

JOHN SEELY *Brown*

Welcome to the InfoWorld Futures Project interviews -- a series of in-depth discussions with members of the InfoWorld Futures Board, a distinguished group of leaders in technology, communications, science, publishing, advertising, and more.

Our latest interview is with John Seely Brown, the Chief Scientist of Xerox Corporation and the Director of Xerox's Palo Alto Research Center. He offers the views of someone who has been responsible for leading one of the most celebrated and far-ranging corporate research efforts. His viewpoint is distinguished by a broad view of the human contexts in which technologies operate and a refreshing skepticism about whether or not change always represents genuine progress.

**Richard Adler**  
*InfoWorld's Futurist in Residence*

Conducting the interviews is Richard Adler, *InfoWorld's* Futurist in Residence. Richard is the president of People and Technology, a research and consulting firm in Palo Alto, CA. He was previously a program director at the Institute for the Future and associate director of the Aspen Institute Program on Communications and Society. He has taught communications at Stanford, UCLA, and the University of San Francisco. He is the author of a number of books and studies on new media, including a forthcoming report on The Future of Advertising.

**Brown on the Future**  
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**Adler:** I'm at Xerox's Palo Alto Research Center, generally known as Xerox PARC. I'm with PARC's Director, John Seely Brown, who is also Xerox's Chief Scientist, and we're talking about the future.

Alan Kay, who used to work at PARC [and is now a Disney Fellow], once said that "the best way to predict the future is to invent it." I'm curious as to what kind of future is being invented here at PARC.

**Brown:** First of all, it is one thing to *invent* a future. I think a more accurate notion is how to *enact* the future. Because enactment requires deep understanding of market forces, an understanding of how to create webs of partners, how to work with customers. The future is not invented; it is co-evolved with a wide class of players.

One of the major transformations at PARC is in the past we sat here in a very kind of cocoon-like way inventing the future. But, in fact, we didn't have much impact on the future directly until various people left the cocoon and then transformed their ideas as they went out and engaged with real market forces.

The future gets created by those who are willing to engage. So one of the major transformations here at PARC is to take much more responsibility to use the forces of Xerox in terms of its worldwide logistics, manufacturing, and sales capabilities. And also to create our own start-up companies -- start-up companies inside Xerox and start-up companies with outside venture capital in order to engage the market and move with it and enact the future.

Now you will find researchers here that are willing to champion their ideas and take them out into [Xerox's] businesses. We have streamlined that process of taking ideas into the incubation stage inside the company and then folding them back into the company or spinning them out.

But back to this notion of enactment, picking up on what Alan Kay said. I think he would agree with me that "to invent the future" is a nice jingoism but is not the real way that the world works. In fact, it is a fairly arrogant way to look at things. But being at the frontier, pushing the frontier, is still incredibly important.

## EXPLORING KNOWLEDGE ECOLOGIES

Adler:

What kind of future are you enacting? Or trying to enact at PARC?

Brown:

I would say we're trying to enact three different aspects of the future. The first is to understand the games you might call supporting and creating "knowledge ecologies." "Knowledge management" is a fad term today. A lot of knowledge sits in documents, and it's not surprising that Xerox, the document company, is interested in how we might unleash the knowledge in documents.

But a knowledge ecology says that we want to look at this as a much more organic structure. For example, an awful lot of action happens in regions. Silicon Valley is its own kind of knowledge ecology. As many ideas happen between firms as within a firm. What is it in the social fabric of Silicon Valley that enables ideas to cross-connect or to combine and cross over? What are the dynamics underlying that type of knowledge formation?

Backing it up a little bit, look at all the knowledge that lies latent in the ensemble of documents comprising the enterprise. If you looked at the collection of all the documents in the firm, what would it mean to unleash that knowledge that lies as much between documents as within a document?

But the main part of a knowledge ecology is to recognize what you might call community-based knowing. That is to say that there's a difference between "knowledge" and "knowing." We "know" much more than we "have knowledge." Knowing is an action. And so we're looking at new technologies to support creative communities, communities of practice coming together, combining their insights to create new ideas and so on.

So one level is what you might call knowledge ecologies. The second level is a rich set of support structures for what we think of as the workscape of the future. I use "workspace" rather than "office," because, in fact, we spend very little time in any one place. We're in offices, we're in conference rooms, we're in hallways, we're in cars, we're in airplanes, we're in homes. In some way, real work gets blurred with real living and these two things fold together across the entire matrix of our lives. So we're looking at ways to capture, to

support, and to engage new forms of work in the workscape and to support community-based distributed work that feeds into the community-based knowing I mentioned earlier.

## CREATIVITY AND INVISIBLE TECHNOLOGIES

Brown:

Now, on top of that, we are concerned with the role of creativity. How do we get people to focus on creativity or creating value through creativity, rather than getting bogged down by the buzzing confusion of new technologies? [There seem to be] information explosions happening around us where we spend all our time reading e-mail. Now reading e-mail is not necessarily a super-creative act. So Mark Weiser and I have been looking at the notion of what it means to build technologies that start to disappear, to become transparent to the work.

The metaphor I happen to use, being a fanatic BMW driver, is the amount of computational capabilities in today's modern high-performance cars. I think of new cars as being basically computational platforms that have wheels. But curiously, the question that never occurs in the showroom of a dealer is "what operating system am I running? Is it Windows 95 or not?"

In fact, most people are unaware that as they get into a car, they are engaging a surprising amount of computational power, probably more than sits in their office. But this computational power is there to enable them to become higher performance drivers by using the computation to keep them better connected to the world. It's ironic. ABS brake systems keep you better connected to the road in panic situations. Computational suspension systems keep you better connected in a panic turn, etc. But when you slip into the seat of a car and turn the engine on, you're completely unaware of the fact that you are reaching through the interface in the car that you're very familiar with, and coupling into a phenomenal amount of computing power.

Adler:

And of course, you're *not* talking about a computer that sits on your dashboard and tells you how many miles you have to go to your destination, which is how people generally think about a computer in a car.

Brown:

Right. That's exactly my point. I'm talking about computers' computational capabilities that are completely transparent to what you're doing, and yet they enable you to do what you're doing more effectively. Adler: Push the metaphor now into the world of work and information. Brown: Surely. I am consistently struck by the fact that when I use most of the day's technology in the world of work, I get an experience that is equivalent to walking around with two toilet paper tubes glued to my eyeglasses. Now think about this a moment. You can start to visualize what it would be like, even for a couple of hours, to walk around the world with these tubes stuck on your eyeglasses or your eyeballs. What happens? What happens is your peripheral vision is completely canceled. And therefore everything is a surprise to you because you have no warning when something comes into your center of attention. It moves discontinuously from background to foreground in a jolting way. If you do that, after a couple of hours you will either collapse into a twitching heap or you'll be left in a state of anxiety -- a state of anxiety that I find very similar to what happens when I sit for many hours in front of even some of the better Web browsers in these "modern" information systems.

I'm beginning to feel that we have been building systems that increasingly give you a kind of tunnel vision. It's like we're extending the power of these toilet paper tubes sitting on our eyeglasses so we can see further into something, but often at the cost of losing the *context* from which that thing comes. And so we're losing the ability to be located, to feel located ourselves, to see information itself located in a broader type of space.

What really enables me to exist in the world and to engage in useful sense-making is this ability to be *located*, to feel located all the time in complex spaces. Which means that we have to look at how do we honor the periphery as much as the center? How do we honor the periphery visually speaking? How do we honor the periphery cognitively speaking? How am I located in the social periphery? Visual/physical periphery, cognitive periphery, and social periphery. We have to re-balance our technologies to honor those peripheries just as much as we amplify the centers.

We have a major challenge in terms of designing useful information systems that help to rebalance this equation. Over the last 30 years, all our technology has increasingly given us tunnel vision, increasingly amplified the center and left the periphery unacknowledged.

Now you're beginning to see new user interfaces coming out of PARC and other places that pay attention to the visual periphery and the social periphery. The visual periphery [is incorporated] in things like the "hyperbolic browser" developed by a company called InXight that we have spun out of PARC. Mapped on the outside part of the screen you always can see the periphery that's dynamically changing as you change your focus. So now, whatever you're focusing on, you're beginning to see it in the context of other things around you.

**Adler:** Does this imply that there's a level of "meta-information" that provides a context for the particular information?

**Brown:** Well, the brain will extract meta-information from the displays that we provide you. Now, it's a curious thing. Should we explicitly give the meta-information? There again is the mistake of falling into the center. One of the curious things is that as a writer, as a designer, as a book designer, as a paper designer and so on, you use all kinds of implicit cues to carry your message.

For example, the difference between a manuscript and the laid out and designed *InfoWorld* magazine is a world of difference. The layout contains all kinds of implicit information -- what's important, what story is laid next to what other story, where the stories actually start, the headlines you actually use, and so on. Those all use implicit cues to communicate the interpretations that you want given for the content that is actually made manifest on the pages.

So as you look at this [hyperbolic] browser, you'll see something equivalent to what you might call layout information, as opposed to explicit meta-information. So part of this rebalancing the center and the periphery has to do with rebalancing what is explicit and what is implicit. To rebalance how you attune to something without having to attend to it.

Consider how the noises in this room and the noises in this building keep me attuned to what is going on without my having to shift my focus to understand anything. Yet, if there's a really rare sound that comes through the hallways, that will cause me suddenly to switch my attention to that sound. How is that transformation actually working in a very smooth way, so that most of the sounds leave me able to attend to you, but still aware that I'm in this broader context that we're sitting in today?

## **CALM TECHNOLOGIES**

**Adler:** You've used words like "calm" and "tranquility" to describe these kinds of technologies...

**Brown:** Yes, I think of this as pushing towards how you construct a sense of calmness in the office, a calmness in terms of being able to focus on one's work and feel really located in what one is doing, as opposed to feeling anxious. So it's calm versus anxious. It's neutral to excitement. Excitement comes from focusing on the things that you want to be able to

focus on without feeling that you've lost contact with the world.

**Adler:** You said that much of the technology today produces stress, chaos, confusion, and anxiety...and so this is the antidote?

**Brown:** This is the antidote to that. And it's also the antidote to feature-itis. We want to harness the computational and communication capabilities of today's and tomorrow's technology, not to just add more features, but to do this rebalancing so that we can restore a sense of calmness, a sense of being located as we move through our information world, second by second.

**Adler:** One of the things that the technologies of the last 20 or 30 years have done is vastly expanded our access to all kinds of information. Is what you're talking about something that would enhance that access and make it more powerful, or do you think that that whole trend has gone too far and what you have to do is to buffer people from all of that access?

**Brown:** I think we have to focus on interpretation as opposed to just content. I'm struck, for example, that it takes me approximately 4,000 hours to write a book that is read in 4 hours. It's about a 1,000 to 1 ratio. There's that kind of compression going on. As we change media and move to the Web, there is less and less compression going on. And so often we write as fast as we read. Well, if you lose this thousand-to-one compression ratio, that alone helps to explain the feeling of chaos and the feeling of being overloaded by information, because I'm really interested in this not so much as information, but as sensible, penetrating analyses, interpretations...

**Adler:** And that takes time.

**Brown:** It takes time. I remember being really struck by a wonderful piece of advice that [economist] Herb Simon gave me a decade or more ago. He was already feeling so overwhelmed with information that he would try to restrict his reading to monthlies because in monthlies you actually get writers that are willing to spend time contemplating what the significance of something actually is.

**Adler:** I just completed a paper that starts with a quote from Herbert Simon, from back in the '70s, where he says, "what an abundance of information creates is a poverty of attention."

**Brown:** Yes, that's what it consumes.

**Adler:** And that really what we need to pay attention to is not so much the information as our attention and how we allocate it.

**Brown:** You can attend to thousands of bits of information, which you have to do in order to construct an interpretation. But I'm really interested in people who have synthesized that [information] and made sense out of it, that have gotten to the core of what this information is really saying and why they think that is the right interpretation, the right act of sense-making from this information.

We live in an increasingly complex world. We don't need more information. We need interpretation. We need more synthesis. But I think we're moving from an age of analytic problem-solving to a new age of synthesis and design. How do you pull things together to make sense out of things?

**Adler:** It seems to me that most of the technologies that have appeared in the last few decades have mainly helped create and disseminate information, not to synthesize and package it in intelligent ways.

**Brown:** Right. They don't help us make sense of the world around us. They provide ways of getting us faster access, but don't necessarily help us make sense out of it. There are very few tools that really do that. I just returned from a conference in which we're looking at what tools might be available to help construct interpretations of the world rather than just flood us with more information.

**Adler:** Are there any examples?

**Brown:** Not that I think are very good. I believe that being able to sketch the napkins on tables and on whiteboards is a wonderful way to start the sense-making process. I think we need to have more visual tools that enable us draw conceptual diagrams of what we think is going on.

**Adler:** I suppose to the extent to which we're sitting at keyboards, that's not very easy to do.

**Brown:** It's not very easy to do. Even design tools, like CAD-CAM, often bring a level of precision that is more than you really want at certain stages of conceptual design. You find very few architects, for example, starting their conceptual design at the keyboard. They still sketch things out on paper and then move from there to more precise design and working drawings where the computer is very good.

## **FROM MAKING STUFF TO MAKING SENSE**

**Adler:** Let's take this idea a little further. Doug Englebart's interest in computer technology was what he thought of as its ability to augment or amplify human intelligence. I don't know that we've seen a lot of evidence that that's been the direction that a lot of the technology has been going. Is that something that you are pursuing?

**Brown:** Part of the problem is [to understand] what human intelligence is about. The role of human intelligence may be shifting. In the past, human intelligence was thought of as making us better problem solvers, and what I'm arguing today is what may be the key aspect we need is being better at sense-making. This is not just a pun, but you're finding an increasing shift in our industries from making products to making sense.

If you look at the whole notion of radical outsourcing, the actual building of a product is not where a lot of the value lies. It's the ability to make sense out of the market rapidly, before anybody else does, that is increasingly important. Then to move quickly from that interpretation to action, where you may use all kinds of outsourcing to manufacture for you. So I think that times have changed a fair amount from when Doug started.

**Adler:** And, as you look, say, at an organization, are they required to make that transition from the "stuff world" to the "sense world?"

**Brown:** Well, one thing that universities are very bad at -- and corporations are also very bad at -- is the ability to bring cross-disciplinary tools and ideas together. Universities are structured so rigidly around disciplinary boundaries that you never really get the advantage of being able



to bring multiple disciplines and their methods together to provide a fresh attack on a novel problem.

So I think that [by virtue of] PARC being, first of all, relatively small and, second of all, dedicated to solving grounded, real problems, we are capable of bringing people from the entire spectrum from physicists all the way through sociologists, anthropologists, and artists -- increasingly so artists -- bringing these different sensibilities, if you wish, to bear on trying to crack some fundamental problem.

**Adler:** A phrase that you've used that struck me was "pioneering research," which you've characterized as different than the sort of typical R&D work. Can you talk a little bit about what you mean by "pioneering research?"

**Brown:** Sure. Pioneering research that is grounded in real problems and radical. Radical in two senses of the word: radical in the original Greek meaning going to the root and radical in the more popular or "rad" sense of the word meaning willingness to reframe the problem as you go to its root, so that you aren't stuck with just one conception of the problem as you travel to the root of that problem.

I am increasingly convinced that radical, grounded research, or pioneering research, is where there is incredible pay-off. With this you can start to explore the white spaces between disciplines which are relatively unexplored.

I think that what we're up to here is this balancing and honoring the creative tension that exists between two modes of thought. One mode is relatively conservative, highly grounded, scientific research. The second involves more of the playfulness that you associate with artists. So what we're looking at is how to have the playfulness coupled with the deep grounded scientific-ness so that these fleeting, inspiring ideas that come from the playfulness can quickly move to highly robust systems. We are trying to get a rich interplay between scientific thought that helps to make ideas real, solid, and trustworthy and the playfulness that guarantees us being at the cutting edge and the frontier.

It's very common to see places that are very much at the playful frontier, but they traffic in vapor-ware or papier-mâché. It's also easy to see research centers at the opposite end that are deeply scientific but often are quite boring. We're trying to bring both of these spheres together to enact the future with really solid, robust, well-grounded systems.

So from an academic point of view, I like to think that we have moved from being ivory tower people to ivory basement people who are willing to think out of the box and have wonderful ideas, but ideas that are deeply grounded both in what the world needs and the best that science can tell us.

## **ARTISTS AND SCIENTISTS**

**Adler:** The PAIR Program [PARC Artists in Residence] is a case where you have brought fine artists into PARC. Why did you do that and what have you gotten out of it?

**Brown:** The PAIR Program has been a wonderful adventure for us. It's an ongoing adventure where we bring in artists that get paired with scientists, where the two of them work together on some problem for some period of time. The artists bring their perspective; the scientists bring their perspective.

**Adler:** What has been the program's impact?

**Brown:** I think it has changed the milieu here to appreciate the role of aesthetics. It has allowed an awful lot of latent interest in the arts to surface in a building with a whole collection of scientists.

But this brings us to a much more fundamental issue. As this world is rapidly changing, it is constantly pushing the boundaries of new genres – not only new genres of film or of documents, but new genres of technology. As you push those boundaries, logic is not the governing factor. So what replaces logic? Well, market connectedness in terms of latent needs is one [replacement]. But the second may be a sense of aesthetics.

Aesthetics is what guides us and guides artists as they push the boundaries of their own genres. What other guide do they have but aesthetics? Yet the sensibility of going beyond logic, going beyond the rational, and looking at aesthetics as a guiding principle is something that is relatively void in the technological community. So we are bringing aesthetics increasingly into our consciousness, starting with the PAIR Program and then recognizing that we need guides and constraints as we push these frontiers forward.

**Adler:** Let's go back to documents. You've used that word a couple of times in this discussion, and Xerox is the "document company." What's so important about documents? Why is that such a central and powerful idea?

**Brown:** The power of the document is a wonderful thing to focus on for us because it transcends technology. It is not a technological notion. The document an incredibly powerful social artifact that brings people together, that helps to create a common set of experiences in the community, in the social mind.

The document is one of the ratchets of civilization because documents capture what we know and enable us to pass that on from generation to generation in a moderately efficient way. Documents are interpretations that have been structured to facilitate human comprehension, that make it easier for us to understand and to pass on our heritage.

So, if you wish, the document is a critical part of the fabric of our civilization. It is the bridge between the individual and the social. It is an incredibly important social artifact. By focusing on that social artifact and how it works, we can look at new forms that are made possible by technology, and new ways to use technology to support the value-creating activities in and around the document. So it enables us to go beyond products, but to focus on something we think is critically important to society.

## **THE SOCIAL LIFE OF DOCUMENTS**

**Adler:** You've written about what you call the "social life of documents." Can you explain what you mean by the social life of documents? What is that social dimension?

**Brown:** The social life of documents has to do with the fact that we as a community tend to construct interpretations around a document. So there are multiple readings of the document that bring us together to debate those interpretations and so on, or to create a common set of experiences.

For example, look at the newspaper. What the newspaper does is not deliver information as much as make news and create kind of a glue for the social mind by providing a common set of experiences every morning. [Each edition] is kind of like a 24-hour best seller. "Everybody" reads the *San Jose Mercury News* or the *Wall Street Journal*, depending on what audience you're in. So you can be sure each morning that everybody has that same set of experiences, which in a very powerful but subtle way fosters conversations as you



walk in the building, step into the elevator, and so on. It creates a kind of common ground around which conversations start to form.

**Adler:** Well, if we end up in a world of a zillion channels and everybody has their own customized newspaper, which provides me with just the information that I want, which may be different than the information that you want, then that commonality will go away.

**Brown:** Yes. I'm not a strong proponent of the notion of an individually tailored newspaper. Now you may want to have an individually tailored information sheet about fast-breaking things that are of particular interest to you, but a newspaper that is individuated in that way ceases to be a newspaper; it becomes an information sheet.

**Adler:** What you're saying, then, is that newspapers serve social functions that are important to sustain a community and that are at risk if we abolish them.

**Brown:** A newspaper, first of all, makes news. It makes news because it is creating a commonality in the social mind at one particular point in time.

But, contrary to what many people think, it also provides a very efficient way to find information, because of the ability to scan a newspaper to find things that you don't even know that you want to know. So the problem with any of these tailored systems is that it is very hard to ask questions you don't even know you want to know about. A good newspaper, well laid out, has a very subtle property of being able to lay one story next to another story, such that if you're interested in this story, then this thing next to it may be also intriguing to you.

## **SMART MATTER**

**Adler:** I understand that here at PARC you are also working on developing "smart matter." What is that and why is it so important?

**Brown:** Well, it's one of the examples of pioneering research at PARC. If we look at the capabilities of the Silicon Age in terms of our photolithographic tools, our production lines, and so on, we can actually start to build micro-machines. We can start to build, as Paul Saffo was talking about, micro-sensors, but we can also take sensors and build micro-effectors, and we can put logic between those sensors and effectors.

So we're moving into an era in which we start to build virtually organic material, material that has an almost living property to it in terms of having a lot of the properties like your muscle has in terms of being able to respond to stimuli automatically: compensate for vibrations, for example, or to be able to cancel sounds. . . to do a whole range of amazingly accurate things.

So if you can build new devices out of matter that may have thousands if not millions of sensors, effectors, and smart computing linking the sensors and effectors, that's a whole new type of material. One obvious example of why we are interested in this is: how do you move paper extremely accurately and very, very rapidly in building fast color printers? Or what it would mean to be able to use substrates that have millions of little fingers that each move 10 microns, but can sense where something is and can then move it along its path, correct certain mistakes in terms of how the paper gets there, and so on and so forth.

There's a whole new class of what you might call "smart stuff" coming along which smashes computing, sensing, and effecting all together in structural materials. The most obvious example would be "smart beams" that have sensors and effectors built into them

so that as they start to buckle, maybe there's a way to cancel that buckling moment in the beam and to strengthen it by generating a micro signal that breaks down that buckling wave, just as it happens, at the exact right spot, at the exact right time, and thereby tremendously strengthening that material.

## THE RISE OF SOUTHEAST ASIA

**Adler:** We only have a couple of minutes left and I want to change the context for a moment. One of the places you've been to and have some interest in is Malaysia. There are some interesting developments going on there. There are plans underfoot to build something called the "Multimedia Super Corridor" that is intended to move this country into the 21st century. I think you've been a little bit involved with that. What is the vision of that, and what do you think is the importance of what they're doing?

**Brown:** Well, I think it's tremendously important to look at the whole issue of Southeast Asia. I happen to be very interested in developments in Southeast Asia. I spend almost every vacation I have in Southeast Asia.

In Singapore, for example, you can see the ability to go from a truly under-developed country to a major industrial power in a surprisingly small number of years. And it is now moving in a very rapid way into becoming a major player in the information age. You see the similar kind of thinking now in Malaysia that you saw with Li Quan Yu in Singapore, but with slightly different political bents. They are trying to create a whole country within a country, if you wish, that is going to be completely based on the cutting-edge Internet-type technologies.

**Adler:** So, what are they doing to move themselves into the future, and are there any lessons for us?

**Brown:** It's interesting to see groups that don't have legacy systems. So, for example, we have huge sunk investments in this country in terms of the telephone infrastructures, in terms of the copper, and so on and so forth, the types of switching technology. What would it mean to just jump-start everything without having to have any legacy systems?

Building an "electronic government," for example, is one of their main thrusts. They will have no paper documents in the government, which will be all managed by very sophisticated kinds of electronic document databases with very interesting types of interfaces to the public. Smart schools, starting out from scratch. Building the schools from ground zero. Greenfield schools that will be completely based upon optic fiber everywhere. Internet technologies everywhere.

And so what I find so interesting is to see how these countries that have no legacy systems can start as greenfield sites and move very rapidly, as Singapore did in constructing very sophisticated ports. Now what Malaysia is trying to do with its Multimedia Super Corridor to build an entire country within a country around the most modern types of digital infrastructures.

**Adler:** One last question. Imagine you could be 100 years in the future from today. It's the end of the 21st century; what would you want to know?

**Brown:** I'd like to know if our notion of progress is right, or if, in fact, we're kidding ourselves in thinking of progress as progress. And whether the quality of life and living has really improved.

I think that we tend to see things so locally that we may be losing sight of the direction that we're actually headed. So it would be very interesting to be able to step back, as historians do now, look back at 100 years and see how we kidded ourselves. In what ways did we kid ourselves? In what ways did we think we were actually helping humankind that actually led to quite the opposite result?

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