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Scriptwriter

John Warnock, the inventor of PostScript
and the founder of Adobe Systems,
plots the future of media.



By David Henry Goodstein

PostScript is to printer output what Beethoven's Ninth Symphony was to orchestral music in the 19th century: a stunning surprise. Meet the Prince of PostScript, the man whose inventive software stood the look and feel of computer output on its head, Doctor John.

Warnock is a jeans-and-comfy-sweater kind of guy among the sharks and nerds who captain the other great software

companies. In his office between meetings, he has the genteel aura of a professor (in fact he has a PhD in electrical engineering) ready to grade freshman papers. To a suggestion that he might someday be considered one of the great working mathematicians of the 20th century he gives a kind of aw-shucks reply. But his invention of the PostScript

language changed the way the world sees what's written, drawn, or scanned with a computer. Without PostScript, the magazine you are reading would probably not exist today, or worse, would look like a collection of invoices from a dentist's office.

Warnock is modest in the extreme, instantly sharing each ounce of praise, crediting his team and longtime partner Chuck Geschke at every possible opportunity.

But there is another side to Warnock: that of the ferocious competitor, the 20/20 visionary, the strategist with boardroom battle skills and the demeanor of Lao Tzu. With the anticipated July acquisition of Seattle-based Aldus Corporation, Warnock will become chairman and CEO of one of the world's largest software companies. The new combined Adobe Systems Incorporated will begin life with annual revenues of US\$525 million.

The applications that have gotten Adobe there – Photoshop, Illustrator, Premiere, and Adobe Acrobat – are tools that help create brilliant digital images, blending words and pictures. Thanks to Adobe tools, those images migrate effortlessly from print to screen, incorporate sound and motion,

and give a rich experience to viewers. This is the kind of software that will be expensive for its buyers and profitable for its sellers for years to come.

Warnock, above all, admires invention. Yes, he runs the company, but he has continued to conduct his own research with Geschke, his collaborator of twenty years. Adobe insiders were not surprised last year when Warnock abandoned his glitzy CEO showplace in a new Mountain View, California, headquarters building – for a no-frills desk in a corner of the engineering building that allowed him to “escape from the accountants and attorneys.” That’s where David Henry Goodstein caught up with him to chat.

Wired: What made you decide to be a mathematician?

Warnock: It was actually a teacher. I flunked ninth-grade algebra, but I had a high school teacher whose creative way of exposing mathematics showed me the intrigue and the beauty of it. I became enamored of the subject.

What are you reading?

Well, I read a lot of history these days, like Daniel Boorstin's books about creators and discoverers. The history of ideas and of intellectual development, how people invent things, and what causes society to change are really areas of interest for me.

What have you learned?

That really very few inspirations are bolts out of the blue. There are exceptions to that, times when an idea flops down and you can't find any connections to the past. Napier. Logarithms. Sort of – *pow!* He figured this out, and there really wasn't a deep structure behind it.

On the other hand, everybody gives Newton credit for having had a bolt out of the blue with the invention of the laws of physics. Many trends were influencing Newton, causing him to think about things in certain ways, and to arrive at the conclusions that he did. It's not coincidental that a year before he made his greatest breakthroughs, the first English editions of work by Galileo and Kepler were produced.

Isn't that era of special interest to you?

Yes, I collect rare books, especially first editions of old science, philosophy, and literature works. Having the first copy of these great ideas, seeing how they looked when they were put down on paper, being able to read those and see how the ideas were formulated is really nice. It takes you back to the roots. My work has always been very closely linked to information invention, to how people think about things and how



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culture evolved. And so it's interesting to own artifacts that represent transitions in history. **As a computer technologist, do you see innovations dismissed at first, only to return and dominate later?**

Any adoption of technology has to combine right place and right time. Ideas that were five and ten years too early have created a lot of failed companies. The timing may just be wrong, or the infrastructure may not be in place.

What are the problems you're working on solving with PostScript today?

We're at a real transition point. The communication of information over the next few years must switch off of paper onto a digital storage base. Therefore, building the tools, mechanisms, and infrastructures to make that happen has to be high on everybody's priority list. **Is this the much-heralded end of paper, the death of print?**

No, although the shift of information from a paper archive to an electronic one does mean that people won't read as much stuff off of paper. But they certainly won't store or send most information that way. There will still be local printing, still copies of reports that you'll take into your study, still books you'll read in

bed at night. There may be a growing appreciation for fine books. After 500 years of tradition and success, paper is certainly not going to just go away, but the all-consuming, tree-consumptive aspect of paper used as a transportation medium for information is on the verge of going away because of the ongoing emergence of computers that integrate sound, video, and print.

When photocopying first became successful, people said that copyright laws were dead. Well, they weren't.

Isn't this change creating problems for people who express their ideas so eloquently in print?

Sure. Newspapers have a certain metaphor for building their interfaces to information. TV stations have a different metaphor, and the two worlds really haven't communicated very well in the past. Only a handful of people can bridge this gap, successfully designing today's new information commodities.

Is this changing?

As more kinds of information become digitally based, creators expand their horizons. The people who dealt with print design are now

becoming video designers. They're learning how to use the tools and to express ideas in a time domain. But that's the transition that will be slow. The world will not just go from print to multimedia overnight.

But isn't video design still a very elitist kind of skill?

The number of designers who can deal with

print media is huge. The number in the video world is much smaller because video production has been so expensive. That is getting democratized too. You have to remember that a graphic artist had to have incredible manual dexterity in order to solve problems in print ten years ago. Our desktop publishing tools eliminated that barrier. Now, a creative person who can't draw a straight line can really create.

This means that technology has liberated designers from a craft-skill requirement, and work can be done by a much broader group of people. As the cost of media tools comes down, the same thing is going to happen with video

that happened with desktop design for print. **How far away are we from the lift-off point for video infrastructure?**

We're close in terms of the authoring tools. I mean, sure, you can build a videotape. And while there isn't an easy, cheap, widespread distribution mechanism today, I think there will be some technological announcements within the next six months that will provide the needed distribution mechanism. Once there is a more attractive channel through which vendors can distribute information products, multimedia has the potential to explode.

When you talk about interactive multimedia, the world is divided into two camps: believers in enhanced television against believers in visually competent PCs. Are TVs or PCs going to be the winners?

The amount users print is inversely proportional to the size of their screens. The bigger the screen, the more you'll read on the screen.

Well, they tried to use videotex on TVs in the 1980s and they turned out to be fairly lousy displays. They're still pretty lousy displays. Sitting there in front of a TV is sort of like getting on a train. It's a group entertainment experience, at least in most households. Everyone hates the guy with the remote.

I can't imagine distributing information that has an interactive, branching architecture to anything but a personal computer. The information tool has to go directly to the user's brain to give him or her a personal experience. Television is another entertainment experience – a 'group' experience where everybody can see a big screen. But when I want to get information, I don't want to have anyone looking over my shoulder. I always envision my information machine as being mine!

Will people in fact learn to read onscreen the way that they read books today?

I think that the more personal computer displays become like lightweight books, the more people are going to feel comfortable reading from them. A PC that you can open up and physically handle easily, that has the right kind of battery and display, will give the same visual impression as a page. Within Adobe, almost everyone gets information delivered to a screen in Acrobat. I believe that the amount users print

is inversely proportional to the size of their screens. The bigger the screen and the higher the resolution, the more you're willing to sit there and read on the screen. Still, if it's a 240-page document, you'll print it.

Can better fonts improve screen reading or is it a cultural problem that will require a generation of Nintendo kids to mature before electronic delivery can take off?

We've done a lot of work on that, and the trick is to make the right thing happen without the user having to worry about it. As we get presentation more under control, users are more willing to read more things on the screen than they were a short time ago. There is a huge amount of user engineering going on in Acrobat. It won't make a bad display into a good display, but it will help. In the end, though, displays just have to become better if they are ever to replace paper.

What role does agent technology have in this electronic environment?

Agents are essential for managing. What happens if this little magazine-sized personal computer of mine holds a million documents? Once it is no longer a problem to see or read the documents, the problem becomes how do you find them? How do you organize them? That is when you need agents to act as facilitators, to go find things for you.

You need ways for the system to alert you when information becomes available. I mean, half the stuff that's on any server you've never seen before. You don't even know what to look for because you don't know it exists, so you need a serendipitous way of finding things, of having things present themselves to you.

Do you see documents replacing operating systems or applications as the main paradigm for human-computer interaction?

No. I see the current page paradigm as an absolutely necessary interim step to go from paper-based to electronic-based information systems. But as media start to mix, the page paradigm breaks down. Now, it breaks down in ways that are interesting. Interactive documents are more satisfying than their printed counterparts. There is a value added that paper doesn't have. People add value to electronic documents with bookmarks, links, and jumps that are lost when they're printed.

Meanwhile, we will live and work in a partly paper, partly electronic world for a fairly long period of time while digital infrastructures can get put in place. The reason you can't jump from paper to a totally electronic media is there's no economic justification for doing it prior to having the digital information to deliver.

er. AT&T and the Bell operating companies are not going to "own" this business. Neither will 3DO. That dictates cooperation and standards if the transition from the paper base to the electronic delivery is to be effective.

Could this delivery platform be an extension of the Internet?

Oh, absolutely. I view the Internet as the correct model. It is a set of roads and highways with a total laissez faire kind of glue around it. There really isn't any management per se. And so I think that's a much more viable model for how the world is going to evolve than, say, CompuServe, America Online, or services like Prodigy, where there's a highly visible control structure, with a signature look and feel.

But isn't that completely different from our model of interaction with video today?

Networks are getting to the complexity point where humans are not capable of dealing with them any more.

Absolutely. Right now the only independent experience you have in front of your TV set is clicking the remote. My observation is that the younger you are, the more you switch channels. Kids have this inherent need to drink from the fire hose, so they drink from one channel for a while, then they switch – because they've got the point on one channel and now they are ready for a blast of data from somewhere else.

That's what leads me to conclude that our interactive models are not really fleshed out yet. We just haven't had enough experience with these media or new machines like 3DO to explore that space. Right now experiments are done with very specialized equipment, on very specialized platforms, to very specialized audiences. And it's sort of like when they were building the first printing presses. The expert technologists had a view and a vision that they focused on before exploring other possibilities. The way these media revolutions turn out isn't necessarily the way that they start.

It's kind of like high-band interactive graphics today. You've got people that can do it, but it's about as many as the number of monks in Europe in the Middle Ages. The multimedia community has acted very much like a priesthood. But isn't the bottom line that bandwidth is still too scarce for us to even understand what the possibilities are?

Like memory, there simply is never going to be enough bandwidth. Everyone says never worry about bandwidth, because there'll be so much of it in the future. But I've never come to a point in the many years I've been in the computer business where I've had adequate memory either.

Adobe currently is running its internal systems on about a terabyte of information. That's the common space, not counting any of the local hard disks on desktop machines. I can imagine in five years that that's going to look like nothing, because as soon as you have a resource like that, you build the applications to fill it up.

Will network administrators have to become skilled librarians and archivists?

I believe that the networks are getting to the complexity point where humans are not capable of dealing with them any more. Automation of network administration and the automation of the building of networks and the automation of the managing of networks is a huge area of opportunity because it's beyond anyone's capability to deal with.

You've become a kind of a celebrity. Has that affected you?

I hope not too much. I'm not going to lie and say that now having money isn't nice. I mean, if you have a certain amount of money you don't worry about a whole bunch of problems. But when Chuck and I founded Adobe, we really, honestly, from our hearts, didn't do it for the money. We really were frustrated scientists who wanted to get what we had been working on into the world. And Adobe has been successful enough where we really haven't changed much of that attitude. We have never been put into a psychological situation that's changed our attitude.

You had a chance actually to work at Xerox PARC during its Golden Age. What was it like? How much of old PARC culture stayed alive here at Adobe?

It's a lot like PARC. There was nothing bad about PARC itself. It was the greatest sandbox in the world. They gave you equipment, they gave you resources, they gave you people to work with who were absolutely brilliant. Adding the freedom to exchange ideas, and the lack of politics, made it a truly enlightened environment. We were told to invent a future and took that charter seriously.

It was a window into the future that very few people have had the opportunity to see, and I think a lot of the insights that both Chuck and I have about the way things ought to work are based on what we learned at PARC. I have very fond memories of our time there. The frustration level was high. That obviously resulted

from our inability to see PARC ideas turned into things that the world could experience.

Who do you admire?

I've always admired Steve Jobs. He has an uncanny intuition about good design, good technology, the viability of a thing. He thinks hard about things, and he has a huge amount of passion. He's always been a friend, and we have a mutual admiration, I hope.

There are companies whose organizations I admire greatly. 3M is an amazing company. They have 65,000 products, almost as many as they have people. How they manage this incredible output of new products is a source of amazement to me. I admire Hewlett-Packard, which has built an enormously successful institution but preserved the ability to make customers happy and keep them that way.

There are also a lot of aspects of Apple that I admire. Apple users are looking forward to the PowerPC. It's going to increase competition in the PC domain. Apple has succeeded in areas where others have had a hard time, like in Japan. They've sort of caught the imagination of a group of people in positive way.

What do you see as the future of copyright and intellectual property?

Medieval printers didn't just go around telling anyone else how to use a press. They protected their copyrights, and that tradition continued right up until the Xerox 914 copier.

Back in the 1960s, when photocopying first became commercially successful, people in the business all said that copyright laws were dead. Well, copyright laws weren't dead. People adjusted the way they thought about things, and

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people really didn't go reproduce their books on Xerox machines. They certainly did copy parts of them. But it didn't kill the book industry. **So copyright will find a new paradigm?**

Absolutely. There are ways to get compensated for things that aren't part of the model that exists today, but will appear as part of the new network environment. Adobe has actually talked to a lot of information producers about

what that model is and how it's going to change. I think that there are a lot of ways you can license information, and there are a lot of domains in which it can be controlled. It's really the business model that determines where you take your value out of the thing. **Do you see yourself being in the content business? That's where a lot of people right now feel that they'd like to go, and it seems that you have a leg up on getting there.** We've actually thought about that. I think that what consumers want to buy is new kinds of information presented in ways that they haven't seen before. And if other content providers were moving at a more responsive pace, my desire to see more content produced would go down. But while I see that there is a big business opportunity, Adobe as a company isn't particularly well suited to exploit it. Would I like to see some other people get into the content business? Absolutely. Would I like to help them get into the content business? Absolutely. Do I want to manage the content business? Not necessarily. ■ ■ ■

David Henry Goodstein (dhg@world.std.com) is president of InterConsult Inc., a media consulting group in Arlington, Massachusetts.