Bruce Dorminey (http://www.forbes.com/sites/brucedorminey/) Contributor

I cover over-the-horizon technology, aerospace and astronomy.

FOLLOW

TECH (/TECHNOLOGY) 5/05/2014 @ 5:48AM | 4 views

Why E.T. Will Need Customer Service

Comment Now **Follow Comments**

Sitting in the waiting room of my local auto repair, I honestly began to wonder if on some other far-flung planet, pointy-eared aliens would be listening for someone to sing out that they, too, were “Good to Go.”

Or, to them, would the sort of back and forth banter that we all take for granted in day-to-day business here on Earth seem as alien as ice cream?

Would a highly-advanced civilization circling another sunlike star even need this sort of social lubricant?

Probably so, says Albert Harrison, a professor emeritus of social psychology at the University of California at Davis. “Every culture on Earth, and many different species [here] depend at least in part on exchange and reciprocity,” (https://twitter.com/intent/tweet?url=http%3A%2F%2Fonforb.es%2F1mufJkz&text=%E2%80%9CEvery%20culture%20on%20Earth%2C%20and%20 said Harrison.

Unless an off-world civilization has a complete “hive”-like mentality, Harrison says it’s probably not a stretch to think that marketing, customer service and even social decorum (or at least some sort of etiquette and civility) would also play a role.

(http://commons.wikipedia.org/wiki/File:Soda_jerk_NYWTS.jpg)

Earthbound customer service comes through with an old-fashioned ice cream soda. (Credit: Wikipedia)

Although such far-flung space civilizations may not "clip Sunday coupons," their ability to communicate effectively with each other and potentially even with other galactic civilizations will arguably be a mainstay of their existence.

"A sufficiently advanced civilization must have some way of making exchanges within their own society, not just of goods, but of knowledge and information," said Michael Gorman, a social psychologist at the University of Virginia (http://www.forbes.com/colleges/university-of-virginia-main-campus/) in Charlottesville.

If so, is it a coincidence that the long march of evolution here on earth "selected" for Homo sapiens like us that, in turn, created civilizations where social decorum still plays such an integral role?

"With humans, individuals that cooperate more tend to do better," said Stuart West, an evolutionary biologist at Oxford University in the U.K. West points out that such cooperation is also prevalent in very fundamental levels here on Earth.

"Mycorrhizal fungi live in an intimate relationship with plant roots," said West. "Fungi provide the plant with phosphorus and, in exchange, the plant gives carbon to the fungi." West says these two very different species have developed a symbiotic reciprocity. That is, they preferentially pass resources to the "individuals" that provide them with "the most" carbon or phosphorus. Those, in other words, that give the best "service."

This sort of evolutionary progression could arguably be usurped by the advent of nano-manufacturing and its prospective onslaught of highly-advanced replication mechanisms. But, if by its current definition "work" eventually becomes optional — either here or off-world — would that necessarily destroy a civilization's social fabric?

"When it comes to creativity, it's either use it or lose it," said Harrison. "Living under conditions where it is not necessary to work would have the potential of weakening the social fabric. An off-world civilization's loss of critical thinking and skills to think outside the box could prove disastrous."

So, if only for self-preservation, does this mean that the evolution of barter and trade and commerce is going to be universal in the cosmos?

"I would expect it to be very common," said West. "Trade is very common in the natural world."

Even people at war with each often engage in some form of commerce with each other, says Gorman; noting that between battles during the American Civil War, Union and Confederate soldiers still traded cotton.

"Cultures that can't understand much else about one another can still trade," said Gorman. "The caveat is that we may encounter some [extraterrestrial intelligent] life form so radically different from ours that there just isn't any way to communicate."

Yet one species' version of decorum may be anathema to the next.

"We could encounter an alien civilization and offend them almost to the point of their being ready to eradicate us," said Gorman. He notes that when social decorum was violated in the antebellum American South, gentlemen usually turned to the highly-regimented practice of dueling.

While an advanced off-world advanced civilization might not opt for dueling, Gorman says it would likely have a highly-evolved sense of rule-bound decorum.

As for here on Earth?

Harrison says as people become more and more dependent on technology and less dependent on one another, technology will likely continue to hasten decorum's decline. Over time, he says the definition of customer service will depend less and less on other individuals and more and more on the effectiveness of the technology needed to access goods and services.

"But technology, like people, can still be incompetent, inefficient, and grating," said Harrison.

So, even for a civilization that's measured in millions of years, he suggests there will be an innate desire for social contact — "I suspect that ancient needs for in-depth social relationships will still simmer beneath the surface."

Follow me on Facebook (http://www.facebook.com/pages/Bruce-Dorminey/106107749545678), Twitter (http://twitter.com/bdorminey) and Google + (http://plus.google.com/u/0/112213262711522006865/posts).

Comment Now **Follow Comments**

Bruce Dorminey (http://www.forbes.com/sites/brucedorminey/) Contributor

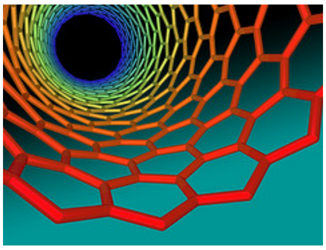
I cover over-the-horizon technology, aerospace and astronomy.

TECH (/TECHNOLOGY) 2/26/2013 @ 7:13AM | 17,799 views

Nanotechnology's Revolutionary Next Phase

4 comments, 4 called-out **Comment Now** **Follow Comments**

(http://www.flickr.com/photos/55643611@N00/4054690610)



The term "nanotechnology" has been bandied about so much over the last few decades that even the researcher who popularized the term is the first to point out that it's lost its original meaning.

Nanotech, or the manipulation of matter on atomic and molecular scales, is currently used to describe micro-scale technology in everything from space technology to biotech.

As such, nanotech has already changed the world. But the fruition of atomically precise manufacturing (APM) — nanotech's next phase — promises to create such "radical abundance" that it will not only change industry but civilization itself.

At least that's the view of **Eric Drexler, considered by most to be the father of nanotechnology. An American engineer, technologist and author with three degrees from M.I.T., Drexler is currently at the "Programme on the Impacts of Future Technology" at Oxford University in the U.K.**

Forbes.com questioned **Drexler** about points discussed in his forthcoming book, **Radical Abundance: How a Revolution in Nanotechnology Will Change Civilization**, due out in May.

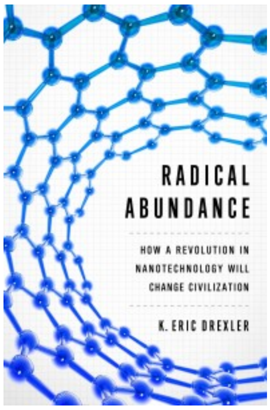
Has nanotechnology, as most of the world currently understands it, been over-hyped?

At the outset, "nanotechnology" essentially meant atomically precise manufacturing (APM). But by the time something called nanotechnology won large-scale funding a decade ago, the term sometimes meant APM, and sometimes meant something more like conventional materials science. But expecting to get APM-level technologies out of typical areas of materials science is like expecting to get a Swiss watch out of a cement mixer. [APM] progress has been in the molecular sciences. People looking to materials science for progress in APM have been setting themselves up to be blindsided, because some of the most important boostrapping technologies for APM are not labeled "nanotechnology."

In "Radical Abundance," you note that APM-level production technology will allow a box on a desktop "to manufacture an infinite range of products drawn from a digital library." This almost sounds like magic. How would the atoms be arranged and manipulated to facilitate the manufacturing process?

An ordinary printer shows how digital information can be used to arrange small things — pixels — to make a virtually infinite range of images. By doing something similar with small bits of matter, and APM-level technologies can fabricate a virtually infinite range of products. 3D printing also illustrates this principle.

(http://blogs-images.forbes.com/brucedorminey/files/2013/02/RadicalAbun



Imagine factory machinery putting small components together to make larger components and you have a good idea of how APM-based production can work. Down at the bottom, the parts are simple molecules from ordinary commercial materials in a can or a drum, somewhat like large ink cartridges. Simple molecules are atomically precise, so they make a good starting point for atomically precise manufacturing. This works if the factory machines themselves are atomically precise and guide molecular motions accurately enough, and physics shows that nanoscale machines can, in fact, do this.

Factories that use very small machines can be very compact, just a few times larger than what they produce. A desktop-scale machine could manufacture a tablet computer or a roll of solar photovoltaic cells.

Follow me on Facebook (http://www.facebook.com/pages/Bruce-Dorminey/106107749545678), Twitter (http://twitter.com/bdorminey) and Google + (http://plus.google.com/u/0/112213262711522006865/posts).

What about the cost-effectiveness of APM?

(http://blogs-images.forbes.com/brucedorminey/files/2013/02/drexler.png)

Cost-effectiveness depends on both production cost and product value. APM products can have very high performance and value because atomically precise materials based on carbon nanotubes can be extremely strong and lightweight, because atomically precise computer devices can far outperform today's nanoscale electronics, and so on through a range of other examples.

Production costs can be low because the raw materials are inexpensive and the processing can go straight from raw materials to final products using highly productive machinery. The key insight here is that nanoscale mechanical devices can move and act almost exactly like larger machines, but moving at much higher frequencies. This is a consequence of physical scaling laws of the kind that [physicist] Richard Feynman described almost 50 years ago, and it enables high throughput. So the prospect is a technology that combines high performance with low cost, typically by large factors.

How can what you term the “cardinal rules of exploratory engineering” be applied to developing APM?

It’s important to ask the right questions. This means setting aside questions of development dates, market prospects, and so on, and instead asking, “What does physics tell us about what is and isn’t possible under physical law?”

To be an exploratory engineer means applying conservative engineering principles — margins of safety, redundant options, and so on — and design analysis based on well-established, textbook-quality scientific knowledge. This is the only way to draw reliable conclusions about what can be accomplished.

The place to look for new and surprising results is in the range of technologies that are beyond reach of current fabrication technologies. APM-level technologies are in this range. We can see paths forward toward these technologies — using today’s molecular tools to step by step build better tools. But a clear view isn’t the same as a short path. APM-level technologies are not around the corner.

Would APM make revolutionary inroads into biotech — specifically, in developing nano-machines that could unclog arteries; reverse brain damage in stroke victims; or even manufacture a truly robust artificial heart?

APM is very different from biotechnology (think of the difference between a car and a horse). But we already see nanoscale atomically precise devices being used to read and synthesize DNA, devices borrowed from biological molecular machinery. Nanoscale atomically precise technologies like these can be made much faster and more efficient. Nanomedicine is already researching nanoscale functional particles that can circulate in the body and target cancer cells. Technologies of this kind have enormous room for improvement, and advances in atomically precise fabrication will be the key. The body relies on atomically precise devices to do its work, and atomically precise devices are the best way to accomplish precise medical interventions at the molecular level.

Would APM lower the cost of access to outer space?

The main barrier to space activity today is cost. With the ability to make materials tens of times stronger and lighter than aluminum, and at a low cost per kilogram, access to space becomes far more practical. The difficulties of producing high-performance, low-defect, high-reliability systems also decline sharply with atomically precise manufacturing.

In what fields would APM cause the most pronounced economic disruption and the collapse of global supply chains to more local chains?

The digital revolution had far-reaching effects on information industries. APM-based production promises to have similarly far-reaching effects, but transposed into the world of physical products. In thinking about implications for international trade and economic organization, three aspects should be kept in mind: a shift from scarce to common raw materials, a shift from long supply chains to more direct paths from raw materials to finished products, and a shift toward flexible, localized manufacturing based on production systems with capabilities that are comparable on-demand printing. This is enough to at least suggest the scope of the changes to expect from a mature form of APM-based production — which again is a clear prospect but emphatically not around the corner.

Would APM help make war obsolete?

I don't see that anything will make war obsolete, but the prospect of APM-level technologies changes national interests in two major ways:

By deeply reducing the demand for scarce resources — including petroleum — APM technologies will reduce the motivations for geopolitical struggles for what are now considered strategic resources.

Secondly, by making calculations of future military power radically uncertain, the prospect of these technologies gives good reason to examine approaches to cooperative development merged with confidence-building mutual transparency among major powers. Changes in national interests will call for developing [military] contingency plans premised on the emergence of these technologies.

When will we actually see the onset of the APM revolution?

(http://www.daylife.com/image/02fFbrZ7tL1C6?utm_source=zemanta&utm_medium=p&utm_content=02fFbrZ7tL1C6&utm_car

The paths forward require further advances in atomically precise fabrication, an area that began with organic chemistry more than a century ago and continues to make great strides. A sharper engineering focus will bring faster progress and further rewards, just as progress in atomically precise fabrication has brought rewards since the beginning in science, industry, and medicine.

Although advanced objectives like full-scale APM stand beyond a normal business R&D investment horizon, incremental steps in key technologies are steadily emerging. But we need a more focused program of design, analysis, research, and development.

Do all roads lead to APM? Thus, is some form of APM likely to be ubiquitous among intelligent civilizations in the galaxy, if of course such civilizations exist?

There's no substitute for atomic precision because there's no substitute for precisely controlling the structure of matter. The only known way to do this is by guiding the motion of molecules to put them in place, according to plan, by means of directed bonding — in other words, by some form of atomically precise manufacturing. Since there are many ways to develop these technologies, I'd say that all roads forward do indeed lead to APM.

Follow me on Facebook (http://www.facebook.com/pages/Bruce-Dorminey/106107749545678), Twitter (http://twitter.com/bdorminey) and Google + (http://plus.google.com/u/0/112213262711522006865/posts).