Oh. It says: 'Where were you a year ago.'" And so I said: "What do you think?" He said: "I think there's lots of work to be done."

CAF: Didn't sound very good.

PER: No, not in that way. He meant:

CAF: Oh, I see.

DPS: Yeah, yeah.

PER: He was like doing this. Like...

CAF: Ah.

PER: And that's actually how it played out. I kind of lost interest. In a way, from that point. To me, my work was done. And he and Dave [Pisoni] I think really to over the project. I think it worked from day 1. I probably had only two other small insights in that.

CAF: But how did you know, or how did Remez know, that anyone would hear it as nonspeech?

PER: Well, we didn't, but he was clever enough to design experiments in which you didn't bias the person as much.

CAF: Right.

PER: And if you remember what happens in the experiment if you just say:

CAF: Yes, exactly.

PER: You just say: "I'm going to play some sounds made by a broken computer "or something like that. You don't say it's talking. You get eighty to ninety percent just say: "Oh you screwed up the experiment, science fiction noise, birds tweeting."

CAF: Right.

PER: And all you have to do as long as they're native speakers of English and are semi-coherent, just say: What does it say? And with *where were you a year ago*, you hear it three times and from then on...And after you've heard it as *where were you a year ago*, you can't go back on the other ones either. You're kind of trapped into a speech mode because your.... Now Robert and I have disagreed violently ever since about why you're doing it. To me, it's a very simple story: This is a pretty clear specification, particularly as it moves over time for a coherent source that changes over time. Mathematically, it specifies that source. It's one you are actually familiar with, and you know how that particular device...It's no different, in a way, well, there are certain differences, from a trombone if you know about that. You know certain aspects of how an instrument changes over time and what it does. But you know he has a different approach. In any case, the only other two insights I had on that were: one experiment that you (CAF) were in and I don't remember if you (DPS) were, where what...The other thing the first night that I heard was I knew it was Arthur talking.

CAF: Wow. No kidding.

PER: And then we made some with Robert. And I knew it was Robert talking.

CAF: Yeah.

PER: And I said: "Gee, you know..."

CAF: But it sounds qualitatively so bizarre.

PER: Right. And you continue to hear the bizarreness to a degree unless you get very used to it. But to me it was weird. I'm saying: "You know, I can hear Remez, or I can hear Arthur." And I know they both have distinctive voices and, again, Remez turned that into an experiment. And then the only other one...

CAF: Yeah, I was in that one.

PER: that we talked about as recently as yesterday was one where I wanted to manipulate the...so now we have three formants let's call them---they're not really formants---changing over time. I wanted to see how you could take one out of time.

CAF: Right.

PER: and where things would break apart. And again my explanation for that would be the same as mine, and his would be different.

CAF: Right.

PER: So that was sinewave stuff. And that's kind of how it came about from our perspective.

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PER: And so my contribution was I created the first laboratory sinewave synthesizer and was really talking about, you know, the interests...my interest was in spectral-temporal coherence and change in time.

CAF: mmhmm

PER: Not in making little short little things with little whistles.

CAF: Right.

PER: Yes, we could do that before, and Peter [Bailey] and others had done that. That's not what we meant by sinewave synthesis.

CAF: So would that relate back to your earlier interest in events?

PER: Yeah. Exactly, yeah.

CAF: Yeah, good.

PER: I continued at that point, and I continue to this day, to be a little frustrated by my engineering friends, who are very talented. But our approach to the world of engineering at that time—it's very different now—was to just take a window of 10 ms, and everything was little snippets. And then how do you connect things up. And to me, none of that stuff actually mattered.

CAF: So, to me, that's why people like, even Khalil Iskarous, who I want to do the work of going back from the acoustic signal to gestures, are frustrating, because they are embedded in a world in which you try to recover configurations of the vocal tract from [acoustic] descriptions at a point in time.

PER: Right.

CAF: And I don't know if that's changed.

PER: No, that's not. By the way, there's a later question you have and that's some of my frustration, because that's such an exciting area. And with the exception of one guy, one person, I haven't seen a lot of theoretical excitement in that area. And that one person, who long ago left, and he wasn't even in the field, and that's John Hodgen. Because he came up with this brilliant method of what's called continuity mapping

CAF: Yeah, I remember that.

PER: Where you watch...So here's a lie that goes on in our field. One is that the inverse problem...are you familiar with the inverse problem?

CAF: Yes.

PER: It's there because it's poorly specified. You can't work..

CAF: Yeah.

PER: And its like: No! That's not the problem. The problem is you've posed the problem improperly. If you actually think about stuff. So, OK . The reason engineers say that is because, if you have these three things and then you have another set of things you are matching, there's an indeterminacy here.

CAF: Right.

PER: And so the...If you actually look at what goes on and how the vocal tract actually constrains certain things, the discrepancies start to disappear. Here's what I mean: So mathematically, there's very disparate shapes that can give you similar

results. Except, if your in a certain place with your tongue and your jaw and your lips, you can't physically move there in reasonable time.

CAF: Yeah. So there's a picture in J. J. Gibson 1966 of a guy sitting at a table and there's kind of a demonstration that there's multiple shapes that could be the shape of the table top from that one static vantage point. And then the guy stands up, and the transformations in that shape [contour in the reflected light] over time tell you that it's got to be rectangular or whatever shape it is.

PER: Exactly.

CAF: Same story.

PER: It's the same story, but more elegantly in a different way. And it actually is pretty simple. And what Hogden showed with continuity mapping is that, in any pattern recognition problem—he didn't particularly care about speech—if you look at something where you had to impose physical constraints—like you could only move from here to here in a reasonable amount of time, right? And you move here to here faster than you move here to here, then all of a sudden what seemed like a poorly posed, you know, unsolvable problem became tractable and then solvable. And then he left the field.

CAF: He did leave the field?

PER: Well, he's, you know, been at Los Alamos, and, aside from some attempts with Louis and myself and I think Elliot, you know, we've done a couple papers together

DPS: Who are we talking about, sorry?

PER: A guy named John Hogden who was briefly here.

DPS: Haugen?

PER: Hogden. H-O-G-D-E-N. So back to the problem. You know, part of my frustration is jumping to a question way a the end on, you know, the future of articulatory synthesis, which we'll get to. I have a couple of very positive things...Is the frustration that, still to this day, you know, you don't see people thinking about real-world constraints, time, space, as part of the solution. They're still caught in the engineering world.

CAF: Yeah.

PER: Sorry. My rant.

CAF: All right. So where are we at?

PER: OK

CAF: Looking back in your own research, what work are you proudest of?

4:26

CAF: Oh, we didn't talk about six either, did we? "What has changed if anything in the Labs' research mission in your time"

DPS: We can take it up later.

PER: We can pick it up later. Get back to it. So, on seven?

CAF: Yeah.

PER: So I see myself as a tool builder. My thing that interested me is: How do you build the kind of tools and devices so that people who are a lot smarter than you, and a lot more talented than you, can, you know, have stuff to work with. But I also sometimes differ from some of them, because I also wanted to make sure that those tools were tools that captured time and space.

CAF: Right.

PER: And so, I'm proudest that I helped, you know, to be part of stuff like that. The other thing I like is trying to put together teams. It's almost impossible to do. You know it's getting people to work together, even in a small environment. Trying to...you know you can get a great dynamic. It all depends on who's there on a given day, month, or year. So you know I liked working with the team thing. So, you know, I think that my biggest contributions here probably were in terms of things like sinewave synthesis, articulatory synthesis. But also I would try to hold some of my colleagues to...by being totally truculent with some of them to a standard that I wasn't gonna give in to certain theoretical appeals, to things like elements and things, no matter how sophisticated and elegant they were. So I'm proud of not playing that game but happy to have been doing that. And also very proud of trying to create an environment at Haskins that could help, as part of a team, because a lot of people did it: sustain a very interesting dynamic.

CAF: Yeah.

PER: That's about it on that one.

CAF: So we sort of seem to be leaving Haskins without talking about the fact that, besides playing those roles you just described, you sort of gradually moved into administration, which might have been part of your..

PER: That was very, very simple. That had to do with one individual, Lenny Szubowcz. So there was a programmer here, named Lenny Szubowcz.

CAF: I remember the name.

PER: And he wrote a program called WENDY. And I said that...It was a waveform editor and display; that's what the acronym...I said I moved over to where Paul Mermelstein was and that was across from Lenny. So I was facing him the entire time. He was very talented programmer. He was a systems programmer. And I watched him be harassed all day long by members of the staff. Not in a bad way. You know: Lenny, could you do this; could you do that, Lenny. And he didn't have good skills for protecting himself from that. Other people do. It wouldn't be an issue. And so, I went to talk to Pat Nye and Al Liberman about it, and I said; "We don't like have any management to deal with that." And they said; "Ahhhh, do we really need that?" I said: "Well, you're going to lose this guy. This is terrible." And they said: "Well, why don't you be a manager." So that's how it finally got started. And then it kind of got escalated one day when I still wasn't doing much. And Michael Studdert-Kennedy was President. I don't know if he remembers this. But he says to me: "Hey, I've caught on that you want to get promoted." I said: "Yeah, I'd like to be making some more money." He says; "OK, I'm going to promote you today to, like, Vice President." I go: "OK. What do I have to do?" He said; "Go downstairs. Fire Frank Merriweather." I said; "Fire Frank Merriweather!" I said: "We're all going to die!" So you didn't know Frank, and...

CAF: Well he was a danger. I remember he was dangerous.

PER: You should be careful about putting this into print just in case he's alive. And I don't think it appropriate, but you can edit. But he was sitting at his desk, Terry Halwes' old one. And he was chanting nonstop: "I want to kill, kill, kill. I want to see blood." You know, over and over. All the other people would just walk by, particularly the tech people, and just look: "Oh, it's just Frank." But that seemed to freak out certain other members of the staff. So I guess they went and complained to

Michael. I don't know what happened. But Michael said; "OK, fire Frank." So I called Joette. I said: "I've got some good news and bad news. Good news; I just got promoted. Bad news: I'm probably going to be dead by this evening. I have to fire this total lunatic named Frank Merriweather, who talks to his dog." So, for my own safety, I got a crowd of people in the outside room. Remember the glass window?

CAF: Yeah.

PER: The little one where George Scholes used to sit with the terminal outside?

CAF: Yeah.

PER: Typing away. I got a bunch of people. I told them: "I'm going to be firing Frank." Got Frank in. Here's the interesting thing. So he's standing where you are. I'm talking. Except he's on the other side of the room. I notice that he's not looking at me. He's looking over my shoulder. And I'm saying: "Frank, we have to let you go." I'm not going into any detail. Went on just fine. Later on next day I hear that somehow in his warped mind, he didn't identify what was going on properly. And he thought he was being talked to by the person standing over here.

CAF: Ohhhh!

PER: Who he then proceeded to go and visit. Including showing up with a gun. And that person was Vin Gulisano.

CAF: Oh my god!

PER: And Vin was never happy after that. Until finally Frank was institutionalized.

CAF: Oh my god.

DPS: It sounds absolutely paranoid schizophrenic behavior.

PER: Oh, he was very...well, we should never have hired him, but I won't go into that. I didn't. In any case, I got into administration because, in part, there was a gap at our institution as there are at many. And you know it just didn't...We needed people to be not going to people like Lenny, but to be coming to someone else who could help triage...

CAF: Right.

PER: or prioritize his time. That was the main reason.

10:21

DPS: All right. Here's a good one. How do you see your research situated within psychology and the related sciences? And has this changed since you began your research career?

PER: I haven't given a thought. I have no idea. You know, to me, looking back on it, I think it's distantly related to stuff like embodied cognition in the sense that [it looks like it]. But so was a number of other people's, you know, including Phil Lieberman's and others: Were just trying to stress the importance of real-world--in this case--physical constraints. But even like the early dissertation work by Bill Warren. Of how our biology, physiology, even our neural structures sometimes, though I don't care that much about neuroscience. But how these different things in general help to shape and constrain our cognitive abilities, in certain instances, not for all things. So I thought that was important. Beyond that, I think the field has moved on to other things.

DPS: Well before we leave Haskins, I just want to remind you of one thing. I see as a real landmark paper a paper that you wrote with Carol and Remez and there was a fourth author.

PER: Sure.

CAF: Fowler, Rubin, Remez and... Fowler, Rubin, Remez and Turvey.

DPS: Turvey! All right. 1980.

CAF: I just got a request for that, but it was from Anders Lofqvist.

PER: So did I! Oh, you're on ResearchGate?

CAF: Yeah. Did he call it "Language Production" instead of what its title really was?

PER: Yeah.

DPS: You and Robert were talking to Carol...

PER: That was the only opportunity we ever had to work together.

CAF: Yeah, I'm pretty...

DPS: Is that so?

CAF: Well, I think the way that it happened, the way it typically happened with me back then was that Turvey was invited to write a chapter or something.

PER: Right.

CAF: And he was just really good at getting his students involved in these things that would get them publications.

DPS: But you were no longer students.

CAF: Um, well I don't know about that.

PER: We were.

CAF: I mean it came out in 1980.

PER: We were when we started it.

CAF: Yeah. I mean publication was so slow back then.

PER: I think that's pretty...that's dead-on accurate. The other thing is, I think, to the three of us, and maybe to Michael too, it was an opportunity to work with each other and it would have been fun. We had different styles, and it was interesting. And part of what we were trying to do was take kind of clashing styles and theoretical views...And I think we were having some fun with that, including Michael's. And say: "Look we don't agree on this stuff, but can we come up with something that we think is useful?"

DPS: I read this paper recently and I must say, it impressed the hell out of me.

CAF: Well, you know, I don't know if you remember Phil, but we used to go to this, um...Turvey called it Friday Afternoon Club, and I don't remember it having that name, but..

PER: Drinking Club.

CAF: No, not drinking club.

PER: Not drinking club.

CAF: But David Rosenbaum would come occasionally

PER: Sure!

CAF: And Peter Kugler eventually

PER: Yeah.

CAF: And we'd sit around and you guys were talking about the cursing outfielder problem

PER: Right.

CAF: And we were just trying to brainstorm, I think, about action and perception and stuff

PER: Yeah. Part of what was going on...You know, we were very inspired when Michael had gone off for the year and come back with the action theory stuff, right?

CAF: Yeah.

PER: We were all, all three of us not counting Michael, including the three of us [and the younger ones] were interested in speech. And I think what we were trying to do is exactly that, to brainstorm and to say: "Look, how can we put these things together, because there's some clear things....?" And a lot of it was, including Michael who was very active, was trying to kick ideas around and just brainstorm them.

DPS: Yeah, well Carol made a real leap forward on that in her thesis.

PER: Yeah.

CAF: Well it was a very exciting time. I mean you and I were talking, you know, about how Haskins was very exciting at that time, and the grad students were really good at that time, and Turvey getting into action was another source of excitement.

DPS: We had a fantastic group of people.

CAF: We did.

PER: Yeah, I know.

DPS: In the seventies. I don't think...There's never been a...

PER: Yeah, it was interesting because..

DPS: cluster of talent...

PER: I mean there was kind of our group when we were coming under the Gibson influence. But a number of others too. And then there was this great group of students in Linguistics.

CAF: Yes!

PER: I mean, you know, there's a whole group—there were people we haven't mentioned, some who didn't end up so well, like Tim Rand. But you know, we had the Ports [Robert and Diane]...

CAF: When we came: Port, Nearey..

PER: Nearey...

CAF: Gary Kuhn, Tim Rand. I don't know why the Linguistics grad students were so good, because that department was so young

PER: Right.

CAF: But they were just outstanding...

PER: They were.

CAF: ...people in the Linguistics Department.

PER: And so almost all my...It's interesting, because I wasn't in the Linguistics Department, but most of my courses were over there.

CAF: Well, of course, it was "under" them right, because the Linguistics Department was in Monteith on the third floor [second floor], and we were in Monteith on the fourth [third and fourth] floor.

PER: On the fourth floor.

DPS:Lyn Frazier was a little later, wasn't she.

CAF: She was later.

PER: Later, yeah. Yeah, as we...There was overlap between us and Kugler and then Bill Warren coming in.

CAF: Yeah, he was a little later.

DPS: All right. I guess we should move on.

CAF: Yeah.

DPS: And I guess...Did you speak to to 9: What do you see is the future of articulatory synthesis?

PER: So...

DPS: Of speech recognition technology? That's..

CAF: separate

DPS: separate

PER: They are two totally different questions. So the future of speech recognition...I'm sorry of articulatory synthesis, probably the state of the art is pretty dismal at this point. And for some reason, I thought I had it here. There's one particular synthesizer, and this is the paper. I'll leave it with you. It's the work of a guy named Peter Birkholz and the work of Berndt Kroger, and we're going to be, I think, finally recently we're adapting some of this. We had a dynamics meeting here at Haskins hosted a while back. And this synthesizer came up, and Birkholz was at the meeting. So this particular synthesizer. It's probably going to become more mainstream. So here's the problem: A couple things going on in articulatory synthesis, and then recognition is a different story, and I'll give you my rap on that. On articulatory synthesis, we...surprisingly, you need the right team to do this, of people. And we've never been able to...No one's ever been able to assemble it. Instead, you've gotten [...] If you were to do a perfect articulatory synthesizer, I'm not saying the only one or the best one, but a really good one. What you would want is a full three-D model. You'd want to do what Reiner Wilhems Tricarico was working on before he...

CAF: Forever.

PER: had to leave the field, and do much better. He's at Google or something.

CAF: Is he! Oh.

PER: He finally landed.

CAF: He had a tongue model that he worked on like forever.

PER: Forever. But imagine that that was easier, and you could actually do a real tongue model in which you are basing it on things, everything from muscle control to viscosity, and you really had something that was useful instead of the fake toy that we had. Imagine, and I'm stunned that we can't do it. A lot of it has to do with individuals. And I'm not going to name names. It just never worked out. But imagine that, in addition, you had an aerodynamic model in which you could actually create sound the way it is actually created. So you need to put together a linguistic model with, in a way, you've got to be careful with that one. You don't want to constrain it too much. But you certainly want the physical model right in terms of the physiology and the acoustics of sound production. We've never gotten there.

CAF: Right.

PER: And the reason we haven't is it's really a hard problem. So we've got this really hard problem, and, at the same time, what's coming along is: Nobody's interested.

DPS: Was Ignatius interested?

PER: No.

DPS: No, he was not.

PER: I've yet to find---aside from maybe Louis Goldstein, Cathe Browman in their early days, perhaps Carol, but it wasn't her area, me, and maybe four other people-- anyone who's really interested in this particular problem.

CAF: I just wanted someone to get rid of the tongue ball [of ASY, the synthesis model].

PER: Exactly! Right.

CAF: The tongue circle.

PER: It's amazing. You wanted someone to get rid of the tongue ball, and here I am with the best model [that of Birkholz, Kroger?] and guess what; we're back at tongue ball, right?

18:22

So that's the sad thing. All these years later, we've made a lot of progress on recognition, synthesis in general. But on articulatory synthesis, we've gone almost nowhere. And we're going to *go* almost nowhere, because who exactly is going to do it?

CAF: Right. Nobody here.

PER: Nobody here. Nobody that I'm aware of. So but this [Birkholz, Kroger?]] is the best shot. I'm not holding out a lot of hope. At the same time, I've interacted periodically with the group at University of British Columbia. Not Bryan [Gick], though Bryan's now connected with it. This is the...

CAF: The Bateson?

PER: No, not the Bateson group. I've interacted with all those groups. But the...Sid Fels group that does something called ArtiSynth. And that's the attempt to do this. But it's just a joke in a way. I'm sorry.

CAF: Because it's so hard.

PER: It remains inadequate because they're caught up in the graphics and the whiz-bang stuff. And it still can't make sound. So what's the use.

CAF: Yeah.

PER: So. That's that story. Speech recognition. And I've been a speech recognition skeptic until a few months ago. And am now a 100% convert.

CAF: Uhhuh?

PER: But here's what I now believe. So prior to this, I've gone...please. So now I believe that speech recognition now works perfectly. Absolutely perfectly.

CAF: Siri does really well.

PER: Well, Siri works perfectly. Here's why. Because I never use Siri. Here's why. You say to Siri: "Siri, can you tell me how to get home from here?" And Siri says: "I'm sorry, I didn't understand you." To me that's perfect! Because it's about the user interface design. So I now use a speech recognition device. And it actually never makes a mistake. It's called Alexa. It's part of a thing that Amazon does. And all it is is a big cube...a big cylinder like this, and it's a fancy audio system. And you just go; "Alexa, could you play some jazz?" The innovation in Alexa is: Around the top, she has an array of microphones that let's her do echo cancellation and noise cancellation. And that means for the first time ever, in a noisy environment, you can do speech recognition. Siri can't do that. With Siri, you have to talk here. So that's one thing that's...All of a sudden, you're going to start seeing this in cars. But the other thing is the realization that what we mean by perfect recognition isn't what

we used to mean. Which is you're going to type a transcript of...a talking typewriting thing.

CAF: Yeah.

PER: Rather, it's about what I think speech and language are, which is a social interaction. Conversation between two or more people in which mostly you don't have any idea what the other person is saying.

CAF: Uhhuh. You're right, you're right.

PER: But it can't just be there. But you have to get to some common understanding. And I think finally we're starting to get there. But you have to break away from what we used to think about recognition. And move in to that more dynamic sense. So I think that what's driving that has almost nothing to do with speech recognition. It's the same algorithms, in the main, that you see in what's called "autocorrect" when you type. As you're typing along, it's coming up with either corrections or predictions on what you're doing. And you have a giant cloud. So this thing is a ver powerful computer thousands of times more powerful than old computers here. But actually, it's the cloud behind this and all the data that's out there that has the knowledge base that it can then tap into.

DPS: The autocorrect that comes with Microsoft Word is very annoying, because it...

PER: Right.

CAF: Makes very bad guesses. Which you don't always notice.

PER: Right, here's...And so you must, particularly, you have to proof read everything.

CAF: Yeah.

PER: But what I say to most people about that, because I really find autocorrect annoying, but what I often ask people is: "Do you turn it off?"

CAF: Right. No.

PER: No. You either don't turn it off for one of two reasons. Either because you don't want to be bothered or you don't know how. Or because it's actually providing a slight advantage over the disadvantages.

CAF: You know, I think that's true that there's certain mistakes that you make all the time like I type "langauge" all the time instead of "language" and I'm really grateful when it fixes that.

PER: Exactly.

CAF: So I don't want to turn it off.

PER: And after a while you can actually start to learn ...it took me a long...I hate autocorrect. But I started to learn. My wife is just [stunning]...then we'll move onto something else. Because she gets autocorrected all the time and she's way too cranky to ever correct it or make anything. So every message she sends out, unless it's official business, it's just littered with...I don't know what she's talking about. "Did you really mean to say so-and-so?" She goes: "You know what I meant." I go: "OK."

DPS: When you were talking about synthesis, I wanted to make a comment and then ask a question, that I visited Frank Cooper in one of his later years, and he was nearly blind and he was trying out the..

CAF: The reading machines.

DPS: version of the reading machine that was available then. And telling me it wasn't very good.

PER: Reading machines. Well, there's not, in the actual technology, for, you know, that kind of recognition, and even for the synthesis, there haven't been a lot of other advances. All this stuff that you're seeing in the Siri-like sets of things is a whole different model for how you do these things. It didn't follow the same path that those paths were on. So what it does is it changes your interaction in a way so that the recognition aspects of things are usually much better defined. So that you succeed a lot better. It really does the thing you need. Constrain and now deal with echo and noise.

DPS: All right. We better get...So now we really shift gears. Did your experience at NSF and/or your experience as Science Advisor in the White House change your views regarding priorities for better[...]

PER: So I'd say both did. In the main, NSF. So I got to NSF very weirdly. I had a stroke in 1998. Very bad stroke caused by abuse of over-the-counter medication. Dristan, Contac, all had a thing, a chemical called phenylpropanolamine in it, which caused massive bleeding in the hippocampus in women in the main. Right, and I was one of the males. They yanked it off the market, a class action lawsuit that I wasn't part of.

DPS: Antehistamines.

PER: Yeah. Right, yeah. I was totally paralyzed, right side. And had a very rapid recovery after three months. I was sitting home in bed. And it wasn't like: Oh, this profoundly changed my life. But I was just sitting around in bed, and Joette says: "You know, you should just like change your life a little bit. You know, just do something different." I said: "I don't want to do anything. Stop bugging me." And she was...I had a *Science* magazine, and there was an ad in the back of it. And it was an ad for a job at...two jobs at the National Science Foundation. She said: "Apply for this." I said: "I'm not going to apply. But I tell you what. I'll call Bennett Bertenthal. He works there. That was my connection with Bennett again. And he was actually in the higher of the two jobs. And he told me not to take his, but to apply for the other one. I applied. Never heard anything for six months. And then all of a sudden got an interview and got the job. By the way, Howie Nusbaum now has my old job.

CAF: Oh, does he?

PER: Yeah. I just saw him a few weeks ago. So when I got there, what I liked about the job was: The NSF as opposed to NIH is the only place in our government that has most of the sciences all in one building. And I just loved the notion that you could be learning about...To me it was a learning experience. That you could be learning about different aspects of science. And you really could; Talks all the time, you could go sit in on anything you want. And that was great. Turns out you don't have a lot of time for that. But what I learned was: It really helps to distance oneself totally from your own personal theoretical or even disciplinary biases.

CAF: Yeah.

PER: And I also learned that the two worst fields in terms of the inability to do that, out of all of science, are psychology and geology. And a lot of that has to do with where we are seeded in the science world, which, in the main, is at the bottom. And in other areas like the big gorilla, physics, or chemistry, or biology, they seem [...]...There's no bickering. They all hate each other like everybody else, but when they see something, they're going to pull together until they get the resources. Then they'll fractionate.

DPS: They don't have nearly the rejection rate for submitted papers, I think.

PER: No they don't. And, again, it's a whole different world. But one thing I also learned there was: Wow, there's really a lot of smart, talented people in other areas, and they actually have good ideas. And so, as a division director, I encouraged...I had 10 areas--archaeology, cultural anthropology, physical anthropology, child development, geography, psychology, social psychology, development and linguistics and environmental sciences--were my 10 areas. And what I learned...I was first asked: "Can you pare this down?" And I was going to lose the geography program. By far the best program.

CAF: Yeah.

PER: Just total innovation, exactly on the stuff I like. They were the only group that understood time and space, and how you deal with data and you work that data. Nonlinearity of data. And they had...they felt that they were an enabling field. They had no theoretical...Everyone has their own strong theoretical things. But when it came to stuff, they were: How can people work together? The only thing they wanted was an exciting problem that fit, related to their theoretical things. And they liked to form teams. A little bit like Haskins, right? And so, what I learned is that it really, really helps to distance yourself and to be open to other stuff. You're not the only smart person in the room. There's always somebody smarter. But also you can learn for your own work from people, because they'll often have theoretically interesting things you never were thinking about. Like, particularly the geographers, like the Z Domain [?] and how you warp space. None of our statistics does that, and these guys are like doing stuff. Why aren't we doing this? So that's what I learned there. At the White House, it was something different.

END OF THIRD FILE

PER: Ok so finishing that question on the White House. My White House experience was a whole different thing. I was asked to come lead what's called "White House Neuroscience Initiative," and I was intrigued because it clearly was written in part by Betty Tuller. I could see some of the language in the congressional language, and it was about development, learning, cognition and trying to do multidisciplinary stuff. And also apply some of the stuff to education. The guy who recruited me is a guy named Carl Wieman, and he and I had been fighting. So I had chaired the National Academy's National Research Council Board on behavioral, cognitive, sensory sciences. Carl, who won the Nobel Prize when he was 40...He's a physicist for Bose-Einstein Condensate. Got bored with his career, mid-career, and switched into...he wanted to...he was inspired by the work in cognition and related areas and thought there might be something in there and wanted to apply that to teaching. He's one of the "clicker" guys if you're familiar with that school. So that's by...you should shape your interaction in classroom...This would be high-end classrooms. So elite universities, physics and chemistry, and those sciences, and you shape it by having a thing [clicker] so you can get feedback during the process about what's going on. I'm not particularly into it. Anyway we had a little bickering going on because of two things, because his board, the board on sciences of the National Academy had released a report on STEM education, and I thought it was misguided. And he also was part of the changes on the human subjects regulations. So I went in to complain on my way to my job interview, I got mugged, got my neck broken, and

that was a complication. But eventually, I was there during that, and we're talking about...So I go into complain, and I know the guy and he goes...He hands me a piece of paper, which was congressional language, and that was about this initiative. He goes: "Do you want to run this thing? I go: "Are you offering me a job?" He goes: "No, go in the next room, talk to them." And I had an interview. At that point, I wasn't feeling well, and it didn't go well. And they said:" Oh, it was great." And I said: "Are you offering me a job?" And they go: "Yeah." And I said: "What's the job?" They go: "We have no idea." I said; "Oh, absolutely I'll come work with you." I love stuff like that. So I went there and unfortunately Carl got a terminal diagnosis a few months after I started, multiple myeloma. He's fine. He's going to outlive all of us. Went through a great clinical trial. But he had to leave the same day. John Holdren, the President's Science Advisory, an old casual friend, the kind you see at a meeting and go: like that, said; "Come talk to me. Could you run this for maybe a month, until we get somebody through the Senate confirmation process. That lasted three years. CAF: Of course. Yeagh.

PER: And so I had to run the Science Division. That was everything. And so, kinda..Again what I learned here is, you know: In general, something like a neuroscience initiative...I'm not the greatest fan of neuroscience...If you're clever, and there are a lot of clever people out there, it's just an opportunity. You make...You do whatever you want to do, but you say: "Wow! We're devoting money there instead of towards a bomb. Or instead of towards physics. You would think that's an opportunity. And lots of people around the country grab it as an opportunity. Except the psychologists and the neuroscientists. So the psychologists are like: "Oh, you're going about it all wrong." It's like; "We're not going about anything; make it what you want. It's like; "Huh?" And the neuroscientists, it's kind of like...Neuroscience in this country is not about the stuff...not about what goes on here or what we're doing. It's about wet neuroscience. You're doing single cell [...] and small recordings. So what I learned there is that, again, that there's opportunity out there, and so the book that I'm writing. I'm writing a book called *Obama's brain: A review of science policy from inside the White House*, which is a combination...

DPS: Say it again slowly. I didn't...

PER: I'm sorry. It's called *Obama's brain*...

DPS: Oh, Obama's brain.

CAF: Colon

PER: Colon *A review of science policy from inside the White House*.

DPS: Got you.

PER: If I ever finish it. I have my interviews to do. It's an attempt to do a little personal reminiscence, a lot like there's how did I get there, with a little bit, without getting too textbooky about all the wonky stuff you see there. You could treat that as nonsense or a threat or a menace. Or if you're very clever, and I've watched some of the more successful colleagues across the sciences who are doing good work, not the ones who are just doing stuff. Or who are really innovative. They just want to brainstorm and kick around ideas. And I realized there are some people who just know how to...who've learned for a number of reasons how this kind of works. And how you go about it. And also how you deal with rejection. So Tom Poggio...do you know Tom Poggio?

CAF: mmhmm

PER: Tom Poggio, a very well known visual scientist at MIT. Wonderful guy. And recently he got at \$25,000,000 Science and Technology Center. The last Science and Technology Center that we had, or even related to our areas, was one that Lila Gleitman had and then Mark Liberman took over at Penn called IRCS, Institute for Research in Cognitive Science. There's been no Science and Technology Center since.

CAF: Wow!

PER: But Tom, in order to...and by the way, it's just people doing the same work, ranging from...It combines biology, cognition, computational modeling. All the things you would do. It's called the Center for Minds, Brains, and Machines. And you can imagine what it is. It's people doing whatever they did, but they don't have to send the grants in until three years from [...]

CAF: Yeah, nice.

PER: And so it's nice. But he, because I was part of the process, had three years of rejection. So it often takes somebody who can, you know, hold together...So when you have an IGERT that doesn't get funded, most people give up. I know most people give up. But others go: "You know, we're going to recast it. We'll listen to what the reviewers say. But when you get a paper...A lot of people deal with reviews a lot differently. Including my coauthors,. Some people get very upset. I always look at almost every review, and I didn't do that many papers...but every review is; "Wow, somebody for free is critiquing my paper and adding something." If they said: "Change the whole thing," I'm not going to change the whole thing. Many of them say: "We disagree theoretically." And you smile, and to the degree that you can, address it. But mostly it's about actually getting a free read and getting some stuff cut off. Not always. There's always some cases...

CAF: Good attitude.

DPS: It's often the hostile reviews that are most helpful.

PER: I've never...I've gotten lots of.. plenty of hostile reviews...I've never had problems with any. I will admit that there have been some times when they would say, you know: "You've got to run 17 new conditions" that I'll do one new condition.

CAF: Right.

PER: Thank you

DPS: All right. So tell us about your work in bioethics and where you would like it to go.

PER: Yeah. So when I was at Haskins as an administrator in the early days when I started, we always did human subjects research here, but, in terms of the paperwork, you would see very little. You'd have like a couple pieces of paper maybe a month, or maybe a year. By the time I ended, there'd be a giant stack of all kind of IRB things. So...and there's an industry out there. When I went to Washington the first time, I ended up, and now we get very wonky here, getting involved in something called the NSTC, that's the National Science and Technology Council. Surprisingly, in this country, we're different than other countries, most other countries have science ministries. We don't. OSTP [network?.] Office of Science Technology Policy is not a science ministry. It doesn't direct the other ones. It helps coordinate things, and it provides advice to the President about science. So it will often talk to scientists. But it doesn't say to NIH: "You have to do this." It's not

allowed to. It would never be able to get away with it anyway. It does help to get their budgets up. We work with them on their budgets. And our highest priority always was two things: Increase budget for NIH, NSF and [MIST??]; and more support, including verbally, vocally and written support for fundamental research. That was it. So we don't have a science ministry. So we have all these agencies of the government, many of them with science as part of their mission. An entity called the NSTC is there for *inside* the federal government coordinating those agencies. It's very complex. I'm not going to get into all of the parts of it. For many years, one of the subcommittees under the Committee on Science which I ended up chairing [along the way?], but under that, was the Human Subjects Research subcommittee. I started out as ex officio on related things. And then was on that committee and took over as the chair of that committee in two different Presidential administrations. It was a committee that did pretty much nothing except, I thought, the very valuable thing of keeping an eye on the big gorilla, which in this case was NIH and making sure that their vision wasn't the only one. Because it turns out that the kind of research that we and other's do, and/or that NSF funded, and I was there representing them, is mostly about minimal risk research and isn't the kind...It's not clinical trials, it's not animal research in the main, and what you need is a system that has more common sense in which the degree of scrutiny is scaled to the degree of risk. If there's not a lot of risk, there shouldn't be scrutiny, as much scrutiny, or the stuff should be exempt.

CAF: I agree 100%.

PER: Yeah. So that's all I was trying to do there. The other thing I noticed is...It's going to be very hard to do that, because, at universities around the country, enterprises have sprung up, and they become self-sustaining. So...and you're never going to do away with it. So my main job with ethics at the time was...started with the Human Subjects regulations and then became part of a group here at Yale, a subgroup of their technology and ethics group dealing with bioethics, and I wrote one paper with some of those people on social aspects of some of these things. I continue to be involved. Going back, now to my revisit at the White House, I ended up creating, with something called the Common Rule Modernization Working Group, to try to move the revision of the regulations along. That was very, very difficult, because they hadn't moved for three years because of a dispute between the NIH, FDA, and CDC over something we don't care about in the main. Which is...in the main, though it's important...called biospecimens, tissue samples, and their disposition and how you deal with that. That all stemmed from the Henrietta Lacks issue. If you've never seen that...

CAF: Yeah, oh yeah.

PER: Read the book. It's...

CAF: I read the book

PER: Interesting book. And it's one of the few times that I was totally in agreement with Francis Collins [NIH Director]. But we needed something where everyone...So the regulations are presently being revised; they're still controversial. I think it's much improved, but we'll see if it gets done before the President's out. That's my main connections with the Human Subjects regulations.

CAF: So were there revisions to the Common Rule?

PER: Yes, there were a lot. So there were some...I apologize for the wonky stuff. There was something called an NPRM, notice of proposed rule making, that went out three years ago, in which people could comment briefly. The comments all came in and nothing happened. What was announced is that they have now a revision called an NPRM, notice of proposed rule making, is out for final comment. A number of people have asked that that be delayed until January. I think we're past January now.
11:43

There was a big phone conference. I was asked to be on it. I refused. I'm not...I'm done with this stuff. But I don't know where it stands now. But hopefully, they'll do that. You know, lots of the...most of the contention remains around biospecimens. And this is a big, big issue. Our communities were engaged...I had chaired this group that I mentioned at the NRC, National Academies...That particular group that I chaired the BBCSS, Board of Behavioral Cognitive and Sensory Sciences produced, after me, it was my suggestion that they get involved with it. I was not involved with it. Su... I'm trying to remember the name...Susan Fiske ended up—she's wonderful—chairing it. They released some recommendations at the Social and Behavioral Sciences. They were all concerned that we would ignore them in the long run. We paid total attention to their enforcement. My friends at the NSF were asked by me and others to make sure that the concerns of the Social and Behavioral Sciences were kept in mind. But all the agencies agreed to that. That was...It wasn't a problem. It's just that the other issues are so contentious (that) nobody wanted to see any distractions. The other big changes had to do with single site review as opposed to multi-site review, an additional list of exemptions for minimal risk research. And some others...We'll see where it ends up. I just hope it gets done, because if it doesn't get done with this President, it depends on who the next President is.

DPS: So: What are the most significant...going back to Haskins Laboratories now, what are the most significant changes at Haskins Laboratories and in the way that it is situated in the scientific landscape over the long period of your association with the Laboratories? And what are your hopes and fears concerning the future of the Laboratories?

PER: Well, I mean there's a number of changes. One of the major changes that I notice is that when I come in the building I have no idea who anyone is.

CAF: I know. Me too.

PER: No idea. I recognize you guys.

DPS: Barely

PER. And mostly you're not here. Barely. That's good. That's not a bad thing; it's a good thing. But that's amusing. I'm not as disturbed at all, you know, by a change in mission or things like that. I always think it's up to the people that are there. I think it's increasingly hard to keep a place like this alive. I know it was a great concern for the Presidents. The burden was always on the shoulder of the Presidents of Haskins Laboratories. All of them. I knew them all. And it was like aaaaaaah! You know it's a frightening thing. It's difficult. What I see when I go to the outside is I look mostly at our colleagues...you know, or any... they don't even have to be [directly]...and I look at the bottom: Who are they getting their support from? So one of the big changes is: We are a place that's funded by NIH. In particular, by one, in the main by NICHD, a

little bit by DCD, and some by Neurological Disorders and Stroke, but really by CHD. The change is less to us than the change to CHD and, you know, so the person who took over after Duane Alexander was Alan Guttmacher. GUTtmacher is how it's pronounced. Nice guy.

14:48

But he's like many people these days at NIH, is more interested in the genome or genetic aspects of things. That message comes down from the top. That's Francis Collins. People see things through their lens and their comfort zone. Our areas, you know, have diminished greatly. But even if they hadn't, the general ability to have the kind of careers that we all had, in the way we had them, is a lot more difficult. It's very, very, very, very hard to get grants in general. The payline is very low. But there's also people thriving both at the low end and the high end in different ways. You know, you see a lot of people. So I look at the people who are doing stuff, and they tend, we still tend to be pretty locked into an NIH model here and that we have to be I think. But...And that's not a bad one. But, you know, there's lots of people looking for other ways to get funded and working in different ways. So I think that's always an intriguing thing. I don't think the fundraising thing is the model that works well for here. Now, I mean you always look for a little bit. But that's not going to pull you out of it. I don't think an [angel?] donor that some people look for...I do think that the thing that's always been at the heart of what we do, not...and I don't mean speech, but I mean thought that's part of what's been at the heart of it, but I mean by the heart, but team work, multidisciplinary thing and trying to, you know, trying to be cutting edge and innovative is something that we have to continue to try to nurture. You know one of the things is to try...You know, sometimes things happen very serendipitously here, not totally serendipitously...A good example would be someone like Michael Turvey. Right?

16:40

CAF: Right.

PER: And you know that was because Frank, you know, thought it would be interesting. You know, the guy was a really talented guy. And Frank, I loved working with Frank. Frank was in a way one of my mentors. He's not the mentoring-est kind of guy in certain ways, but we got along great. And I was always modeling myself more after Frank, I liked his kind of approach to stuff.

DPS: A very underappreciated man.

PER: I thought so. I just thought he was great. I loved him. I just thought he was great. You know, Caryl Haskins I would say hello to. And I actually saw him more later on after, because he

DPS: You mentioned that you visited him when he...

PER: Yeah, because he was in Carlton, which was owned by my neighbor. So I could go in anytime I wanted, and my son played soccer right on the field. So we'd go over all the time and say hello to Caryl. He had no idea really who I was but...And I actually would go visit him occasionally down in DC. But I had no...I think it was like this. But he was always very coherent, you know. But Frank, you know, we'd actually have a conversation about stuff. So the reason I brought that up is: Frank was pretty good at...very open to: Let's bring someone in. Because I think Frank understood that you don't really know where things are going to go.

DPS, CAF: Yeah.

PER: And you wanted to keep that flexibility in there. Actually I think one of the best things we did, and we'll see how it works out, and it was kind of a little painful to do it, was to bring Joy Hirsch in over here, but we'll see. You know, maybe, maybe not. But you know she adds another dynamic and that may draw other things in. We don't interact that strongly with her. She's not, you know, directly part of the Haskins team. But I start to see little dynamics going on in certain meetings that I've been to here like that. And we do see that...I do think that continuing some of the interactions have played out. Others never worked out. Like trying to strengthen our stuff with USC.

CAF: Right.

PER: It's just....you know that was...

CAF: It's too far.

PER: It's too far and you know Sri [Narayanan] wasn't into it. Louis had other things going on. But other kind of dynamics like that tend to work. So I guess what my suggestion is is that you don't throw all the eggs in one basket. But it's got to be about talented young people. And you don't...you have to be a little open to that. You have to worry a little bit that the person isn't too talented...I mean, that's not the right word. There are certain people who I don't think would have worked out in the long run as well. Even though I guess good people like Jim Cutting. Because they're too strong....

CAF: Uh huh.

PER:...in their personality

CAF: Not good at being on a team maybe.

PER: Yeah. Not good...That's the right word. Yeah. So that's the other thing you find out when you do a thing like NSF. So at NSF, there's a couple things...Or NIH or any...[...] all the agencies of government. You're always having either workshops or you're bringing the agencies together or, within an agency, you're bringing people together. One person can screw that meeting up. It's known as playing well together with others. And it's really important to be able to identify. And sometimes the person is good and people think they're good like Poeppel. And you just watch him get thrown out of the meeting because he's so annoying in the meeting. So that issue really matters toward staffing here. You want to bring people in, if you can, in ways...I guess I'm a little less fond of the concept that's being kicked around here, but it's none of my business and I keep out of it, of what's called bridge funding. So I know, and again, and everybody always worries about bridge funding, particularly if you're here. You know what bridge funding is?

CAF: You mean...so you mean people who run out of support?

PER: Yeah. So Woods Hole adopted the Woods Hole mode: No more bridge funding.

CAF: Right.

PER: And unfortunately, it's cruel and harsh. I tend to be on that side. I just don't think a small place could equitably...I think you could do it, but I don't think you could equitably do bridge funding. If you don't do it equitably then you get people angry. Why is that person getting the money and not me?

CAF: Right, yeah.

PER: And I know that Ken would like to protect some of his people and other people that are not his. So he's talked about it. I still don't think it's a good idea. And I've talked to him about it and I don't think it's a good idea.

CAF: Yeah. Certainly, we tried it for, like for Bruno Repp, long ago and decided it was financially disastrous.

PER: It's very very very very expensive.

CAF: We were very tough on on people like Anders and Doug and others that lost their funding.

PER: Yeah, and I'm also not totally destroyed if the doors close one day and you can't do it any more. You know lots of things happen and places come and go. Right now actually, you know, it's a tough...It's always a tough time, but right now it seems to be doing OK.

CAF: So I got an email, probably a month ago, giving me permission to edit drafts of A40. I thought it was A40 projects. So does that mean A40 is going to be submitted again

[PER: Just so you know, but don't say it on the outside. There will be no A40. There can't be, it's not allowed.

CAF: There will be no A40. Uh huh.

PER: But that's not public.

CAF: It really surprised me that it...

PER: Just so you know, that's not public information. It think it was a bit of a pipe dream. Oh, that's OK. By the time...I think it was a bit of a dream. You know, Ken...First he didn't like the idea, then saw a reason that it could [...]. But he knows now...

CAF: I think the cycle before, it was just marginally OK, so it's not surprising...

PER: It's not going to happen.

CAF: OK. Good to know.

PER: Not that you wouldn't do it...I think the model going forward on that will be more...so in A40s in the past, as you know, there was a lot, and you did a great job of paring this down by the way...Where people just threw everything in and you were able to kind of see through to the actual mission.

CAF: It was a terrible strategy, but..

PER: It was a terrible ... but guess what? For the approaches we'll be doing you actually don't do that strategy. And so that is a bit of an enabling thing. Because you don't have to then do that. You just say more like: "Well, what are the things we want to be doing?" And then you start putting those on the table.

CAF: Right, right, right.

DPS: So what did we neglect to ask you that we sh...?

CAF: that you wish we had?

PER: Nothing. I'm just delighted that you're doing this. I thought what Pat [Nye] did was wonderful.

CAF: Well that's kind of...we're just trying to continue.

DPS: Trying to continue that.

PER: I think it's a great idea. I had made some videotapes a while back . They're probably all gone. Like years ago. With people, but gave...Probably two of them.

You've done the same thing with audio. [Up to date?] with Arthur. You know thinking that...this was originally a little follow on but I never stuck with it. Mostly I was interested in playing with my video camera.

DPS: If you have any documents or things that are in your possession that could...should be saved be sure they're not...

PER: Well, I tried to hang on to things, you know. My main regret is that some of the code disappeared over the years. You know people would...you know I look at papers and I read, both new and old papers, and I go: How are people doing all those things and I realize it's all Matlab and stuff like that...Thank you.

CAF: Thank you, Phil.