Desktop Publishing Pioneer Meeting
Day 2 Session 8: Atex and TeX

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Abstract: Session 8 of the Desktop Publishing Pioneer Meeting provides details about the company Atex. As a prehistory to the desktop publishing era, Atex cofounder Richard Ying explains the company's early business arrangement with *U.S. News and World Report*, the Atex management style, and why the founders decided to sell to Eastman Kodak in 1980. Donald Knuth also talks about funding support for this research work at Stanford University developing TeX for mathematical and scientific formatting. Lastly, the workshop participants discuss various TeX spin-off businesses and the impact of TeX on scientific publishing.

Participants:

Name	Affiliation
David Brock	Moderator, CHM Center for Software History
Burton Grad	Moderator, SI SIG
Chuck Bigelow	Typography
Paul Brainerd	Aldus
Liz Crews (nee Bond)	Xerox PARC and Adobe
Chuck Geschke	Xerox PARC and Adobe
Steve Kirsch	FrameMaker
Donald Knuth	TeX
Butler Lampson	Xerox PARC

Lee Lorenzen	Ventura
Martin Ruckert	TeX
John Scull	Apple laser printer
Jonathan Seybold	Rocappi, Seybold Newsletter and Conferences
John Shoch	Xerox PARC
Bob Sproull	Xerox PARC
Larry Tesler	Xerox PARC and Apple
John Warnock	Xerox PARC and Adobe
Richard Ying	Atex
Thomas Haigh	Historian, University of Wisconsin/ Milwaukee
Matthew Kirschenbaum	Historian, University of Maryland
Dave Walden	Historian
Ann Hardy	SI SIG
Mike Humphries	SI SIG
Doug Jerger	SI SIG
Ed LaHay	SI SIG
Hansen Hsu	CHM, Historian
John Markoff	CHM
Paul McJones	CHM, Software Preservation Group

Len Shustek	CHM, Chairman
Dag Spicer	CHM, historian
Marc Weber	CHM, Internet curator

Burton Grad: Now we're going to take advantage of having Richard Ying here, even though he's not really part of desktop publishing. We know he's sort of an outlier. Richard, you said that you were sort of locked in the back room at Atex by your brother Charles and Douglas Drane. Tell us about how the company Atex started.

Atex Startup

Richard Ying: If this is the history of desktop publishing, Atex is the prehistory. Yesterday we covered the business starting up, the technology, and the customer base. When we started Atex, the three of us got together and did have a bit of background with Hendricks Electronics in publishing. That was really just to get text into the computer. We didn't know anything about fonts, getting ink onto paper, bleeding, halftones, color, none of that stuff. With the *U.S. News and World Report* contract, we got not just a customer, but we got Jonathan Seybold's dad. John Seybold taught my brother and me about printing and publishing. John is wonderful. I had this regular back problem so every now and then I would be flat out for three days. One day I was flat out, so he came to visit me at home. At that time, I was living in a house that was 40 feet above ground level on a big rock. The only thing that I could afford was a shack, and half of that had collapsed. He worked with me on lying on my back when I couldn't even get up to go to the bathroom. We were talking about printing, publishing, and all of those things. That was the kind of guy John was.

Our starting capital for Atex was $300 per person because that was the limit of our credit cards. We each decided that we would put in our entire credit cards and charge everything on then until we ran out. And that's what we did. When we signed a contract with *U.S. News and World Report*, Doug asked for a one-third down payment. They said, "Why do we need to pay you a down payment?" He said, "Otherwise, you're not going to get anything because we can't buy your computer to build your things for you." They said, "We don't know that you have anything." Doug said, "We will put your name on the computer. It's yours. We buy it in your name, so if it doesn't work, you have the computer."

That was Doug's brilliance. We got our one-third down payment, and we used that as a template for all future sales. *U.S. News* paid that. And every time we signed a new contract, we bought a new computer. Remember those 19-inch racks? Well, the top of it has space. We put the magazine or newspaper's logo on it, including *Minneapolis Star* and *Tribune*. One-third paid for the cost of the product.

Atex's Initial System Installations

Grad: What kind of computers were you getting then?

Ying: We used a PDP-11, but we had to buy a lot of other parts for it. In those days, those were 64 kilowords, so we had 128 kilobytes worth of memory running at sub-megahertz, which by the latter part of the 1970s actually broke one megahertz. We were very happy about that. We couldn't afford one computer per monitor, so it was driving 16 terminals.

Incidentally, wire service had to go in and you had to send telex out. You have to manage AP (Associated Press) wires coming in, UPS, and all of those things. By the way, we had to keep track of paper tape too because every now and then stories came in paper tape.

Later on, Doug said, "We can't afford to sell those expensive terminals. We need a lower-end product, and we need to support more terminals." He called those "reporter terminals." They were the same terminals, just a lower price, but that meant having to put more to terminals on the poor PDP-11. My brother said about the hardware, "No problem, I'll give you an extra bit on the terminal number." That was easy. For the software, we had to run with the same bandwidth and all of that. So, what do you cut out, and how do you squeeze everything in? But we managed.

And then, of course, everybody needs to justify. So, we made H&J (hyphenation and justification) manual. When you write a story, you actually don't care. It's only later on. So we made it manual. Then we had to speed up H&J. Why do we need to speed up H&J? It doesn't look good. Well, I couldn't speed up H&J because, like you guys know, the PDP-11 had no multiplier. You couldn't multiply or divide. It was all addition. You couldn't even do subtraction. You had to complement and then add. So to do multiplication, to multiply by seven, you added seven times. If you wanted to multiply 77, you multiplied 7 times shift it again, added 10 times and 7 times again. My brother said, "No problem. I'll build you multiplier hardware. But we can't charge for it."

Grad: Was this the PDP-11, not the PDP-8?

Ying: The PDP-11. I refused to go on the 8.

Butler Lampson: The PDP-11 can subtract.

Ying: It can add and subtract. It was the 8 that didn't have the functions.

Lampson: Yes.

Ying: The 8 didn't even have the real add. Right? It was a tad. To complement an add, you had to figure out the shift before you actually did the add because then you lost the carry.

John Warnock: I thought it could multiply though. I thought the 11 could multiply?

Ying: No.

Warnock: The lowest models.

Lampson: Maybe there was some really feeble 11 that couldn't.

Larry Tesler: I think the lowest model couldn't.

Ying: Yes. Later on, they had the VAX that had everything.

Warnock: There were higher-class PDP-11's.

Jonathan Seybold: There were several different models.

Warnock: Right.

Ying: We had the custom-built hardware multiplier, but it was an extra cost. Because it cost money, Doug said, "That's not a multiplier. Why do you call it a multiplier? It's called fast H&J." So, we sold fast H&J for $1,000.

<group laughter>

Ying: That's how we got the business going, totally bootstrap. I was looking at your picture, the first picture you have of the *Newsday* and newsroom. You can see those terminals here. Did I mention about the cardboard box yesterday?

Seybold: Yes.

Ying: So, you notice that this looked like a cardboard box. For good reason: I didn't want the customer to think that we had actually built a new terminal on them that looked different from the cardboard box, so it looked like a cardboard box. There's another reason why it looked like a

cardboard box. Notice a seem around the edge? That was so we could save money making the mold. The top and the bottom of the mold the same. You make the mold, you slap them together, and you save money on the mold.

Grad: How much money did you get from *U.S. News and World Report*?

Ying: I think the first order was about $150,000. We got a $50,000 down payment. We actually rented an office afterward with that. Then Doug had a completion payment and a shipment payment of a third. When we were ready to ship, they came up here and accepted the product. Then we shipped it, and we got another third. When they started production, we got half of the remaining third payment. And then there was another 15 percent ballpark left over for customer satisfaction.

I kept saying, why do you have customer satisfaction? They never pay us. We don't want them to pay us? What do you mean you don't want them to pay us? That's money in there. There is an accounting method called completed contracts. It has to be a customized; everything has to be custom. I think Boeing pushed for that long ago because it is not taxable revenue. In which case, the profit doesn't get recognized. If the customer doesn't pay us for one year, we don't have to recognize that. And if your sales go up, it can be such that you never pay taxes. So, 10 years later when we sold the company, there was accrued tax of $20 million on the books. That was the primary source of our investment.

U.S. News and World Report actually had to pony up another $100,000 because my brother, Doug, and I weren't getting paid for about a year plus. Then we ran short. I said don't pay the programmers. They don't need anything. You don't have to pay them. That wasn't quite the way it was done. You couldn't do that, but then what did I know?

U.S. News and World Report actually invested $100,000 in the company, and that was the sum total of all of the investment we received.

Grad: How much of an ownership did you give them for their investment?

Ying: I believe it was 10 percent. At the time, we thought, "Wow, they are wonderful."

Grad: Did you deliver multiple systems to *U.S. News and World Report*?

Ying: *U.S. News and World Report* started out with a production system. They had four terminals that their production department used. Instead of punching paper tape, they used our system for that initially. When we shipped, it was what today would be called a 0.8 version. We

were updating software. Before the first live production, I was at their shop for four to six weeks on a 24-hour shift with Mike McDonald [???], their production manager. Between 2:00 a.m. and 6:00 a.m., we each got 2 hours of rest on the couch in the ladies' restroom.

Grad: Did you have any other clients at that point in time?

Ying: No, we didn't. They were the only customer. We got that up and going, and then we started selling to other customers.

Atex Expansion and Growth

Grad: When was your next customer?

Ying: It was *Newsweek*. We got all of the magazines and then newspapers.

Grad: Once you got past that beginning, your cash flow was pretty good?

Ying: Right. I think that Doug was talking to a lot of people.

Seybold: Yes, he was.

Ying: But they were all waiting to see whether we could deliver.

Grad: How many people did you have working for you by the second year or third year?

Ying: The second year we grew pretty rapidly. I think that when we delivered the first system we had about five to seven people.

Grad: A year later? Two years later?

Ying: Two years later maybe 20 to 30 people. By then things started growing rapidly. We had a sales staff and developing programmer staff. We were taking kids out of school, classmates of ours.

Grad: Where were you located?

Ying: For the first year, maybe even two years, we had a one room office in Lexington. We picked that office because we noticed a trapdoor with a fold-out ladder leading up to the attic

that was open and found out our office was like about 125 square feet. That was the headquarters. All of the programmers ended up in the attic. The fold-out ladder was important because when the customers came, we folded it up.

<group laughter>

Grad: That's wonderful.

Ying: That attic was not insulated, so it was a little hot in the summer and cold in the winter. Cold in the winter was fine because computers don't mind that. When it was hot in the summer, we had a problem. Business has changed since then, how you start a business today versus back then has changed.

Atex Sold to Eastman Kodak

Grad: How long did Atex exist as a separate company?

Ying: We sold to Eastman Kodak in 1980. At the time, I think we had 1,000 people. By that time, even maybe a year before that, I realized, as Chuck or John mentioned, that you should always hire somebody better than yourself. We always knew that. It was easy for me personally because it is easier to hire up. For me it was almost a necessity because there's nobody down below.

Anyway, come the latter part of the 1970s, we started putting in professional management. We had a personnel department, and the head of personnel said we couldn't call everybody a programmer. I said, "We have a junior programmer." He was a junior in college. Then when he went to the next year, he was the senior programmer.

I realized that I had no idea how to run a company, and we needed help. At the time, Eastman Kodak was at its prime. They were in the graphic arts industry. They knew all about our customers, so we thought that that would be a good way of us to learn from them. They also wanted to learn from us about the computer systems business. We were at their research lab. The head of research eventually became their CEO. I can't remember his name. He showed us the digital camera. They said it was a 4,000 bit in one row, linear, and you run it down the plate to make the scan. They said, "We have about a 15-year window. We have to transition the company in 15 years to get out of film." He actually was conservative because the film business didn't start to go away until 2000 with the first two-megapixel camera.

Grad: When you sold the company, did you stay with it after it was sold?

Ying: Not really. They put in a new president. What I thought that I learned from them wasn't what I really wanted to learn. It's a process. Right? The company had a lot of middle management, depth of management, a big bench. The guys in the middle have no chance to go up.

Grad: When you made the sale, what did they pay you for the company?

Ying: I believe it was about $70 million. We had a revenue stream of about $50 to $70 million at the time. We were running about 60 to 65 percent gross margin.

Grad: It sounds like you sold for a very low price then.

Ying: At the time we thought it was great. But even by 1980s standards, it was already low. Of course, then in the 1990s when the bubble came, that was ridiculously low.

Grad: How long did you, Doug, and your brother stay with the company after it was sold?

Ying: None of us stayed very long.

Grad: Are we talking months, years?

Ying: I don't know. I think in title we were there for a little bit.

Paul Brainerd: Well, Charles stayed on and consulted for probably a year or so. He took me up to Rochester once. That was an experience.

Ying: Charles was more involved in it. I felt that my "best by date" was long past. I think that I've done well hiring people better than myself, including Paul and quite a few others. I have to thank you guys, John and Chuck, for looking after Paul and my nephew. You guys bought his company Auditude about four or five years ago.

Warnock: Probably.

Ying: It was only nine figures, so of course, it's a round off area. It doesn't even go up to the board. It's good to see the next generation and the next generation all doing better and better.

Grad: That's a wonderful story. It's a totally impossible story. It's ridiculous. You had no business succeeding. Fundamentally, it just shouldn't have happened. Right?

Ying: No. It should never have happened.

Grad: And it did.

Ying: But that's what life is.

Atex Digital Typesetters

Chuck Bigelow: I am curious, what were the first typesetters that you actually drove with the Atex system?

Ying: Was it the *U.S. News*?

Seybold: It was a Triple I 820 [???], something like that.

Bigelow: Is that a digital typesetter?

Seybold: It was a digital CRT (cathode ray tube) typesetter. That was a four pace typesetter.

Bigelow: Did you drive it electronically? You had an electronic interface, not paper tape?

Ying: It was electronic.

Seybold: Well, the typesetter thing, the output devices weren't there. They were in Chicago.

Ying: Oh, that's right. There was an output device in Chicago that was connected by a 1200-baud modem. There was a local Compugraphic with the spinning disk. What is that model called?

Seybold: I forget what it was.

Ying: Yes, it had four film strips, four fonts, on a drum. The fonts don't correspond, so we had to fake it to get the drum to step back if it was too wide and stretch it out because it was only for proofing. We had to lie to the Compugraphic about the font information that would come out finally on the Triple I. It was fun.

<group laughter>

Bigelow: The Triple I, was it RR Donnelley?

Ying: RR Donnelley.

Seybold: Later, they moved to everybody in the building having their own video terminals, everything written on video terminals doing pages. By 1975 those were sent out with a hold for the graphics. Then by 1977 they had a Triple I scanner for all of the halftones. They were scanning the halftones, dropping the halftones in place and transmitting directly. That came to us from multiple locations because it was printed in three different locations. There were multiple output devices, and it would be sent to all three of them at, of course, much higher speeds.

Donald Knuth: I always think it's interesting to look at source documents from the actual time. I happened to have an article called "Document Preparation Systems and Commercial Typesetting" that was written by John Seybold in February 1981. This was before the term desktop publishing. I want to read a sentence from it. At the end of it, he said, "These systems developed for commercial use may also prove to be viable in a scholarly setting. Such an example is offered by the adoption by the Supreme Court of the United States of an Atex copy processing system."

Ying: We sold products to all three branches of the government including three-lettered agencies. At the time, I don't think I was even a U.S. citizen, but I had to go Langley to install systems. They escorted me in and escorted me out.

<group laughter>

Ying: I guess those were more innocent times.

Seybold: That was standard practice for everybody. Everyone got escorted.

Grad: Thank you very much, Richard. That's a fun story.

Funding Support for TeX Research

Grad: We have a little bit of time. Donald, you asked to talk a little bit about the business side of TeX.

Knuth: Yes. I've never been very good at understanding money, but during the time I did the development at Stanford, we did have to pay for some things, so I could say a few words about

that. Scientists do have to ask for grants and renewals of grants, but it isn't the same as starting a business by any means. I had regular contacts from the National Science Foundation and from the Office of Naval Research to work on algorithms. I had also a little bit of money that IBM was paying to support research. The IBM money was more like $20,000 a year or something like that, but it was unrestricted, while the other funds I had to tell what I was spending it for. I was obviously doing research on algorithms, but of course, I was really spending an awful lot of time writing software for TeX. I wrote a few papers and then at the end of the report to National Science Foundation I said, "And by the way, in order to prepare these papers, I have some software that we used to do the formatting."

So, I was able to keep this up and get enough money to pay for graduate students to help me. We had a private donor who gave a few hundred thousand dollars to help me bring Chuck Bigelow to Stanford to supplement the salary because it wasn't coming from Stanford's endowment. It wasn't an official billet to have typography.

After a while I got a very interesting message from the National Science Foundation that said, "Don, this product is actually doing very well." Charles Smith, I think that was his name, had been given the responsibility for figuring out what to do with the money that was left over from the system development work for the missile shield at the end of the 1950s. All of the remaining money has been given to this foundation in order to do good things with it. He had given like $1 million to the Stanford music department. He came to talk to me and said, "What do you need in order to finish this project?" I gave him a few things, and he said, "No, no you've got to ask for more."

<group laughter>

Knuth: So, at the end of the project, I did have this money that was able to bring in distinguished visitors, and we had about a dozen graduate students who all, I think, contributed to the field of desktop publishing later on.

TeX Spin-Off Businesses

Grad: Let me ask you a question. In all of the people who ended up using TeX and doing their own variations and so forth, did any of them every contribute money or pay anything to the university or to you for the use of that product?

Knuth: I was very adamant that I wanted this work to be in the public domain because I didn't have any particular stake in it. I thought there was a big, big need among the mathematics community. I was very happy that I was not competing with the newspapers and trying to write a

system that was going to cause a lot of competition and other people other worries. I mostly wanted to serve this underserved community. I specifically told Stanford I was not going to apply for any intellectual property. Stanford was interested in licensing things, but I said no, this is going into the public domain. Otherwise, I quit.

Grad: You mentioned that yesterday, but I was taking it to the next step. Did anybody ever sell things using the TeX capability to the scientific market or anybody else, and do it as a business proposition?

Knuth: So, there's a couple of things. First of all, I was very disappointed that I thought I wasn't competing with anybody at first and making anybody unhappy, but it turned out that the American Math Society had been using one man's services. He wrote me and his congressman a letter. He said, "Why are U.S. taxpayers paying Professor Knuth to put me out of business?" His system was nowhere near as good as TeX. Still, when I had introduced TeX, I didn't think I was hurting anybody, but in fact I did destroy his business. This made me unhappy. I showed the letter to the NSF people and so on, and they said, "That's nothing to worry about."

Many other people did and still do get their main income because of TeX. Not only consulting services, but many companies do a lot of publishing around the world. they have expertise in TeX and they use TeX internally, especially in Eastern Europe, as I mentioned yesterday. In the Czech Republic there are many, many books and encyclopedias produced with TeX.

Grad: To your knowledge, is anyone selling it as a software product?

Knuth: PC TeX came out about 1986. Before he went to work for FrameMaker, David Fuchs had developed and sold a version of TeX for the IBM PC. It was called personal TeX, I think. He demoed that I think in the spring of 1986. It was very contemporary with the other things that Lee was mentioning. And Lance Carnes made a good business out of PC TeX. He had a client base for newsletter and user group meetings that I knew about. There was another company in Beaverton, Oregon that made TeX for the Macintosh that came out in 1987 or 1988. TeX, of course, is considered a specialty for mathematicians. There are a bunch of mathematicians, and mathematicians seem to have found that it was what they needed.

Grad: It's not just mathematicians who are using that notation. It's also anybody who is doing scientific work—physicists, a whole range of engineers, a whole range of people.

Knuth: About 10 percent of chemists, and it used to be about five percent of biologists. Now there's a lot more mathematical biology going on, so I'm getting up on that.

Seybold: Has Bob Sedgwick used it for his books at Princeton on computer science?

Knuth: I think he might have done it all on raw PostScript. I know he used InDesign for his last book, but he fought with it every step of the way. I mean he's on your board. He said he was having trouble because of the way InDesign was really not designed for this kind of book. Every time he made one change, he would have to go change a whole bunch of other files and so on. He has no limit on what he wants to put into a book.

Dave Walden: There are a number of companies that sell versions of things built on TeX, packaged in a way that meets some market. I believe Lance Carnes' PCTeX is still in business today.

Another point I'd like to make about TeX that came up in another discussion is about user groups. There has been a group for TeX since I think 1981. The early years were all about getting it on different computers, taking advantage of the fact that it was portable. Although I'm sure it's a small percentage, people in the humanities use TeX all of the time. For instance, if you're doing a critical edition, you want to have one page with one set of footnotes and then the second page point into the first page. Those kinds of people are using TeX and come to the user's group meetings.

Grad: So, it's a business you didn't make, but other people have made businesses out of it to some extent. You've contributed so much to such a wide range of people worldwide, haven't you?

Knuth: As I said, it was something that I didn't need because I had already reached my main goals, but I could see that people were being held back by not having such a thing. Still, I had absolutely no idea of trying to compete in this way. I wanted to help the people who were willing to put the extra mile in themselves in order to get some quality.

Grad: Wonderful.

