

ANECDOTE

The History of Franz and Lisp

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In 1984, while a graduate student in mathematics and in the relatively new Computer Science Department at the University of California at Berkeley, Fritz Kunze founded Franz, Inc. along with a few fellow students and one professor. Their mission was to commercialize a programming language known as Lisp (originally LISP for LISt Processor), which for a moment in time was the most widely used in the world for artificial intelligence and expert system applications.

Today, while Lisp may seem in danger of going, in Fritz's words, "the way of the dodo," he would argue that not only is a quiet Lisp resurgence underway, but a modernized version would afford a huge, unique opportunity to gain a global competitive edge in artificial intelligence (AI). What follows is an interview with Fritz, conducted by his daughter Lauren Kunze, who was in her early childhood subjected to programming tutelage entailing Lots of Isolated Silly Parentheses. They cover the history of Franz and the origins of Lisp and Macsyma, the applications implemented by customers ranging from Sun Microsystems to the U.S. government, and the future of Lisp today, including its usage at Pandorabots, the conversational AI company Lauren now runs.

Lauren Kunze: Tell us about your background: where did you go to college, and what did you study?

Fritz Kunze: I transferred to the University of California at Berkeley in 1973 from Washington University in St. Louis, Missouri.

I dropped out of high school, and never got a Tests of General Educational Development equivalent. But, I was able to enter night school at Washington University in 1971 because I was working as an Electronic Technician at their Biomedical Computer Laboratory. After passing an entrance exam, the main university admitted me as a full-time student majoring in physics and math.

Lauren: What drew you to study mathematics?

Fritz: It is kind of a funny story. My father was an acclaimed mathematician, but I found him difficult to

learn from and never really understood the field. So, when I was studying physics, the professors claimed I had a math deficit. To remedy said deficiency, I ended up enrolling as a math major at Berkeley.

Lauren: And then you fell in love with the major, ultimately pursuing a math Ph.D....

Fritz: I was working on ordinary differential equations under my advisor William Kahan: a Turing Award winner and primary architect of IEEE arithmetic [ANSI/IEEE Standard 754-1985 for Binary Floating-Point Arithmetic]. Kahan's work was foundational for things like global positioning system (GPS) and satellite technology.

I was focused on a particular problem posed by the famous mathematician David Hilbert, about how many limit cycles you could have in an ordinary differential equation in a plane governed by a polynomial right-hand side. Nobody knew the answer, but recent papers prior to 1978 had postulated a maximum of four limit cycles.

Another faculty member and Fields Medal recipient at Berkeley, Stephen Smale, asked Kahan if he could verify the recent four-limit cycle proof. But it included numbers that were ten to the minus 300, i.e., difficult to represent on computers at the time. So Kahan dumped the problem on his nearest grad student: me. And I never figured it out despite forty years of effort; although I do have some results that I hope to one day publish.

Lauren: At what point did you switch from math to computer science?

Fritz: During grad school, I was also working for the University's computer software center, installing software packages for Berkeley scientists to use in their research. I decided I should probably learn how the software actually worked, so I began taking classes at Berkeley.

Lauren: And was computer science a formal major, or was it an emerging field?

Fritz: Computer science had been added as a major by Lotfi Zadeh, the inventor of fuzzy logic, I believe sometime in the 1970s.

Lauren: How big were the computers back then?

Fritz: The initial computers at Berkeley were made by a defunct company called Control Data Corporation (CDC). Their computer was a CDC 6400, which had an absurdly small amount of memory by today's standards. Nonetheless, the computer equipment took up several rooms.

Lauren: And did students have to rent time on that equipment?

Fritz: Students did have to rent time, but given that I was working for the university, I had unlimited free time (one of the reasons I took the job).

Lauren: Always a hustler! Now, this is a tangent, but you once claimed to have invented the "first" online dating system. Please elaborate.

Fritz: This is a crazy story. Basically, none of the math graduate students could meet women with the exception of me, who had a girlfriend. So, they came to me, asking what algorithms I used. While trying to explain, I realized I could create what I called a "campus computer dating program" to match them with appropriate candidates.

The system was initially built on punch cards. We went to Mills, a women's college in Oakland, to recruit, because nearly all the Berkeley math majors were men. Campus computer dating did not really use a computer, but I already had a company incorporated as CCD where I consulted on transforming Fortran from the CDC 6400 to new Unix-based computers. Because I already had a CCD bank account, we branded the punch card match-making system—which I maintain was a precursor to modern online dating—Campus Computer Dating.

Lauren: So, in between these side hustles and your job as a "principal programmer" at UC Berkeley, did you ever actually complete your Ph.D. in math or computer science?

Fritz: Technically, I never formally left the Math Department, but Kahan had asked me to become a student of Richard Fateman in the Computer Science Department to complete my Ph.D. Frankly, I was weary of the Ph.D. cycles of elation and despair and did not want to go through oral exams. By then, I had learned enough computer science to start a company and felt that was sufficient for me without a degree.

Lauren: And that company was Franz, which Fateman co-founded. As I understand it, Franz sold a Lisp program similar to MACLISP, which was first used in a program called Macsyma, developed under "Project MAC."

Fritz: At MIT (where Fateman was a student prior to becoming a professor at Berkeley), Project MAC aimed

to use computers to do symbolic mathematics, among other initiatives. Calculating integrals posed a big problem for the U.S. government early in the Second World War. I used to run into these old mathematicians who had been hired to calculate integrals by drawing a graph of a curve and then cutting pieces of special paper called "constant width paper" to exactly fit underneath the graph. By measuring the weight of the paper, you could compute the integral.

Because computing these integrals symbolically would yield more accurate answers, the government put money into Project MAC, which developed Macsyma: a program for doing symbolic mathematics that initially in 1978 ran on a Digital Equipment (DEC 10) computer running a variant of Lisp called MACLISP.

Fateman wanted to run Macsyma on a DEC VAX 11/780 running a variant of Berkeley Unix, which required a paging version of Unix. This was built by my fellow grad student, William (Bill) Joy, funded by money Fateman obtained from the National Science Foundation. It later became the core operating system for Sun Microsystems, which was built on the Motorola 68000 family of processors in the early 1980s. One of my other Franz co-founders, John Foderaro, also a student of Fateman, built a Lisp system used to design the microprocessors that Sun Microsystems' initial computers were based on.

Lauren: In addition to Joy and Foderaro, was Eric Schmidt in the same Ph.D. cohort?

Fritz: Eric Schmidt was a fellow graduate student. He went on to a very storied career and is now in venture capital, including (presumably) various government AI endeavors.

Lauren: So, in a parallel Universe, you might have ended up at Google or Sun, but instead you went into business selling Lisp software. Why was that "the thing" to do?

Fritz: I became greatly enamored of Macsyma as a wonderful tool for avoiding making mistakes in mathematics. Today, people use Wolfram's Mathematica or Maxima to get similar results. The U.S. Department of Defense (DOD) had stipulated that Macsyma be open sourced at the end of its lifecycle. So, I realized I could build a company around it, which was in fact my initial purpose in starting Franz; and I only needed the Lisp to build this software.

But then, in the early 1980s, a company called Symbolics claimed ownership of Macsyma. Symbolics made machines solely for running Lisp efficiently, and they were very expensive. When the government decided to invest in AI, they essentially told anyone who wanted to work with them that they had to buy these very large, very expensive Lisp machines. But then commercial

hardware like Intel and Motorola processors quickly became good enough to process Lisp code as well as the Symbolics Lisp machine, so I saw a major market opportunity in building Lisp for low-cost workstations.

There is a historical analog here. Back when mainframes were everywhere, people wanted to run Fortran code quickly. So, some of the mainframe companies, in an effort to differentiate from IBM, created machines designed to run Fortran as fast as possible. But it turned out no one understood how fast microprocessors would actually develop; ultimately, it was cheaper to build Fortran machines with commercial microprocessors than building any kind of mainframe machine. Meaning, the mainframe machines went the way of the dodo, and workstations and later PCs overtook the market.

Herb Schorr has a joke: Fortran is built by geniuses to be used by idiots, and Lisp was built by idiots to be used by geniuses.

Lauren: So, tell me more about the “idiots” who built Lisp.

Fritz: Lisp was originally developed in 1958 by John McCarthy: one of the leading AI researchers in the United States.

Lauren: I believe he actually invented the term AI.

Fritz: Right, and after inventing the Lisp language at MIT, McCarthy went on to Stanford in the 1960s, where he became head of the AI Department.

Lauren: Why did he build Lisp? What was it meant to do?

Fritz: I do not know exactly, but I believe he was exploring how to build a data structure in a computer that would model the way people think.

Lauren: So that is the AI component. Who built the interpreters and compilers for Lisp?

Fritz: Initially, MIT produced interpreters for Lisp with whatever language was lying around. But when Fateman came to Berkeley, he recruited John Foderaro to clone MACLISP with sources that would be portable to less costly, more commonly used machines than the DEC 10. That clone would become Franz Lisp.

Another company in LA was also making a Lisp dialect around this time: Ill, run by Al Fenaughty. Al became a great friend and mentor of mine after a brief stint as Chief Operating Officer of Franz, and later went on to cofound the search engine Yandex.

Lauren: It sounds like a lot of initial Lisp funding came from the government. Why was Defense Advanced Research Projects Administration (DARPA) specifically interested in Lisp and AI?

Fritz: DARPA is the research arm of the DOD. At the end of World War II, the Allies asked what could be done better in the future, to win wars faster. The main thing that had really helped them was figuring out the Enigma:

the German crypto machine cracked by Alan Turing. This led to the hindsight realization that computers could enhance people’s ability to problem solve, which you can think of as AI. As a result, U.S. President Ronald Reagan authorized large amounts of military spending in the 1980s to compete with Russia and solve real and perceived future problems.

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Lauren: Tell me more about Symbolics. As I understand it, they were both your first competitor *and* your first customer.

Fritz: Symbolics was started by Russell Noftsker out of MIT in 1980, which was doing early research in AI. Noftsker has been somewhat disparagingly described by Fateman as a “routine academic manager,” but personally, I always thought Noftsker was very smart. He realized he could take this machine MIT made and commercialize it.

The idea was that a symbolic program could manipulate symbols, whereas computers typically only knew how to manipulate numbers. As a symbol manipulator, you could do things like manipulate English, including, for example, the first chatbot program, ELIZA.

Lauren: A Rogerian therapy bot written at MIT in Lisp by Joseph Weizenbaum in 1960s.

Fritz: Correct. There are a lot of funny stories about ELIZA. But, I digress.

Symbolics became our first customer when they purchased a \$5000 license of our Lisp, which was actually just a version of the open-source Franz Lisp running on the free Unix distribution. Because Franz Lisp (so named to induce feelings of false familiarity stemming from a wide awareness of composer Franz Liszt) was free, it became the most widely distributed Lisp in the world for building AI systems at the time (1984). But, we were able to sell a license because Symbolics wanted our support services in using it to run Macsyma. To run Macsyma back then, you needed a Symbolics Lisp machine called the 3600, which had a 36-bit word. Ironically, the last four digits of our first phone number at Franz were 3600, and I remember receiving a call from Symbolics’ lawyers claiming we could not use those digits because they “owned every version of 3600.”

Lauren: That is pretty funny. Where does Neuron Data fit in?

Fritz: Neuron Data was an early expert systems company, attempting to promote the programming language C as a Lisp alternative because hiring Lisp programmers was and remains very hard. But building robust expert systems proved to be even harder in C, so briefly, Lisp prevailed.

Lauren: What year did you start Franz?

Fritz: I wrote the business plan in 1984, and then recruited the founders: Fateman, Foderaro, and an undergraduate named Kevin Layer, who built the first version of Franz Lisp that ran on the VAX 11/780. A fifth founder, Keith Sklower, wanted to make the Lisp program free, but we needed money to build the company and eventually bought him out.

Lauren: So, Franz, Inc. was formed to commercialize a version of Franz Lisp—which was initially open-source—through licenses, and support services?

Fritz: Yes. After briefly considering the name Blazing Bits (after the 1974 movie *Blazing Saddles*), I decided to name the company Franz after our first product. Our purpose was to produce a dialect of Lisp that would be competitive with Symbolics Lisp and run on low cost, easily deployed hardware. Back in the day, a Symbolics Lisp machine cost \$100,000.

Lauren: Damn.

Fritz: I think Symbolics went on to have a high year in 1987 of maybe 120 million dollars in revenue. But they were out of business a few years later.

Lauren: So, your vision was that Lisp was going to be the foundational language in AI, and everyone would need a version to run on way cheaper hardware than what Symbolics was offering, and Franz would supply that product. How did you market this?

Fritz: We went to Unix trade shows and left out pieces of paper saying: “we’ll put a Lisp on your computer.” The customers were easy, because they were all the companies building small workstations, like Sun, MASSCOMP, ISI, SGI, Apollo, and Techtronics. We would charge them about \$140,000 to build a system suitable to run on their machine.

Lauren: How did you close Techtronics, your first major client?

Fritz: We had a competitor at the time named Lucid. We had tried to collaborate with Lucid, because the government had requested that the industry create a single Lisp dialect. There were many dialects floating around, including one from Xerox PARC, making it difficult to standardize. Eventually, Common Lisp arose from these efforts.

Lucid bluntly told us our people were not up to spec, and that we could not possibly succeed, and they were warning customers that going with us would cause lots of grief. Lucid tried very hard to get a copy

of our sales proposal, including by planting fake customers. So, I hatched a plot to leak fake information to them: that we were converting Franz Lisp to Common Lisp, which was infeasible due to different underlying semantics. Lucid then tried to use this falsehood against us in conversations with Techtronics, whom I informed under our nondisclosure agreement that we were actually building a Common Lisp from scratch. Which John Foderaro did in about a year, and it became our next product, Allegro Common Lisp.

Techtronics wrote me a check on my birthday. Without it, we would have gone out of business. I think it was for \$69,000—enough to make payroll. Right after they wrote the check, the Lucid guys flew out and offered to port the Lisp to a new workstation at no charge to Techtronics. Unfortunately for Lucid, we had already cashed the check.

We had another competitor, Harlequin, whom I briefly entertained buying. But, we terminated acquisition talks after I caught the founder Jo Mark’s wife going through my luggage while I was staying at their home. We poached their top Lisp programmers instead.

Lauren: Did you ever take venture capital?

Fritz: For the first six years, we funded ourselves entirely on cash flow. Around 1990, we took venture capital from a fund affiliated with SRI International, the largely DoD-funded Stanford Research Institute that was investing in entities to commercialize SRI software. They wrote us a check for \$1.5 million to develop products around licensed technology from SRI. However, that license turned out to be invalid, so we purchased the shares back at half what they paid, after doubling their initial investment in an interest-bearing account.

Lauren: Who were some key customers and how did they use the Lisp?

Fritz: One early customer was Cray Research, America’s then-famous supercomputer company. We know they were developing something for Apple, but we do not actually know how they used the Lisp, which was very memory intensive and did not work well on the CRAY. To this day, Apple’s usage remains a mystery. Years later, I would meet Steve Jobs when he expressed interest in putting Lisp on NEXT machines at the steep discount of \$5 a copy in exchange for marketing, which we agreed to do along with Wolfram and other vendors, but Jobs never marketed us. Once, at a party, an Intel exec offhandedly said: “I heard you did a deal with Jobs. Bet that’s the last one you’ll ever do.”

Lauren: So *that* is why I was never allowed to use Apple products growing up.

Fritz: Yes. Another customer was Ascent Technology, founded by the famous MIT AI professor Patrick

Winston to solve logistics problems for the government. When they wanted to move a bunch of troops during the Gulf War [1990–1991], it was historically a game of giant spreadsheets filled out by hand by captains, fueled by pizza and beer, until Ascent developed the DART system to do this automatically. DART was a very sophisticated piece of Lisp software that worked really well because it ran on Amdahl Corporation machines, which back then were the fastest machines around.

People had tried to build DART in C, resulting in a roughly 30-million-line program that took all day to compile. When you are developing large computer programs, they have hundreds of bugs, and you cannot develop new versions quickly in C. With Lisp, if you find a bug, you can change a line of code and redevelop it in compiled form in minutes, not days.

We also did a lot of business in Japan. In Europe, people were promoting Prolog as another Lisp alternative, but the Japanese ultimately decided to create a Common Lisp like the Americans. We worked with some Japanese gaming companies backed by Sony, and Nippon Steel, which were using expert systems to control their manufacturing process; they became our first distributors in Japan.

Another client, ICAD, founded by Larry Rosenfeld, made mechanical engineering software and used Lisp to power an app for airplane design using expert systems.

Lauren: What were the financials, revenues, and profits?

Fritz: Revenue was enough to support at peak, 60 people, and 20–30 on average.

Lauren: Right, eventually Lisp sales began to decline, and Franz started developing other products, like AllegroGraph.

Fritz: One of the problems with being a Lisp company is that you are selling a very complicated language with notation considered cumbersome by many that uses “lots of silly parentheses.” Most people say Lisp is no longer relevant; it is not even taught at universities anymore. But people who do use and love Lisp—including legends like Y Combinator founder Paul Graham, Ray Kurzweil, Gordon Bell, Peter Norvig, and Edward Feigenbaum to name a few—find that it makes them far more productive at building complicated programs quickly. Lisp’s decline is primarily due to a shortage of programmers willing to undertake the learning curve, who favor languages like Python.

Anyway, by the early 2000s, we knew we needed a new product at Franz, and in 2004, we were approached by a DOD group that was trying to solve the degree of connection problem, i.e., the number of branches or

links you have to go between people to find somebody who knows somebody. In this case, they were looking for Osama Bin Laden. Such connections could be represented using graph technology. Hence, AllegroGraph was born.

Lauren: Wait, so was AllegroGraph actually used to find Bin Laden?

Fritz: Ultimately, I believe they used a different solution, but they did test early versions of AllegroGraph on machines with 256 terabytes of memory.

Lauren: So, AllegroGraph was initially developed due to inbound customer interest around national defense applications, but what were the other use cases?

Fritz: AllegroGraph has found key use cases in call center applications and healthcare. Traditional databases cannot represent trees of connections, but a Lisp-based graph database can, using a notation called triples.

Lauren: When did you leave Franz, and what is its status today?

Fritz: I left Franz in 2007. It is still a profitable company running under my successor as CEO, Jans Aasman. I think most revenue comes from AllegroGraph and associated services. It is a hard market because many graph database companies have raised hundreds of millions, but Franz has continued to bootstrap.

Lauren: After Franz, what came next?

Fritz: Before leaving, I had started a project within Franz in 2002 called Pandorabots: a large, Lisp-based web service allowing people to build artificially intelligent software robots, or “chatbots.” When the website went live, it was besieged by hobbyists and university professors interested in building or teaching people to build natural language agents.

My instincts told me there may be a business here, and that the most compelling applications would be based on the ability to build a meaningful relationship with the human user. The first chatbot ELIZA proved people can form powerful connections with talking software, even with a seemingly stupidly simple program.

When I left Franz, I spun out the Pandorabots project, in 2008, which my daughter Lauren—

Lauren: C’est moi!

Fritz: Took over in earnest in 2014 while I recovered from a stroke. Since then, I have spent most of my time thinking about and planning for a next-generation Lisp.

Pandorabots, which has been profitable and growing for years, was originally conceived as a showcase for a massively scalable Lisp-based backend. I believe many of the scalability challenges faced today by large-scale consumer applications—from Instagram to WhatsApp to massively multiplayer online games—

could benefit from such a backend, if there were proper educational resources available to teach people Lisp.

That said, a number of successful companies, in addition to Franz's customers of AllegroGraph, still stealthily use Lisp. Google has hundreds of Lisp programmers working on low-cost airfare. Three massively funded quantum computer companies use a quantum compiler written in Common Lisp. Grammarly, a cloud-based writing assistant, heavily uses Lisp, as does the scheduling system for the James Webb Space Telescope. I speculate that such companies keep their Lisp usage quiet because it is a true competitive advantage. The foolish majority would rather add more machines than face a learning curve for an older language. Nonetheless, I have rallied a multigenerational brain trust who still believes in Lisp, and we are tinkering away at a feature-rich, future proof, and freely available version specifically targeting large scalable web applications. I believe Lisp can help America keep our AI edge.

Interested parties are encouraged to get in touch: fkunze@gmail.com.

FRITZ KUNZE is currently a Board Member and Advisor with Pandorabots, an AI chatbot platform he founded and ran as CEO from 2008–2014. Previously, he founded Franz Inc., a LISP company, in 1984 where he served as Chairman and CEO from 1984–2007. He received the undergraduate and master's degree in mathematics from the University of California, Berkeley, CA, USA, where he also completed partial work toward the Ph.D. degree in mathematics and computer science. Contact him at fkunze@gmail.com.

LAUREN KUNZE is currently the CEO of Pandorabots and Founder of ICONIQ, a Pandorabots spinout developing embodied artificial intelligence. She is the author of four books published by HarperCollins and a frequent writer and speaker about AI at conferences like TED, South by Southwest, O'Reilly Media, and Mobile World Congress, and for publications like *TechCrunch*, *Quartz*, *Yahoo Finance*, and *VentureBeat*. She received the graduate degree in literature and language, and neuroscience from Harvard University, Cambridge, MA, USA. Follow Lauren on Twitter [@laurenkunze](https://twitter.com/laurenkunze) or on LinkedIn.



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