

## Technology and Change of Mind: an interview with Robert Ornstein

**R**obert Ornstein, Ph.D., has the same dark beard, twinkly eyes, and wry sense of humor I remember from our first encounter almost 20 years ago, as a seminar he had organized called *Educating Both Halves of the Brain* (four years before Sperry and Hubel's 1981 Nobel for their work on brain organization and functioning.) A neurobiologist, Dr. Ornstein was involved at that time in both experimental studies of the brain and their implications for healthcare, an interest that led him to organize other symposia: *The Healing Brain* (1980) and *Understanding the Brain* (1985).

The seminars were one of Ornstein strategies for closing the gap between scientific knowledge of the brain and the application of that knowledge in the culture, especially in terms of how it deals with science and education. Another strategy was to write books about it, and Ornstein has turned out more than 20, including *New World New Mind* (1989, with Paul Ehrlich) and the best-selling *The Psychology of Consciousness* (1975).

In his keynote address to the AMS Fall Regional Seminar in Santa Monica, CA, Ornstein shared ideas from his most recent book, *The Axemakers Gift: A Double-Edged history of Human Culture* (1995), coauthored with award-winning television host James Burke (*Connections*, on PBS). One of the reviewers says on the cover, "This fascinating new book tells a gripping story about how we humans have used our minds throughout history in a way that has led to both our biggest successes and our biggest problems." The book also offers a sophisticated and original way to recapture hope for the future.

Currently head of the Institute for the Study of Human Knowledge, Ornstein works and lives, with his wife, Sally, in Los Altos, CA.

**Joy Turner:** *Dr. Ornstein, your work poses a number of questions about the relationship between human nature and the problems of the world we have created: What is it about us that makes us act the way we do? Why have we built this world the way we have, a world that's turned out to be overpopulated, polluted, violent, and difficult—and what can we do about it?*

**Robert Ornstein:** *The Axemakers Gift* is about how the tool-making left hemisphere took over the world. The axemakers are, in this view, the people who learn to operate in sequence, in order to make tools. To cut up the world and rearrange it, that's what we do that nobody else does. We make computers out of sand, we make telephone lines out of plastic. We're able to change the world like nobody else, but it has also given us a

very limited way of looking at the world, so that the people who are very good at this kind of analytical thinking are the people who've taken over the world, they're the people who make up the IQ tests, the people who do well in business, the people who do a lot of things.

We have to remember that all of us are exactly the same *biologically* as the nomads who lived 30,000 years ago. But when we first started to cut stones into tools and used those tools to cut up the world, we changed the world forever. Until then, and still now, every other animal lives in a cycling world where nothing really changes in their lifetime or in their history. The life of your cat is probably awfully similar to the life of a similar cat in Egypt. There's Purina Cat Chow, of course, but it's not as different from the lamb and rice an Egyptian cat got to eat as, say, space travel and computers are from the pyramids. We're the only species who have had the capacity to cut into the world and change it. You might call that development sequential thinking: make this cut, make that cut, make this cut, make that cut, in this tool, then use it to cut this tree, this way, cut it up this way, put these things in this order and you have a house, you have settlements, you have a very different world.

**JT:** *When you say that technology has "changed our minds" what does that mean? What effect has technology had upon humans?*

**RO:** It's an awfully big question that would take much more than a single book to answer. We're so change by the nature of the world that there is clearly no way we could ever go back to nature. For instance, our world has a lot more right angles, squares and corners, than the natural world has; seeing those as you grow up changes your visual cortex, so that you tend to look at things in terms of angles and borders. People who don't grow up in the "built" world don't see the world that way. So we already grow up in a world that's carpentered; it's built. We see it very differently and our brains get organized very differently. I think the main thing we should be concerned about is that our technology, especially in the way we've learned to express ourselves and communicate, has in fact changed not only the nature of education, but the nature of our mental system. Being able to represent ideas in speech and language in a certain sort of way has promoted one of the main human talents way beyond it's completely rightful place in the whole team of talents that we have, so that the ability to speak and express ourselves in language has sought of become the sine qua non of what human beings do. And all history from Greece to our current civilization has shown that people are

The people who gave us the world in exchange for our mind. . . They are the axemakers, whose discoveries and innovations, over thousands of years, have gifted power in innumerable ways. To emperors they gave the power of death, to surgeons the power of life. Each time the axemakers offered a new way to make us rich or safe or invincible or knowledgeable, we accepted the gift and used it to change the world. And when we changed the world, we changed our minds, for each gift redefined the way we thought, the values by which we lived, and the truths for which we died. And we always came back for more, unmindful of the cost. . . The Earth was so rich and so vast that for a long time the damage caused by the indiscriminate axe was not worth consideration. . . Today, that disregard expresses itself in distressing terms. While some now celebrate a few improvements to the environment, millions starve, and the developed nations have used their immense technological and scientific capabilities to pave almost half their cultivatable land. . . one-third of Earth's forests have disappeared, the population is exploding, the oceans are getting depleted . . . and the atmosphere remains severely polluted. Axemaker's knowledge and the destruction of the environment are inextricably linked.

Prologue, *The Axemakers Gift*

more and more able to represent the world in a particular way, that is, to reduce it to numbers, reduce it to letters, and so forth.

**JT:** *What other talents you think we have neglected—or promoted out of balance?*

**RO:** Everybody comes into the world with hundreds of different abilities—the ability to match colors, to dance in a particularly graceful way, to play music, to understand what other people are needing, or the ability to construct an environment that people are happy in or to move a sofa out of the room in the right way or the ability to know where we are and where we need to go. There are lots of talents besides our ability to calculate, represent, and express verbally.

**JT:** *Do we lose those other abilities—or have we just devalued them?*

**RO:** For both a society and an individual, if you don't develop them early enough, you lose them, at least to a great extent, just as you and I have lost our ability to learn Japanese for instance. Obviously if we'd been born in Tokyo, we would be speaking as fluently as we speak English; but if you try to learn it now, in adulthood, it seems totally impossible, though any 3-year-old can do it. It is not *quite* that strong with other abilities, but what happens in the development of an individual is that certain talents

get emphasized by the early educational system and others don't. That's the general education, of course; it's not something your kind of teaching does.

**JT:** Yes, the Montessori approach seems to include a lot of right-brain activity, as well. And at least a few people consider it to be very negative that we don't develop these abilities, or overdevelop the other capacities, perhaps at their expense.

**RO:** Right. It's certainly limiting to a lot of individuals. On the other hand, high development of that ability to sequence has brought us a civilization that's been unparalleled in human history, so it's certainly not all negative. In the industrialized nations, people are healthier, wealthier, better fed, more informed, and more mobile than anybody ever. But the problem is twofold: one is, a lot of people are trying to fit a mold that fits only a few—those who really need to be symbolically literate. That's the first thing. And the second, which I think is even more important, is that the modern technologies like computers and multimedia and other systems have begun to make it possible for people to return to their more natural abilities and deal with the world more as it really is.

**JT:** Are you referring to the amount of information the technology makes available? Or do you mean that things like CD ROM can make experiences more multisensory?

**RO:** Both, really. First of all, it means there will be lots of different ways to access world knowledge again, rather than just the kind of limited, drip by drip, word by word channel, so that people whose talents are not particularly verbal and analytic might be empowered to learn in a different way, their own way, and to follow their own curiosity as opposed to the kind of formal lesson plans everybody has to deal with in school at the moment. For at least 2500 years, since the time of Greece, our society has more and more emphasized abstract representation of the world. If you wanted to learn about Beethoven, for example, what you'd generally do is read about him. It would be reduced to a set of letters. But with modern technology, you can listen to the way Beethoven composed, on the instruments he composed it for; you can get the view of Vienna, hear what other composers were doing, change Beethoven's music around to see how it worked with it. That's a very different kind of learning experience; you don't really need to read about something if you can listen to it and look at it. So modern technology is now beginning to bring education back to what we started with in the world, listening and looking. People have more direct access to what that they're trying to learn about. And with this kind of access, they will need to know a lot less about reading and writing.

**JT:** Although that is wonderful and marvelous, people at my age may feel a little depressed to consider that it may represent the end of civilization as we know it. In many ways that's not at all a bad thing, if it happens peacefully; yet it also threatens that it's too late for me personally to cope with the new technology and learn to look at the world in a completely new way. It feels a bit like being passed by. Is this revolution going to meet teachers and schools obsolete?

**RO:** Not obsolete, but it will make it possible for people to follow their own paths much more easily, simply because the information available to them is going to be multiplied by hundreds of thousands. There are knowledge bases today and many under construction that will provide information options on an enormous scale—like going to a video store today and being able to choose from 10,000 movies one that you can rent for two bucks. The same thing is going to happen with the world of information. Right now, with the Library of Congress digitizing all the stuff, it will fit for any school into something the size of a Little CD chamber. Any student would be able to get access to anything within days, or maybe even minutes. Every school, for several thousand dollars, could have the equivalent of a million dollar library. That's going to be a big difference, let alone the other stuff that creative people will do. It won't make teachers obsolete, but it will make people much more able to learn what they want to learn rather than what the system needs them to learn.

The second thing, as we're already beginning to see now, is that lots of people who are in their 20s and highly intelligent just don't read as much. They move through information space, they look at things in a very, very different way, so that the culture is going to move towards being much more visual and oral, rather than literate. Why do you need arithmetic so thoroughly when you have a calculator to do all your work for you? It's decried a lot by people of our age, you know, that the younger generation doesn't value books and all this other stuff; but in fact, why do they need it?

**JT:** Certainly they will still need to know how to read!

**RO:** They will. And they will learn how to read. But they won't need to do it as exclusively as they do now, and people who read well won't always be at the top of the tree.

**JT:** What about broader implications, for example how people will earn a living?

**RO:** A lot of people earn their living in these industries, plus a lot of people's work now doesn't necessarily involve reading, but instead responding to visual and other kinds of information.

**JT:** And yet that's still abstract experience, because it's secondhand.

**RO:** Well, of course it is. But it's still closer to the way we're normally built to deal with the world than is highly abstracted information. When we have somebody there that we're supposed to educate, we've got to know about their mental system. Yet most of the time people don't really understand how the mind works, or why the world changes so fast sometimes, and why some things are very hard to change.

So I want to give you four points about how the mind works. The first principle is *What have you done for me lately?* What that means really, is that whatever happens in the last 10 minutes is really the most important thing, or whatever happens in the news over the last period becomes very important. You see it in the O.J. Simpson business—all of a sudden spousal abuse is made to be a big deal, even though the instance that was so heavily reported was just one more instance. If an airplane goes down in a crash in Japan, people get terribly worried about whether they should fly; if the wife of the US president gets breast cancer, the next morning millions of women who should have gone in for checkups now do it. Why are we like this? Well, we're like this because we're short term animals, we're animals who are really designed to respond to what's going on at the moment. We are *not* animals who are organized very much for our times. It's one of the contributors to our difficulties.

Principle Two is *Don't call me unless something new and exciting happens.* The mind is specialized for the perception of the news; it's headline news that the mind wants to know. You never pick up the newspaper and see "Last night 226 million of the 250 million people in America had a pleasant dinner. Then they went to sleep, got up and went to work, 9 million had meatloaf, 30 million had sex," etc. What goes on over and over again is just not interesting to us. Again, that's because we're not organized to see the world as it is; we're only organized to see a few things that are very important.

The third principle was enunciated by the famous psychologist and comedian Henny Youngman when he was asked, "How do you like your wife?" and he said, "*Compared to what?*" Comparison is one of the ways we actually look at the world. We don't really look at the world as what it is. Everything is relative, and it's often relative to our *expectations.* For example, if you expect a bonus in your job of \$5,000 at the end of the year and your boss hands you \$2,000, it's a very different experience than if you weren't expecting a bonus at all. The actual event is you got \$2,000; on one hand you're thinking, "I'm \$3,000 down"—and on the other hand you're thinking "I'm 2,000 up." So we judge almost everything we look at by what our expectation is. Changing expectations is very

important and keeping them under control is very important.

And the fourth and final principle is *Get to the point*, which you might be thinking yourself. Last summer, you probably saw a billion leaves, or a million automobiles. And you probably don't remember any of them. Or maybe there was one leaf you kept, or one car you bought. But most of our experience is simply thrown away; what we remember of what goes on is a millionth of what happens to us. And we pick a few things. A police siren is very important; although it's got no meaning in itself, it's important because it means *danger*. A tragic event in your life means a lot, because your life is going to get changed. But most of the time we go about the world in a very simplified way, which means that what goes on in our *little* world makes a big difference.

The truth is that people are just not very reasonable or balanced, none of us are. We all respond to what's going on just at the moment and we act in a very simplified way because of the simplified mental system. The key is to find the things that actually move you along, and educational experiences that are more involving than print may do that better, for most people. When the newest technologies get fully into the educational system, it will change enormously, and that will also mean secondarily that a different sort of people will be able to come to the fore.

**JT:** *You spoke of the axemakers being only a few people. What is your estimate of the percentage?*

**RO:** Well it depends. From the beginning of time, the movement is toward more and more people becoming empowered, with access to information. At first, the shamans had the exclusive control of information. When we get to Greece, all of a sudden literacy jumped to about 10%, and the modern world really began. People began to discuss ideas, compare ideas, write different versions of ideas, et cetera. With the Gutenberg revolution, the information available increased dramatically again. When more and more people are educated, they are able through that technology to participate in what's going on in the culture. Today if you want to send a message to the White House, you can do it on your computer without any trouble. Now it's true that not everybody has a computer; but that is changing and it's going to change more and more, the way 97% of families in the US now have a television. There will always be the have-nots but the ability of everyone who has one will increase radically.

**JT:** *And the axemakers of the future: who are they?*

**RO:** A lot of them are going to be the people who deal with the large-scale information systems—which brings up one of the things you *would* want to deal with, in terms of the problems of the

future: who is going to control them. But what's happening is that the more information that gets

A holist view of life. . . examines all social decisions for their effect on the community and the environment. . . . The web (and all of the support processes it could provide) might make small communities viable once more, functioning in a way that ought to become commonplace all over the planet, where the maxim would be "Think globally, act locally." And it would take only the kind of currently available renewable energy systems such as solar or geothermal or wind power to make such communities energy-independent and ensure the survival of many cultures that will otherwise face the axe in the next few decades. . . . For such communities, the most valuable skills would be generalist rather than specialist. They would prize the ability to connect, to think imaginatively, to understand how data are related, to see patterns in machine-generated innovation, and to assess its social effect before releasing it on society. . . . We can use all technology as it has been used time and again through history. We can use it to change minds, but this time for our own reasons in our own terms and at our own pace, if we use the coming technologies for what they could be: instruments of freedom. . . . The culture we live in. . . has given us the wonders of the modern world on a plate. But it has also fostered beliefs that have tied us to centralize institutions and powerful individuals for centuries, which we must shuck off if we are to adapt to the world we've made: that unabated extraction all kind of planetary resources is possible, that the most valuable members of society are specialists, that people cannot survive without leaders, that the body is mechanistic and can only be healed with knives and drugs, that there is only one superior truth, that's the only important human abilities lie in the sequential and analytic mode of thought, and that the mind works like an axemaker's gift. We have also been persuaded to think that it is unacceptable to be different or even to acknowledge that differences in abilities exist between us. But our survival may depend on the realization and expression of humanity's immense diversity. Only if we use what may be the ultimate of the many axemaker's gifts—the coming information systems—to nurture this individual and cultural diversity, only if we celebrate our differences rather than suppressing them, will we stand a chance of harnessing the wealth of human talent that has been ignored for millennia and that is now eager, all around the world, for release. (Burke & Ornstein, *Axemaker's Gift*, 1995, pp. 308-311)

out, the harder it is to control. It's one of the reasons the Soviet Union finally collapsed; you just could not have a Commissar in every TV set or deal with what people got to reproduce with

photocopiers. And that, multiplied a millionfold, is what's going to happen tomorrow .

**JT:** *When will "tomorrow" come? Or is it here already?*

**RO:** Well, certainly in the first decade of the next century. By that point many, many schools will have access within days or hours to what you might call the simultaneous world knowledge tree. It means that anybody *can* have access to everything, whether it comes to be is another matter, but I think teachers are going to become guides.

**JT:** *Well it certainly sounds as if computers have to be part of the education of the teacher.*

**RO:** They will be, they will be.

**JT:** *Want to guess how many teacher education schools do it now? I'll bet it's a very small number.*

**RO:** Oh, I'm sure. But it will have to change. And as people get computers in their homes, their kids will teach them. What teacher education schools need now is a whole bunch of 8-to-10-year-olds! One of my colleagues, who is very computer literate, is constantly overwhelmed by what his 9-year-old does. And again, a lot of it *will* have passed us. It will be like learning a language and, you might say, a way to navigate the world. But what it argues for is a very diverse basic education, which I think is very similar to the kinds of things Montessori people are interested in. We do face lots of difficulties and we can't ignore a lot of the havoc we've wrecked on the world, all over the world. It has happened, there are people in central Europe who are told not to open their windows because the air is so bad. Life expectancy is decreasing in a lot of countries because of the pollution. So it's not as if there aren't serious problems, and if they were left unchecked, we could be in serious trouble. We *are* in serious trouble.

**JT:** *So we need axemakers who will work on it.*

**RO:** Well the point is, we *have* to. We have to know how to move this giant juggernaut so that it works for the rest of us. One point *The Axemaker's Gift* tries to make is that this particular way of doing things is a relatively short period in human history, say 2500 years out of 30,000. Maybe the axemaker mentality is not necessarily the way things are, but really more of a *detour* in human history. In fact, I think the last tool of the axemakers, the computer, is going to be the end of that domination. Once you can look at it and play with multimedia material, you don't have to be as illiterate as you used to be. Maybe that period that started in classical Greece is going to end up with the computer, because the modern media are going to change the way people look at

the world and the way they think. In some ways, it's going to be a change *back* to the way people were before the axe started.

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