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New Knowledge: A Vast Enabler

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Many people don't believe in the economic value of obscure, esoteric, long-tem research. Especially in today's economic climate, when it comes to most companies' research (with exceptions, of course), research that won't pay off in the relatively near term is not seen as a good investment.

That is one way to look at it, often for seemingly sound economic reasons. But oh, the potential future cash streams that those businesses may miss!

For example, let's explore just a few of the ways in which scientists are harnessing some new-found knowledge as the basis for new products with extraordinary (and completely unanticipated!) capabilities.

Towards The World Of Star Trek

If you've followed some of the early work on very real teleportation (www.theharrowgroup.com/articles/20020701/20020701.htm#teleport and www.theharrowgroup.com/articles/20030310/20030310.htm#_Toc34561029), you know that scientists can now repeatedly "entangle" some photons, then separate them by some distance, and then alter the state of one of the photons or encode information on the photons of a laser beam. The magic is that instantly (perhaps in zero time!) the other separated photon demonstrates these same changes! Clearly, although this is just the very beginning of our understanding of the potential for this effect, as we learn more about such teleportation it holds incredible potential for transmitting information with no time lag. Along with many potential terrestrial applications, this could be a boon to interplanetary or even interstellar spacecraft!

"But the distances between the entangled photons are currently pretty short," you might be thinking. And that's been true -- so far -- yet it's already getting better. For example, the Aug. 19, 2004 Scientific American reports that scientists at Vienna's Institute for Experimental Physics have just teleported photons 600+ meters across the Danube river, and with

97% success during 28 hours of testing! Which is just the very beginning of this journey...

Authentication

Forgers can be very good at their art given enough time and resources; it's a continuing game of technological escalation between forgers and new techniques that are constantly being developed to "indisputably" verify the authenticity of a document (paper currency, stock certificates, bonds, and the like). But new research into the arcane world of quantum dots may break that cycle. As described in the Aug. 11, 2004 Technology Research News,

> *"Researchers from the Canadian National Research Council have devised a way to use quantum dots to print invisible secret codes onto surfaces such as documents. The dots measure between 3 and 6 nanometres in diameter. The method could eventually be used to authenticate valuable documents such as passports and certificates, the researchers say.*
>
> *Quantum dots can be made to emit one wavelength of light when hit with a second wavelength of light. This method uses three quantum dots that emit three different colours of light. The intensity levels of the three lightwave peaks represent a three-digit code. The code can be kept secret because the intensity levels change depending on the colour of the light source. For example, three single-colour quantum dots can emit fluorescence corresponding to the code of 2-7-3 when hit with 470nm light waves, but the code changes to 3-5-3 when hit with 450nm light.*
>
> *The correct code can be read only by a person who knows the key, which is the correct wavelength of light for each set of three quantum dots contained in the cryptograph."*

Fascinating, and potentially quite useful.\

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Holograms

Speaking of forgeries, the ability to verify that signatures are authentic is a highly trained art form rather than a definitive science. Experts analyze the sequence of marks by looking at the 2D signature. But original handwriting is more than 2D, since the varying pressures on the pen cause constant changes in the depth of the strokes, and other alterations. Now, Rome's Università degli Studi has created a 3D hologram of handwriting that exposes the 3D hills and valleys caused by the pressure on the pen. This enables handwriting experts to determine the 'stroke order' 90% of the time, which better enables them to determine if the handwriting matches an original specimen.

Again, unintended consequences.

SPAM Marries DNA?

What could seem a less likely pair? What could the majority of Email messages on the Internet (SPAM) have to do with the "stuff of life" that defines US?

According to the Aug. 19, 2004 New Scientist, scientists decided to treat SPAM messages as if they were DNA code, extracting patterns that identified the messages as SPAM. They then did the same for known non-SPAM messages and deleted any patterns that occurred in both SPAM and legitimate messages.

With these patterns of what was and was not SPAM, the software chugged through almost 67,000 random messages using the Chung-Kwei algorithm (which is used to do DNA sequencing) to identify SPAM in new messages. Which it did with an accuracy of 97% while only generating ten false-positives (non-SPAM messages incorrectly labeled as SPAM) out of the 67,000 messages!

A very impressive achievement that I suspect will get better over time. This is a great example of a VERY unintended consequence of software developed to decode US!

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The Bottom Line

These are just a few of the fascinating, potentially useful, and potentially profitable results of seemingly esoteric research. I believe that we must continue to expand our understanding of the core processes that drive our universe, such as the most basic structures of matter and antimatter, the "emptiness" of "outer space," and the spaces within molecules and atoms and even smaller particles. Also, of life itself such as our DNA and genome and proteome. This knowledge will have enormous payoffs and impacts on everything around and within us -- this knowledge will make everything that we've learned throughout history (and the way most products and services are created today), passé. Just look at the results of our increased understandings over the pass 100 or 50 or 25 or even 5 years. And the RATE at which we gain better understandings of the things around us is increasing exponentially, just like the rats or the grains of rice on that early chess board.

For many people, exponential growth is VERY difficult to understand, accept, or to plan for. Josh Wolfe, in the Aug. 20, 2004 Forbes/Wolfe Nanotech Weekly Insider, provides some perspective as to what types of people can, and can not, easily embrace the all-too-real exponential growth of technology:

> *We all see the world through different lenses. How do YOU see things? Try answering this:*
>
> > *It's 12:00pm and there are a few rats in a room. The population of rats doubles every minute. After one hour, at 1:00pm, the room is entirely filled up with rats.*
> >
> > *At what time was the room half-full?*
>
> *What is your answer? What time was the room half-filled with rats?*
>
> *Let's take an important diversion that, even though it talks of "investors," is relevant to our discussion:*

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A wise mutual fund manager suggested there are three kinds of investors--and they look at the world in either "points", "lines" or "curves". The "point people" need well-defined starting points and don't deal well with abstract and dynamic concepts. They'd say that the rat question was incomplete and they would ask for more information. As investors they look at a fixed point in time or a fixed point in a growth curve and make decisions based on that point. They're also very weak with forecasts.

"Line people" are a little better. "Line people" are most likely to guess that the room of rats was filled at 12:30pm. They can make linear approximation and are good at situations where the past is a consistent predictor of the future. This is the majority of investors.

But unfortunately, such linear progress represents only the minority of situations. The past is very rarely a good predictor of the future. For example, in the case of our rats, remember that "the population of rats doubles every minute," which is far faster than merely linear growth.

Which brings us to the "curve people". These are the rarities. These are the non-linear, out-of-the-box thinkers who understand exponential curves, compound growth rates and why the king got suckered in the fictional legend of how chess was invented (you remember: the inventor asked the king for a "simple" reward-- a mere grain of rice on the first square, two on the 2nd, four on the 3rd and so on, until he'd bankrupted the king.)

Back to the rats -- the correct answer to this riddle that began at 12:00pm, is that the room was half full -- at 12:59pm.

One minute before 1:00p, there were half as many rats as there would be at 1:00pm.

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It took 59 minutes to fill the FIRST half of the room, while the SECOND half of the room filled in just that one remaining minute.

Think about the similar growth of technology -- rather slow for most of our history, and incredibly fast (and constantly faster) over the past hundred years. This is a demonstration of why exponential growth is so incredibly powerful, and why it's so hard to grasp "from the inside," as it's happening to US.

Consider how this applies to each of us, and to each of our businesses: Where do you wish to position yourself along the incredibly important and well established exponential technology curve?

Remember what happened to businesses that didn't rapidly embrace the telephone. Or the automobile. Or computers. Or the Internet. As history proves time and time again, a lack of cutting-edge research and understanding, and the foresight this can bring, can leave you building the perfect buggy whip as the automobile marginalizes whips out of the market.

Similarly, an unwillingness to rapidly embrace new technologies as a competitive advantage -- before your competitors do -- can lead to a downwards spiral that can pass the point of no return.

The choice is yours, as you decide whether to allow at least part of your research organization to think far beyond the next quarter, year, or several years, and beyond the scope of your current business. Similarly, will you will hire one of those "curve people" and give him/her the freedom to understand and synergize and forecast the potential results? Will you encourage him/her to communicate these insights across your organization so that all of your employees are constantly updated on the opportunities, and problems, that exponential technological growth may bring to your business?

Your competitors will...

Don't Blink!

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