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Visionary Insights from the Xerox Experience

by Leon Enriquez

Reading Time:
18 minutes

Reader Benefit:
♦ Learn from the insightful ideas and perspectives of well-known IT guru Dr John Seely Brown;
♦ Observations about a wide range of topics relating to IT and the knowledge-based economy;
♦ Discover what the future holds for you in the Internet age.

To the uninitiated, talking to Dr John Seely Brown is like going through a mental stress programme. Emphatic, deep, precise and measured, Dr Brown speaks a tongue that leaves his audience with a sense of profound understanding that is both unsettling and reassuring.

But for a man who has been at the helm of one of the world's top research centres, mincing sharp words to crystallise his ideas is perhaps as natural as going on a vast cross-country motorcycle ride through the back roads of the U.S.

In a rare exclusive interview, Dr Brown shares his views on a myriad of topics (during his visit to Singapore in 2000).

Visionary Insights from the Xerox Experience

by Leon A. Enriquez

Xerox Corporation's Palo Alto Research Center (PARC) is one research facility that needs no lengthy introduction. The centre's numerous achievements in high-technology is exemplary of what a rich pool of talented researchers are capable of doing. And finding the right environment for talents to grow and shine is one of Dr John Seely Brown's top concerns.

Dr Brown, former director of Xerox PARC, and presently a corporate vice president of Xerox, highlights the need for new blood to get to know a "community" as soon and as much as possible, before they would be involved in mainstream discussions. Citing how researchers' initial sharing of information and ideas led to others adding to the "knowledge base" – and thereby providing another way of learning for others – he encourages participants of the community to *"link-and-lurk"*, so that they have time to get to know the community before participating in idea exchanges.

This *"linking and lurking"* – a phrase Dr Brown uses to refer to this practice of letting participants passively know what ideas have been floating around and progressively learning how to contribute ideas and suggestions – is another way of learning that should benefit the corporate world.

"There is a great opportunity to understand that almost all learning happens through apprenticeship learning. You can be an apprentice either to a master or to a community of practice," said Dr Brown. "We started developing this notion in Xerox a way to transform our tech-reps (technical representatives) – the people who repair all our office equipment – how they could take the ideas they discovered in the field and distribute those practical ideas as a learning mill for the other 22,000 tech-reps that are using the Web."

The result was the Xerox Eureka, an innovative information system originally for knowledge capture, creation and sharing. The basic idea was to help people trying to learn by linking and lurking on the virtual periphery today, and moving on to the centre to trap ideas the next day.

Dr Brown explained, "The idea is to create a learning context where you use your peers to help refine the idea – not some random opinion but some trustworthy idea. Because what we really care about is how do you create knowledge that you trust enough that you are able to act on. In the corporate world, action is what matters."

According to Dr Brown, people have to look at how to construct learning environments simply because new knowledge to be shared needs to be trusted by the community sufficiently before it can be acted upon. This learning mindset is radically different from the university context. The tact here is to look at the learning environment with a highly pragmatic viewpoint rather than just a simple problem that needs to be fixed in a static way. In other words, learning needs to be dynamic and spontaneous, and connected to the actual human experience.

"Our discovery was that a lot of corporate training was just pouring information into the heads but they didn't lead to action. To become a part of the community of practice, the community must be constantly testing and sharing ideas. So, you learn by being a member of the community of practice," noted Dr Brown.

For instance, the fundamental way to learn on the Internet depends on how the learner feels towards a certain subject. Considering that there are millions of these communities of interest on the Net, no matter how narrow your interest is or even how bizarre, there has to be a community of interest somewhere in the world to match your interest. It is now possible for, say, a kid to "link-and-lurk" on the periphery and become a kind of a virtual apprentice to the masters of such a community of interest.

"What's so interesting is that there is no extra work. It is not a question of designing new curriculum but a question of saying that it is a naturally occurring asset," said Dr Brown. "And how do we leverage on those assets more, and how do we transform those assets to communities of interests as resources where students can learn? How do we generalise cognitive apprenticeship from the Internet to this new form of virtual apprenticeship?"

From Lab to Business World

One of the keys to success at Xerox PARC is to continue to be at the cutting edge of thinking. The centre has found increasing powerful ways to use diversity to challenge its own beliefs. Likewise, Dr Brown believes that the key to innovation in the corporate world is being able to challenge one's own assumptions. But it would be difficult in a hierarchical organisation to "check your own eyeglasses – your own conceptual lenses – and challenge your assumptions of the world and your current business models," said Dr Brown.

"In PARC for example, we have people from different disciplines. We have people from assorted backgrounds such as physics, maths, computer science, anthropologists, artists and designers, etc. That creates a very rich ecology. We are thinking about how to create a knowledge ecology that has enough diversity that any particular point-of-view gets challenged productively by a slightly different point-of-view from different discipline-based people," said Dr Brown.

Dr Brown even ventured as far as using young people to add that extra perspective that might help trigger new idea creations. "For example, 15-year old kids employed as researchers at PARC means that they bring a whole new perspective. We hire kids from several countries – which for you in Singapore is natural, but for the West is not so natural – to bring in different perspectives and cultures. We are trying to create this ecology that leverages diversity that helps to facilitate radical brainstorming."

"This challenges the many dear and sacred beliefs that we hold individually, and thus helps us see situations afresh. So the key to innovation is being able to see differently. And to be able to say what you see in a clear, compelling way."

But how can researchers here hope to achieve the sort of breakthroughs Western R&D centres can? "Think out of the box, consider multiple and diverse points of views. Learn how to work across white spaces between disciplines, because in each discipline, most things have been explored. But there is an unknown white space between the disciplines. Each discipline is a silo to itself, which means a lot of things are possible between."

"As Singapore moves into life sciences, the whole ability is to use new tools to probe life sciences. IT has helped Singapore developed a platform for future advances in life sciences. But life sciences really bring about a lot of differences together. And learning how to do that is critical. It is the same with my 'smart matter' – organic chemistry has become key for us inside PARC."

Technology and Social Responsibility

Social responsibility in the light of technological pursuits is another issue Dr Brown holds close to his heart. "I think it has to be impressed on people to be more socially responsible for their environment and community," he said. "Technology and society forms two elements of a co-evolutionary system. Both move ahead at a certain pace. But now with the e-world, in this era of radical entrepreneurship, technology is in some ways moving faster than society. I think in order to bring it back to the balance, we must first of all, have to design technology that is much more useable and much more transparent to society."

His view is, instead of expecting society to always adapt to technology, technology should adapt to society. "We need to better educate the world on what are some of the world's technological issues at stake here. Not just seeing from the old point of view, but what maybe some future calls of concern. This is not to constraint things but to open the dialogue and create public deliberation on some of these types of issues."

He observed that public and private sectors – and sometimes involving a third sector or not-for-profit organisations – are paying attention to issues that come not only between society and technology, and also issues around national harmonisation. Because the e-world cuts across nations, people don't necessarily have all the right institutions to understand one another's concerns and points-of-views.

"It is going to be more important than ever that we learn how to honour local cultures but still get the best benefits out of a global economy. We have to become better as entrepreneurs or government organisations. And we have to learn how to see the world differently; to see the world from different points-of-view and in some cases, to see the world in truly the customer's perspective," he highlighted.

Advice for Entrepreneurs

For entrepreneurs, Dr Brown's key message is "Think Customer". "Put yourself in the customer's shoes and look at the world through the customer's eyeglasses," he stressed. "In the entrepreneurial world, we are going to be involving all kinds of organisations and new kinds of businesses and offerings. Going beyond the old bricks-and-mortar companies to the new business hybrids, we have to be willing to look afresh at what are the sources of frustration that we have as customers. We must get to the root of the customer's frustrations and make change or create offerings to create value that helps resolve such frustrations. That is the key to being entrepreneurial."

According to Dr Brown, you don't have to be a start-up to be entrepreneurial. The power of being entrepreneurial is being as important to the large corporation, maybe even more importantly, than in the small organisation. Both types of corporations need to understand how to challenge the status quo. But to do so, they must understand where the real value proposition lies and where the real business model lies.

For instance, organisations can't just say that they have a radical idea, and in the dot-com world, all that matters is a radical idea! That era passed some months ago – with the Nasdaq tech stock crash! Now they have to be able to say why their idea matters, why it has lasting value, and what their real business model or secrets of business models might be. These are the kinds of thinking that large corporations have to become more agile in doing than simply being dot-coms.

Answers in Nature

But how can society find new ways to solve problems brought about by technological advancement? Dr Brown believes nature has the best answers to some of the problems we face with technology. Similarly, the corporate world can reconcile with this idea by copying nature for the formula to corporate success or business success.

"I use a metaphor that helps me think through this issue," he said. "It comes from the East's notion of Judo – organisational Judo. How do you let the world do most of the work for you? How do you use these naturally occurring forces, not work against them but blend with them, to move with them? How do you really understand what those forces are, because they are always latent and not at the surface?" Like learning Judo, businesses and societies have to learn how to read the context very quickly to see how to face the force against you and do something with it.

According to Dr Brown, this style of thinking applies not only to how partnerships are built, but also how to let nature do the work. That requires alertness so that nature can be turned around and be used as a feature and not a foible.

"How do you turn foibles into features, or how do you transform constraints into resources? Look at what a really good architect does. Invariably what separates the great architects from the normal ones is that, if you give a great architect a really constrained environment to work in, those constraints will be transformed into resources," explained Dr Brown. "For example, take the Guggenheim Museum (in Bilbao, Spain) by Frank Gehry. Look at where the museum is placed? Look at how it was built under the bridge. Look at how that whole terribly constrained context got used as a resource to help bring that building to life. Instead of building that beautiful museum on a hill offered to him, the architect chose to put it right down there in the centre of the city!"

Radical Learning

Dr Brown shared his feelings about learning and compared it to the learning experience in schools where there are curricula to follow, and what's the best way to learn. The learning environment has become so dynamic that continual content updates are inevitable in order to give students the latest information.

"I think that you definitely have to supersede the basic schooling curriculum over time with the latest information updates. Not that some curriculum is not important but we may be placing too much emphasis and time on them rather than engaging them in projects that will unleash the passion of the student, often through collaborative learning projects," said Dr Brown.

"If you see a 12-, 13-, or 14-year old, willing to work in groups building amazing things, you'll understand the significance. What they are learning is incredible! And they don't think of that as learning but creating. In the act of creating, you are learning but you are learning in a situation that makes sense – why it matters to finish the project. These creative individuals are creating with a fun attitude, and the results are compelling."

To Dr Brown, there is need to radically re-think our learning environments. The change will help capitalise much more on natural learning and organic learning and avoid looking at things out-of-context.

"I ran into a 15-year old here who was visiting Singapore. I asked him what he did and he told me that he loves to build website design. As a joke, I said that if you love to do it so much, you should start your own company. He looked at me oddly and said: 'I do.' The kind of learning that this kid is doing in the process of building this company is fantastic in understanding customer's needs and design, programming and Java."

In an opening learning environment, it will not only become a natural recurring resource but an incredible way to transform the way we all learn. Thus, Dr Brown agrees with the cycle of learning, unlearning and re-learning as the most innovative way to learn. "First of all, with learning, you have to engage this process with a passion in lifelong achievement. It's not a question of passing exams which might become obstacles if you spent all your time preparing for the exams. If you are not trying out new ideas, or trying out your ability to triangulate what you want to believe or not believe in, then you're not putting learning to good use."

"Now, what I am also saying is that we have come through classical education and have become very successful in large-scale corporations where our very success is a problem. It is a new kind of success disaster. The old success disaster was that you were so successful that you couldn't scale up your product in time. The new type of success disaster is being so successful now but the practice that you have evolved over the years that made you successful need not constantly keep applying," said Dr Brown. "I am saying that we need to keep track in this new world we're in where the Internet is transforming the infrastructures that we are used to live, work, learn and do commerce."

Transformational Change

The Internet is bringing transformational changes in many facets of our lives. By transformational change, Dr Brown meant that there will be a lot of unlearning for successful businessmen or technologists. The way that products are built, the way that technology is invented, the way people make money now have to be re-thought, stressed Dr Brown.

"Many of those successful practices are so tacitly held that we are unaware of what those assumptions are. Ideas that are dear to us – that we created certain set of assumptions 10 years ago – may now be dead-centred wrong," highlighted Dr Brown. "The accelerating pace of change is going to continue at least for the next 10 years. The Internet is truly a transformational infrastructure revolution, simply because transforming the infrastructure is going to affect every aspect of living, working, learning and commerce."

"As an infrastructure change, it is at least as great as electrification was. The bringing of electric power into the home, into the city, into the building changed where cities were located, changed architecture, changed every aspect of how people live, work and learn. The same is happening now. That's why the next 10 years or so is, in my opinion – and I claim – a kind of the peak of innovation of this infrastructure change. Bear in mind that any infrastructure change takes 20 years to permeate society. First, a 10-year period where everything changes, and then, relative stasis afterwards," he said.

This therefore is a great period for being an entrepreneur who is willing to relish challenging the status quo, said Dr Brown. Given that scenario, leaders are also arguing that the dot-com was an interesting brief experiment. Some of them will survive, but they now have to look seriously at their business models. But the interesting dilemma now is how bricks-and-mortar will move to being bricks-and-clicks. Businesses will have to ascertain what their current advantages are and see how they can use them in the digital world. "How do you use your brand differently? How do you use your channels differently? How do you re-think your product forms?" he asked.

To make the bridge from the old to the new economy, it is not just a question of finding new ways to do your old business. It is also a question of finding fundamentally new businesses. Either of those require companies to re-grind their conceptual lenses, explained Dr Brown.

"For example, with 20/20 hindsight, take Barnes & Noble. They have in fact, a couple of advantages over Amazon.com, if they have stepped back and recognised that every bookstore is also a micro-warehouse. And Barnes & Noble could have positioned themselves as a company and used an old-fashioned technique such as Amazon.com's where the customer simply waits 48 hours for the book to be delivered to him. But if you want a modern service, and want a book delivered to you in two hours, Barnes & Noble could transform these bookstores into micro-warehouses using IT to find which bookstore has that book that you wish to buy, and which one is closest to you and then send a courier to your place," said Dr Brown.

It requires seeing that the bookstore is simultaneously a retail outlet, a warehouse and a platform to create a user experience – where if you want to come to the bookstore to pick it up, then the bookstore could offer you free cappuccino, for instance. Plus the fact that they would know exactly which bookstore to send you to since they know which bookstore has the book you want, and if not, they will tell you that there's no point going.

It brings back to Dr Brown's emphasis on "Think Customer". Barnes & Noble would have the resources to provide that new customer experience, and companies will have to run as quickly as they can to see what their customers really want – what is the price they are willing to pay for that convenience and so on. But these are very hard to do as these types of explorations and forays into the e-world from the old manufacturing world will again be displaced as the emerging m-world (mobile-world) has a very different culture than the e-world.

"Therefore, you must be able to have management that is willing to be ambidextrous and be able to support both kinds of cultures and be able to bring synergies of the two kinds of cultures," said Dr Brown. "That is a gigantic management challenge. But if you start from there, you will see a radical restructuring of the whole corporate world."

"It ends up with a calming notion that in fact, contrary to *the digerati* – the *'Wired magazines'* of the world – the way ahead is not to become solely preoccupied with futurism. But rather to look more carefully around, to look at how society works, how real learning happens, what are the natural forces to look for? And just like in Judo, you look around," noted Dr Brown.

"The way ahead is to look around and to pay more attention to how communities function and how context really matter as opposed to individuals and information. And what the book** that we have just finished, is really saying that you have to take the social life that is happening in information that creates the meaning. Technology has to be designed to support and honour the social life. And if so, you are not only going to find tremendous ways to create value to your customers but also to create a better society because it is going to be more attuned with the best parts of how we live, work and learn today."

(Note: ** *The Social Life of Information* by John Seely Brown and Paul Duguid, Harvard Business School Press; for book review, see www.et-writer.com Book Reviews section)

Box Story 1:

Flashes of Insight

How does one encourage creativity? While Dr Brown did not have a straightforward formula to share, he emphasised the need to just let ideas bounce around and to share flashes of insight with co-workers to derive higher understanding and insight.

“Flashes can come anywhere and any time. You have to be context-rich which is your willingness to bring that flash of insight forward and to make it public. For instance, for a high percentage of my ideas – after I have thought them over with more people, I realise that they aren’t any good.

“Working with others turned out to be a major source of creativity because you can take your personal flash and test it against their personal flashes and bounce them back and forth. We can help each other scaffold our ideas into something that neither of us had in mind.”

Dr Brown added a practical tip: “Being willing to play that role is critical to the young R&D type. The other thing to recognise is that invention is the easy part. Implementing it is the hard part. I tend to define innovation as invention implemented. Not only must you be willing to think out-of-the-box, in terms of invention, you must now understand what it takes to make the trip to the market. That involves working with different kinds of people.”

Silicon Valley is famous for many innovative breakthroughs and when asked whether this can be duplicated or achieved in say, Singapore, Malaysia, or Hong Kong, Dr Brown said, “There are several new books that are coming out on the magic of Silicon Valley – serious academic books. Several of us now are focusing a lot more time on trying to understand innovation in the region rather than innovation just in a firm.”

“The key set of insights thinking about Silicon Valley has been a knowledge ecology. What is the dynamics of the knowledge ecology? You will realise how situated the ecology is. You can’t pick up an ecology here, and put it there. So each region has to find new ways to grow its own ecology which takes a lot of time. You have to learn how to husband that. But husbandry causes you to do the *right mill* here and the sensibilities as opposed to the right process to design the ecology,” stressed Dr Brown.

"Ecologies are nurtured into existence and if done correctly, it can take advantage of the local capabilities. So the first thing to do is not to overdesign a knowledge ecology, and to honour the spontaneity that comes, and look for the right balance. Those are very general comments. But I am willing to say one thing that Silicon Valley and Singapore is somewhat similar. Silicon Valley has natural physical barriers – we have the bay, the bridge and the desert and that leaves us with a very small area. This means that the density of action is high. Which means that you start to rub shoulders with your competitors. You start to sit down and have lunch and you overhear things. You do all kinds of informal benchmarking."

"An economist once called me up and asked what was Silicon Valley's secret. And I told him it was the bars! Drinking together with competition is a give-and-take operation in an informal community. On top of that, you need to have a culture of openness."

"In PARC, we have been accused of leaking secrets in but not out. In this day and age, leaking information in is far more important than leaking things out. I think that the difference between PARC and Interval is that they were very closed. We may be too open!"

Dr Brown agreed that the open source movement, e.g., Linux, etc. seems to be taking off in this millennium. "The success of the open source movement has been surprising. None of us would have thought five years ago that a distributed, disparate unfinanced loosely organised community of programmers around the world, could be so well orchestrated that one can create an operating system that is so complicated as today's Linux operating systems and still work beautifully."

"We thought that would be the scared ground of a large-scale corporation. And what they have shown is using self-organising systems that enable a robust organisational architecture to emerge. This whole process has tapped the creative expression of a community mind. So it has taken to the extreme that creativity lies in the community's mind as much as the individual's mind. By opening the source code, it means that you write code to be read.

"So new learning happens because tricks are shared across the communities. They don't write papers about it, they write action. The idea lies in the action and when I read the action, I can use the idea. The action is the by-product of the community."

Dr Brown said, "And because the code is being read, it is constantly being improved and is in fact, potentially much more secure. Being in the security game, if I can't have total access to the source code to be able to test it, I can't really tell you what the system is.

"And so in an ironic way, it has opened up a community of open source that may lead to a much more secure and definitely more robust, cleaner, and even simpler systems. Simply because the open source movement has found a way to tap the creative expression of the community mind. The Internet recognises the diversity of the knowledge that can be acquired from different sources."

Box Story 2:

Insights on the Knowledge Economy

To Dr Brown, the rise of the knowledge economy is perhaps a skewed prediction of the Marxist dream. "It is so ironic that this electronic age is letting us live out the Marxist dream! The dream wanted to put the means of production into the hands of the worker. In the knowledge economy, the means of production are between my ears – the mind. The means are therefore in the bodies of the workers in the knowledge economy."

"So we have by the most secure route created a world in which we all are the workers creating ideas. Idea creation, problem-solving, imagination are the queens of the day. This is why we need new forms of learning when we train our students and this approach is going to become increasing important – focusing more on innovation and creativity rather than rote memory."

However, he also cautioned the need to recognise the big difference between knowledge and information. "I think we are going to see a very interesting singularity happening where we are going to look more towards how to build information systems that tap the subconscious processes of the human mind, rather than the conscious processes."

"Symbiotic computing" is what Dr Brown calls it. "You'll find that we are going to create a knowledge fabric for the knowledge economy that we are play in. And even here, only those who are willing to think out-of-the-box and think differently will be the ones that would be the most powerful and productive."

Box Story 3:

Climate for IT Success?

In Singapore – where soft skills are said to be rare and talents are imported to make up for the shortfall in population pool – Dr Brown thinks that it is quite possible to innovate by putting a bunch of smart people together in order to come up with some winning product or service.

He explained, "I only come to Singapore once or twice a year, and I notice the abrupt nuances and changes each time. For example, I observed that the change in entrepreneurial spirit in Singapore has been tremendous compared to last year."

"I work a lot with KRDL (formerly Kent Ridge Digital Labs). From the way this research incubator/institution has been transforming itself over the last two to three years, it is really positioning itself to be the next-generation kind of incubator," said Dr Brown.

"The catch is how do you create a mindset here that people can constantly generate new ideas, test them out with one another, without being afraid of being wrong. The key to surviving in the e-world is to be willing to take risks. And to have a culture, instead of government regulations, to actually support risk-taking. You need to build an environment or ecosystem that supports learning from failure as much as learning from success!"

Citing Silicon Valley as a good example of such an entrepreneurial ecosystem, Dr Brown illustrated a simple fact: In Silicon Valley, most of the start-ups or companies failed. "But remember that Silicon Valley is a knowledge ecology. In a knowledge ecology, basically those companies that have failed turn back into nutrients for the ecology. Therefore, we all learn from these failures.

The net effect is that the people who were CEOs of the companies that failed have become even more valuable because they are able to show what they have learnt from these types of failures and so risk-taking becomes paramount. In a culture that honours risk-taking, and honours challenging the status quo, and in thinking out-of-the-box, I think that means you have to have an artistic sense as well as a technological or business sense."

According to Dr Brown, the key to the 21st century is *'to recognise an art in technology,'* and where business equals components that point the way to where the success of the future is going to be. You have to look at the aesthetics as well as the technological components. It must be human-friendly but also coherent and has a tasteful design sense to them.

"What is human-friendly but also coherent with a tasteful design sense really means, is always under debate. But I think that today in Silicon Valley if you are a designer, you are in more hot demand than if you are a software engineer."

Dr Brown sees the arts and social sciences infringing on technology to create an offering that allow it to be more human-friendly. Yes, knowing how to keep the balance between the social and the technical will be more important in having lasting value and not to cause a backlash in society or community.

That balance has to be done in a creative, open and thinking way. So, the sense of openness is becoming increasingly important. For instance, in Singapore, the mindset is opening up in a lot of ways and is showing signs in becoming so in more social and cultural ways as well.

Box Story 4:

The PARC Hotbed

Dr Brown remembered with great affection two significant accomplishments during his 10-year tenure as director of Xerox PARC.

"The first accomplishment is really bringing the cross-disciplinary effort into full operation. At PARC, they really have built a serious set of researchers in the social sciences and in the artistic world. And they're working shoulder-to-shoulder with world-class technologies to create a new technology ecology that really fosters a new level of productivity," said Dr Brown.

"The second accomplishment is to be one of the pioneers to move from just information technology to that of atoms and bits. Looking at how bits and atoms interplay in this realm of nanotechnology, MEMS (microelectro-mechanical systems), leading to what I call *'smart matter'*. This is setting the platform for a radical new form of materials – to use to build products out of, and it will then give us a new way to use advanced organic electronics as well.

"With smart matter, you can build robots to reconfigure themselves. For example, down at the microscopic level, you can build printers that can print at amazing speeds, with no macro moving parts, because things are moving at a micro level."

According to Dr Brown, this is the world that is at least as foreign to most people as the PC was in 1970. Back then, moving processing power from mainframes to the PC was considered a far-fetched idea.

Today we are moving from passive materials to materials that are made out of inorganic compounds but appear almost biological. And they can adapt to the context by themselves. They enable engineers to build incredibly reliable products that can transform things that seem very simple but are very complicated.

Box Story 5:

Wheeling Free

When asked what he does to relax, Dr Brown had this to say: "Motorcycles. I drive a BMW motorbike and there is no better way for me to relax than to hop on the motorcycle and head off for the mountains. Motorcycles and skiing have a lot in common -- being totally free in nature, having the feeling of the world and you together is a very exhilarating notion."

"With such a high performance bike, you have to concentrate and read the context so much because on the highway, when you get into trouble like a car weaving into you, so you have to read that car's movement before it hits you," said Dr Brown.

"In a way it is a mentally cleansing operation to help you stop worrying about things not immediate to you. I like to take long trips. I like to cross the country. My last trip was 7,500 miles on the back-roads in the US in three weeks. It was a great vacation for me."

Box Story 6:

PARC's Legacy

In 1970, Xerox Corporation gathered together a team of world class researchers and gave them the mission of creating "the architecture of information."

The scientists of the Palo Alto Research Center (PARC) lived up to this challenge by inventing personal distributed computing, graphical user interfaces, the first commercial mouse, bit-mapped displays, Ethernet, client/ server architecture, object-oriented programming, laser printing and many of the basic protocols of the Internet.

In the years since Xerox established the centre, PARC technologies have changed the world.

Presented here are some of the highlights of PARC's work.

The Alto
PARC's vision of computers as tools that could help people work together changed the course of the computer industry and led to new ways of organising interactions to support both individual and collaborative work. The first personal computer, the Alto embodied a number of PARC innovations, including the world's first WYSIWYG editor, commercial mouse, graphical user interface (GUI) and bit-mapped display.

Ethernet
Ethernet became the global standard for interconnecting computers on local area networks. The Ethernet standard spawned a series of increasingly sophisticated networking protocols that not only enabled distributed computing, but led to a redesigning of the internal computer-to-computer communication within Xerox copiers and duplicators. The 10 Series copiers were the first to use numerous built-in microcomputers with a low-bandwidth Ethernet as the communications interface.

Network Architecture
The development of Ethernet, Alto and research prototypes of networking protocols for distributed computing led to the development of XNS, Xerox' robust, leading-edge networking protocol. This led to the Corporate Internet an internal wide area enterprise network that was well ahead of its time in enabling employees to exchange formatted documents worldwide with speed and ease. In fact, with Xerox' STAR system, 1981, users were able to access file servers and printers around the world through simple point-and-click actions, a functionality that has yet to be matched by today's computing systems.

Flat Panel Display
Work in amorphous silicon led to the development of thin film transistors. Arrays of these devices now provide for a new generation of flat, print-quality displays. This technology, resulted in the formation of dpiX, a Xerox New Enterprise Company. The panels that are used to make electronic documents as easy to read as paper documents have also found application in document scanning and digital X-ray imaging.

Laser Printing
Electronic printing provided a means of seamlessly transferring digital documents into the paper domain. The original idea of modulating a laser to create an electronic image on a copier's drum migrated from Rochester to the newly-formed PARC where it became the basis for Xerox' multi-billion dollar printing business. The early Raster Output Scanner optical designs for Xerox laser printers were also developed at PARC. This invention changed the entire notion of documents and document processing.

Laser Diodes
PARC's laser research has made Xerox a world leader in semiconductor laser diodes, resulted in hundreds of patents and spawned Spectra Diode Laboratories. Laser diodes are used in all new Xerox printing products.

Blue Lasers
In October of 1997, Xerox PARC was the first printing company to create a blue laser. The reduced wavelength of a blue laser will ultimately allow much higher resolution printing than is possible with today's standard red and infrared lasers.

BITblt
This small but important invention enables programmers, without special hardware, to manipulate images very rapidly. The computer command enables the quick manipulation of the pixels of an image and was built into the instruction code of the Alto.

Box Story 7:

About Dr John Seely Brown

Dr John Seely Brown is chief scientist and a corporate vice president of Xerox Corporation. He is also the director of the company's Palo Alto Research Center (PARC) in California.

Brown joined Xerox in 1978 and has been involved in expanding the role of research to include such topics as organisational learning and ethnography of the workplace. His personal research interests include digital culture, ubiquitous computing, user-centring design, organisational and individual learning. He is also responsible for maintaining a strong link between corporate research and corporate strategy.

PARC focuses on fundamental research in device physics, computer science, human/computer communication, and the social sciences. The research is aimed at creating innovations that can improve both human and organisational effectiveness.

Brown is a co-founder of the Institute for Research on Learning, a non-profit institute for addressing the problems of lifelong learning. He has published more than 95 scientific journals and was a recipient of the McKinsey Award for his article, *"Research That Reinvents the Corporation"* that was published in Harvard Business Review in 1991.

More recently he has published the book *"Seeing Differently: Insights on Innovation"* by Harvard Business Review Books and was executive producer for the award winning film *"Art · Lunch · Internet · Dinner"* which won a bronze medal at the Charleston International Film Festival in 1994.

He is a Fellow of the American Association for Artificial Intelligence and a member of the National Academy of Education. He serves on various scientific advisory boards, editorial boards and boards of directors and is often called on to give congressional testimony.

John Seely Brown has a bachelor of science degree in mathematics and physics from Brown University and a Ph.D. in computer and communication sciences from the University of Michigan.

(Afternote: The face-to-face interview was conducted sometime in May 2000 at the Marriott Singapore.)

About the Author

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