John Seely Brown divides his time between being the Chief Scientist of Xerox Corporation and the Chief Innovation Officer of 12 Entrepreneuring, a recently formed entrepreneurial operating company headquartered in San Francisco. From 1990 to 2000 he was Director of the Xerox Palo Alto Research Center (PARC). There, he expanded the role of corporate research to include such topics as organizational learning, sociological studies of the workplace, complex adaptive systems and micro electrical mechanical system (MEMS).

JSB's personal research interests include digital culture, ubiquitous computing, design and organizational and individual learning. His views are distinguished by a broad view of the human contexts in which technologies operate and a healthy skepticism about whether or not change always represents genuine progress.

JSB is a member of the National Academy of Education, a Fellow of the American Association for Artificial Intelligence and a trustee of the MacArthur Foundation. He also serves on numerous boards. He has published over 100 papers in scientific journals and was awarded the Harvard Business Review's 1991 McKinsey Award for his article, “Research that Reinvents the Corporation.” In 1997 he published the book Seeing Differently: Insights on Innovation by Harvard Business Review Books. He was an executive producer for the award winning film “Art Lunch Internet Dinner,” which won a bronze medal at Worldfest 1994, the Charleston International Film Festival. He received the 1998 Industrial Research Institute Medal for outstanding accomplishments in technological innovation and the 1999 Holland Award in recognition of the best paper published in Research Technology Management. With Paul Duguid he co-authored The Social Life of Information (HBS Press, 2000).

JSB is a graduate of Brown University (BA, mathematics & physics) and the University of Michigan (PhD, computer & communication sciences), and has been awarded honorary doctorates by both Brown University and the London Business School. He is an avid reader, traveler and motorcyclist.

David W. Gill: Your recent book, The Social Life of Information, injects some realism into today's discussions of technologically-transformed futures. How have people reacted?

John Seely Brown: Even when I am speaking on topics like nanotechnology, people invariably ask about the book. That's what they really want to hear about. People see me as a high tech type so when I say things about the softer side, the social dynamics of the work place, and so on, it gets heard slightly differently than if an anthropologist were to say it. Much of the modern world discounts these matters but at a subconscious level we all seem to know that they are important.

Albert M. Erisman: At a recent conference for technology officers I attended, the evening panel discussion on the future of technology mutated into a discussion of the social impact of technology. Rather than predictions about technology the major concerns were about how people will be affected.

Brown: When I was being recruited to Xerox PARC in the mid-70s I remember saying that technologists will be able to build virtually anything in the future. Our constraints will not be determined by what technologists can build but rather by what people can successfully understand, appropriate, and comfortably use in their lives.

Gill: You have been right in the middle of the high-tech revolution. How is it that you have managed to step back and see some of its weaknesses in a broader perspective?

Brown: At Xerox PARC, we hired anthropologists, sociologists, philosophers, ethicists, and artists, along with the mathematicians, physicists, and computer scientists. We created the tremendous disciplinary breadth of a university but all located in one relatively small building, a compact physical, social and intellectual space.

Gill: But why did you do that? What motivated you?

Brown: Since I first came to Xerox PARC I have been interested in radical innovation But for really radical innovations, where do you look? I suspected that a lot of the action would be in the white space between disciplines. Corporate research centers generally lack suitable breadth for this because they concentrate on pure technology. Conversely, universities have many disciplines, but each works in an isolated silo.

Also, radical innovation changes social practices. So you have to understand what social practices are, and how society accepts and rejects changes to its practices. We are in a co-evolutionary game where technology influences society, and society influences technology. Once we break out of simplistic (or sophisticated) views of technological determinism, we find that we must understand better how individuals, organizations, and societies appropriate technology.

I also had the good fortune of meeting Paul Duguid, a historian of 17th and 18th century Portuguese commerce. Our two intellectual worlds are quite different but we have developed a great respect for each other and have built a productive long-term collaboration. We both believe that theory should emerge from practice. Paul brought the practices of the historian and I brought the practices of both the technologist and of someone who has run a complex organization. So, through this collaboration I have had a chance to marinate in the richness of real technical and institutional issues but from the purchase of social theory.

Erisman: You mentioned the synergistic way that technology impacts society and society impacts

technology. Isn't a business a microcosm of society? What advice would you have for a business trying to use technology effectively? Xerox, Boeing, GM and many others have had problems taking ideas from the lab and actually getting them into the business.

Brown: First, it is very easy to see why something won't work. So it's very easy to kill something. But it's hard to step back and question whether the basic assumptions that show it won't work are any longer relevant. Very few of us are able to question our own understanding this way. But as we move from managing in an era of continuity to an era of discontinuity, executives that can challenge background assumptions will really thrive.

Also, organizational unlearning is much more difficult than organizational learning. Part of that has to do with the fact that so many of our practices are distributed across the enterprise and are embedded in the tacit fabric of the organization. Most of us are completely unaware of this level even with regard to our own individual work. This is why so much of the business process reengineering didn't work out. We are unaware of how real work really gets done—as opposed to what the formal descriptions of work processes describe.

Knowledge is, paradoxically, both sticky and leaky. Knowledge flows on the rails of shared practice. Within a community practice it flows seamlessly. Through joint work, shared practices evolve, enabling us to share tacit knowledge and to trust each other. This is not some squishy kind of trust but a very fine grained understanding of "what John really does know." When he says "I've got this instrument calibrated" I feel confident to act on that belief.

Now consider two different communities of practice. When I call the engineering community at Rochester from the research lab at PARC and say we've invented this great new technology that is really robust, they say "well maybe, but tell me John, what was the last product you delivered?" I say, "…I've never delivered a product." "Well, what is the last manufacturing plant you ran?" "Never ran a manufacturing plant." "Well, tell me about your quality assurance methodology." "Well, in research we don't have a quality assurance methodology but we have lots of data that we have analyzed." You can imagine what he thinks— " why should I trust a researcher's judgment that this new technology is robust?"

We come from two different communities. Knowledge flows well in mine and knowledge flows well in his but it sticks as it tries to jump from my community of practice into his. We need help at the boundaries, knowledge brokers to help bring mutual understanding. Constructing boundary objects and bridges between communities of practice can start to create shared trust for what we mean at a particular moment in time around a particular point. It is a kind of negotiation, bringing two practices together, constructing a set of shared assumptions between our two sets of practices.

Erisman: But the bridge-building process somehow has to rise above an individual technology and an individual practice because both the technology and the business practice will be changing in a year.

Brown:. This kind of social negotiation in practice is always ongoing and in a state of flux. Done right, it leads to continuous and productive innovation.

Erisman: Is it a knowledge management fallacy to think that we can capture, store, and later reuse some particular knowledge without paying attention to the assumptions (that are not necessarily explicit) and without acknowledging that the world is changing?

Brown: Knowledge management doesn't understand very well why knowledge sticks and why it flows. We can store information in machines but this is not really storing knowledge. We can store some of the artifacts that knowledge has produced and we can build linkages between people who can reconstruct the knowledge but a simplistic notion of knowledge storage and retrieval doesn't work. Knowledge lives in people.

The real challenge is to accelerate the ability to dynamically construct shared frames between communities that will allow knowledge to flow more readily. It is not a formulaic game. Am I willing to listen deeply not just to what is said but to what is unsaid? Great negotiators, remember, spend more time listening to what is not said.

Gill: How do you make the case for such patient listening in a business and technology environment that likes to challenge us to get up to "warp speed"?

Brown: "Slow can be fast." To get the fastest possible product development, spend time up front. Nothing appears to be getting done except for bringing a team together and getting a gut understanding of what the product is and what the real challenges are in building the product. It may take weeks and seem like a waste of time but being slow up front often enables much more interesting and ultimately productive (asynchronous) improvisation to happen later on.

Gill: Was the dot-com melt-down an illustration of too rapidly pushing things out to market and throwing money at things without taking the time to look at the context in which these ideas would have to be implemented?

Brown: I think that the dot-com blow-up could be partially understood as a failure to understand that information out of context doesn't carry much meaning. Think about the futures market in wheat. It took years for everybody to come to agreement on how to describe and judge the different qualities of wheat. Without such a common framework a commodity market can't reliably work. Nor many retrieval systems. The dot-com world didn't understand how the context of information gives

meaning to information or how humans interact and create value. For example, B2B exchanges trying to cut out the middle man often ignored what distributors do. They're not just box (or bit) pushers. They actually add value through their interpretive structures. A distributor of produce, for example, understands the vagaries of ripeness of fruits and how these actually depend on the season. The distributor also knows how each farmer describes his or her produce and how to broker what they say to the needs of the market – that day.

More generally, we see a value migration from products to solutions to services and eventually to sense making. Each of these depends increasingly on bringing 'text' and 'context' together.

Erisman: Do you see any companies doing a good job in sense making?

Brown: The company I'm closest to that does a pretty good job is Corning. They have been hit pretty hard in the telecom collapse. Nevertheless the company is not panicking or blaming folks or, worse yet, denying reality, but they are trying to get to understand what is really happening and to figure out what new strategic opportunities set the stage for tomorrow.

Gill: Are there leaders of companies who have read your new book and are now trying to incorporate these perspectives? Are there universities that are modifying the way they train technologists to help them understand the social life of information?

Brown: We are delighted that our book still has "feet"—still selling and being used by an ever expanding set in professional communities. It's been reported back to me that the CEO of Hewlett Packard has talked about this book on national television as an example of things that HP has to take into consideration. And it is being picked up more and more by universities, especially in schools of information, and now percolating into schools of product design and architecture, and so on. It's not that our book says anything incredibility deep but it does pull a lot of things together and in a way that makes the subject matter very approachable. It unleashes people's intuitions and gives voice to what many have been thinking. It uncovers invisible social resources that we all use to get work done but that many of the new technologies don't honor.

Gill: Earlier, you referred to a kind of simplistic technological determinism that expects technology to automatically apply itself and solve our problems. There is also a species of pessimistic, negative technological determinism, even fatalism, in some quarters. But doesn't this view also underestimate the influence of the social context of technology?

Brown: You can see this in Wired where one month they sing the praises of intelligent agents, suggesting that software agents will be our trustworthy butlers-nearly a utopian vision. Then precisely one month later, they sound the alarm of doom. Nanobots will take over the world and destroy civilization. A dystopian view in the extreme. Both of these extreme technological predictions left society out. Society and technology co-evolve. Each helps to shape and constrain the other. Together they form a complex, co-evolutionary system. We have seen that in nuclear power, in genetic engineering, in stem cell research and we will see it again in nano research. The accelerating speed of some of these advances demands that we strive harder to develop social and institutional mechanisms to keep the co-evolution intact and insure that the right feedback loops are in place.

Erisman: What happens to the university as the really interesting problems become interdisciplinary? The university doesn't seem prepared for this.

Brown: Universities by and large fail to understand that traditional disciplinary boundaries have outlived their usefulness. Some campuses are trying to drive fundamental change and look at things in brand new ways, but the academy in general is incredibly conservative. In today's world we must question the assumptions that led to the specialization of various fields of study. We must also ask what does it mean to be educated for the 21st century. This is not a throw away question but a rather deep question, I think.

Erisman: Is there a danger that interdisciplinary work will become soft in some of the technical areas, like mathematics, for instance? If the mathematics is not superb, the whole interdisciplinary project can fail. How do we maintain rigor and excellence in the individual components while bringing them together?

Brown: It is critical to make sure that that doesn't happen. If we bring the disciplines together in order to crack some fundamental issue, we must let the problem guide us. Pursuing a problem to its root may well perturb some our cherished beliefs, stress our methodologies and require us to master new techniques and retool our intuitions. I see this all the time in mems (micro electrical mechanical systems), organic electronics and so on.

If you honor the world and listen to its backtalk, you become a little less likely to navel gaze and indulge in second rate thinking.

Erisman: And get locked in for a very long period of time.

Brown: You build your own communities, your own terminology, and you talk to yourself. Corporations are prone to this, to believe their own PR, engage in denial, and construct a shell around themselves.

Gill: Universities and their disciplinary organizations, for all the weaknesses noted, also have helped people organize and evaluate the sea of information around them. In a somewhat tattered and chaotic social and cultural context, with outmoded universities, must we invent new ways of filtering and

evaluating information, whether as workers in companies or as citizens?

Brown: Before the Web there were all kinds of institutional warrants that usefully filter. If I read a book from Stanford University Press I know what kind of editing and review process it had been through. I know how far to rely on a story from the Wall Street Journal or a plane built by Boeing.

On the Web, where there's plenty of junk, this sort of warranting is hard to find. So the ability to make good judgments becomes more important than ever. The literacy of tomorrow has to do with judgment—how to triangulate on multiple sources and determine for ourselves how much to rely on what we find. We may be returning to the original need for education, to insure an educated public for safe guarding our democracy, a public that can make judgments.

This means that the social fabric is more important than ever. The books that I buy are books that other people (and not the Amazon recommendation system) tell me to buy. The papers I read, others have sent me (and the parts I zero in on are the parts they have annotated). Our ability to rely on others, to reach out to divergent sources, check things with others, and have focused and focussing dialogues will be increasingly important.

Erisman: Xerox helped create a lot of paper copies of things. Whatever happened to the paperless future technologists predicted?

Brown: As part of creating the paperless office (back in the late 70s) we created the bit map display. Once you have a bit map display you can draw anything you want. But without a bitmap printer, how can you print out what you have in front of you? The laser printer gives you that capability—the bitmap display and the laser printer are complementary innovations. So they led to the radical proliferation of paper.

But technologists have never quite understood the social importance of paper. Consider the book. Open the cover and feel the weight of the paper. Look at the font and the overall design. You may be amazed just how much you have reliably discovered about that book. So the book “affords” all of these peripheral cues. It's much more than just a carrier of information.

Or consider the newspaper. A newspaper uses our peripheral vision to catch our attention to stories that we might not normally seek out. The format of a newspaper contextualizes stories within other stories. It opens your mind to things that you might not explicitly know that you want to know about. It expands your point of view. Newspapers can overcome the tunnel vision of interest groups.

Moreover, a newspaper is as much a social artifact that supports communities and makes news as a deliverer of information. If every one receives a personally and “efficiently” customized version, the ‘newspaper’ stops making news and stops creating a common experience for its community of readers. In fact, it stops being a newspaper. Under a misguided notion of efficiency we destroy its effectiveness as a social artifact.

Erisman: What do you think technology will do to newspapers in 50 years?

Brown: Digital technology in general will find ways to augment the physical/social world. The virtual can augment the physical and vice versa. On line newspapers can not only provide archives but also a platform for discussion groups on controversial articles. They provide ways for the public at large to bring certain issues to the attention of the others.

Mark Weiser and I believe that “calm” technology will come from a balance between between text and context, the center and periphery, the explicit and implicit. Part of why we feel overwhelmed is that current user interface designs tend to make everything explicit; everything demands our attention.

When I drive a motorcycle I feel very much at one with what's happening around me; I am processing more information than I ever process sitting in front of my computer. My peripheral vision is processing astronomical amounts of data, keeping me aware of unexpected changes in the surround. But it does this by pulling my attention seamlessly from one thing to another. Well-designed workscapes can do something similarly—enhance my awareness of what is going on without distracting me from a state of flow.

Erisman: Tunnel vision means losing sight of the periphery and that is so important in dealing with technology.

Brown: There is a physical visual periphery but there also a social periphery and both have to be thought about.

Erisman: Give us a couple of book recommendations.

Brown: Dick Foster's Creative Destruction is an extremely good book that just recently came out. Another great new book is by Mitchell Waldrop on Licklider. It provides a very sensitively written, historic discussion of the invention of the Internet and the distributed computer revolution. A third book is by Ilkka Tuomi called ‘Theory of Innovation – Change and Meaning in the Age of the Internet' is just about to come out. It is a wonderful manuscript on innovation, one of the most expansive yet rounded books that I have read in a long time. He argues that real innovation is something that changes social practices. He's one of the few technologists with a deep understanding of the social texture of invention and innovation.

Gill: If the social fabric is so critical to technology, isn't the free agent work force going to be a growing problem?

Brown: In fact, recent data suggests that telecommuting is not catching on anything like the

digerati have claimed. But I think one way to view the social fabric is to think of it in ecological terms, namely the notion of knowledge ecology. You can think of your own corporation as being a knowledge ecology or you can look at the corporation within the broader region, like Silicon Valley, as being part of a knowledge ecology.

The task of management is to create a context that fosters continual learning and self-improvement. But a person may also get to a point where he or she has learned enough and it makes sense for them to go someplace else where they can jump onto a new learning curve. But they will feel good about where they just came from and they are moving into a world of increasing partnerships.

Think about Mckinsey. Most of their people don't last all that long, but Mckinsey goes out of its way to nurture its ‘alumni’ community. They have local reunion events continually. The ‘alumni’ are willing to help each other and even help McKinsey, itself.

Gill: How does the social life of information play out on the global stage?

Brown: If we think globalization means imposing homogeneity rather than leveraging heterogeneity we will have missed a great opportunity. Just as we sought and valued many different disciplines and sensibilities at Xerox PARC, so on a broader scale for the world: if all the world has just one set of sensibilities it will die. Being able to honor multiple sensibilities is going to be critical.

One related challenge is to invent new types of social institutions. When electrification disrupted and radically changed our factories and cities, many of our current social institutions, like the labor unions, PTA, Boy Scouts and ACLU, were created. They helped handle the disruptions and gave voice to people who felt excluded.

Today we need to invent again new types of institutional regimes, ones that can move with the speed of the technological advance, can understand some of its social entailments. What these new regimes are going to be we only have a smattering of understanding. They will use the net to tap the social mind and amplify voices that don't get heard normally. Greenpeace, for example, has amplified their impact through their use of the net. You would be surprised how small Greenpeace really is compared to the impact they have. You may not agree with all they do or say but they certainly have used the net in a very interesting way.

Quite likely, the invention of new kinds of institutions will be as important as the invention of new technologies themselves. Social justice does not necessarily follow from Moore’s Law.