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The Harrow Technology Report

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**Insight, analysis, and commentary on the
innovations and trends of contemporary computing,
and on its growing number of related technologies.**

**An ongoing journey towards understanding,
and profiting from, a world of exponential
technological growth!**

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Believe In The Possibilities of the Impossible! Dec. 17, 2001

- [Quote of the Week.](#)
How to foster Innovation.
- [Ah, Those "Impossibilities!"](#)
Yet another dose of evolutionary and revolutionary
advances,
compared to one issue ago.
- [The Fashionable Borg?](#)
The melding of Man and machine.
- [The Wayback Machine.](#)
Travel back in time on the Web.
- [A SuperSize Holiday Gift To Berlin.](#)
What a few good people can do for the many.

- [Happy Holidays! And, Just The Beginning...](#)
What a journey we've had, and what a journey we have coming!
 - [About "The Harrow Technology Report"](#)
-

LISTEN To This Issue.

Do you prefer to let your ears do the work of keeping you in-touch with, and thinking about where technology is taking us? If so, "*The Harrow Technology Report*" is also available in an audio-on-demand, Web-based, MP3 version.

If you have an MP3 player on your system (and most do, such as Window's Media Player, RealPlayer, etc.), clicking on the link below will either stream the file to you, or, depending on how your system is configured, it might download the file before playing it. Alternatively, if you specifically want to download the file, simply right-click on the link, and choose "Save Target As..."

So, if you wish, just click on the following link to listen to this issue! <http://www.theharrowgroup.com/articles/20011217/20011217.mp3> .

Quote of the Week.

On "Innovation:"

"Ideas need a home. They need a place to go. They need people to review them," says Linda Yates, a partner in Painted Wolf Ltd., as well as cofounder, former CEO and adviser with Strategos. Once that process begins to percolate, management must pay attention and call

attention to it.

'It's important that we notice innovation, nurture it and reward it,' says Simon Jeffery, president and COO, LucasArts Entertainment Co.

The next step is to create the right combination of people working together as a team. 'Have dreamers, have planners who can take the dream and put together a plan, and then have executors who can make that plan a reality. And let all of those people interact and work closely together,' says Ron Beegle, executive VP of the Gap Inc. Direct.'"

From the July 18 Innovation,
excerpting from the July "Fast Company" magazine
<http://www.fastcompany.com/online/48/fasttalk.html>

Good advice, I think.

[Back to Table of Contents](#)

Ah, Those "Impossibilities!"

The title of this issue, *"Believe In the Possibilities of the Impossible!"*, is a closing line from one of the better TV movies of late, *"Jim Henson's 'Jack and the Beanstalk,' the Real Story."* If you think you know the fairy tale, this movie does a fine job of reminding us that there can be very different ways of looking at the same set of events. And that sometimes, events force us to believe in the "impossible."

In fact, "impossible" is the word that comes to many peoples' minds as we continue to explore both the evolutionary and the revolutionary changes that are in store for the "electronics" around us.

PREVIOUSLY, In The Harrow Technology Report...

Indeed, we're going to have to find a more expansive word than "electronics," given some of the revolutionary advances that we explored last issue such as ultra-dense plastic memory, biological molecular memory, single-molecule and carbon nanotube transistors, and even computers whose inputs, outputs, and processing elements are all composed of DNA. And on the evolutionary side, we found that Intel has demonstrated a "Terahertz" transistor capable of switching one trillion times each second, which may grow into commodity chips that will run at 20 gigahertz and contain a billion-plus transistors -- within six years. Whew! (<http://www.theharrowgroup.com/articles/20011203/20011203.htm#Toc531680855>)

THIS Week:

Now, just one issue later, we find that AMD has announced a transistor capable of switching THREE trillion times each second (<http://www.pcworld.com/news/article/0,aid,73923,tk,dn120301X,00.asp>). The "gates" within these transistors are but .015 micron long (compared to typical gate lengths today of .1 micron), and these much smaller gates will help pave the way towards further shrinking the size of the transistors that we create on-chip. Which means we'll be dramatically increasing the number of transistors in a given space while reducing the distance that signals have to travel -- a good thing, since distances are limited by that nasty old 'speed of light' law that is becoming more of an issue as our chips get ever-faster.

Today's premier commodity chip techniques can scribe lines as close as .13 microns to each other, and AMD's and others' advances have us on-track to decrease the size of these on-chip elements to .1 micron in the near future, and then to .07 micron, .05 micron, and finally to .03 micron by 2009 or so. Which brings us to AMD's .015 gate length transistors -- because such tiny gates represent one of the steps necessary for us to be able to build the .03 micron chips anticipated by the end of this decade. In a similar vein, Intel had previously announced a .02 micron gate length transistor, which they hope to have in production in .05 micron chips by 2007.

What all these numbers mean is that the semiconductor industry

is on-track to deliver seemingly impossible amounts of commodity computing power over the next 5-10 years.

On a similar note, IBM has announced a new "structure" for transistors, called a "double gate transistor." Instead of a traditional transistor where the "gate" element sits on top of the transistor's "source" and "drain" elements, this new design finds the gate *"wrapped around the source-drain connection like a clamp,"* which IBM says will lead to smaller transistors that will consume less power and generate less heat.

(<http://www.zdnet.com/zdnn/stories/news/0,4586,5100188,00.html>).

Totally Tubular?

Of course, these developments may turn out to be just a hint of our technological tomorrows if scientists working with carbon nanotubes have their way -- Harvard chemistry professor Charles Leiber, in a recent TRN article brought to our attention by reader Kenneth LaCrosse, said,

"We have developed a... crossed-nanowire field effect transistor that is readily amenable to high-density integration -- without the use of lithography."

(http://www.trnmag.com/Stories/2001/111401/Crossed_nanowires_compute_111401.html)

What does this mean, if we eschew lithography (the process used to build today's chips) in this way? Leiber suggests that,

"Nanowire transistors could be packed one billion to a square centimeter, and narrower nanowires would permit one trillion transistors per square centimeter."

That's not a "billion" transistors on a chip, as our evolutionary lithographic processes might yield by the end of this decade, but potentially a "TRILLION" carbon nanotube-based transistors in about the same space, if (remember that all-important "IF") this laboratory experiment can be commercialized!

Building Blocks...

But since these experimental nanotube transistors were not built using lithography in a traditional "fab," how were they built? It turns out that -- they built (self-assembled) themselves!

"The researchers built the transistors by chemically growing silicon and gallium nitride nanowires 10 to 30 nanometers in diameter and several microns long. They coaxed the nanowires to form circuits by suspending them in fluid and flowing the mixture across a surface. The tiny wires line up in the direction of the flow. They placed the silicon nanowires in one direction and the gallium nitride nanowires in a perpendicular direction.

Simply putting the wires in place was enough to assemble the gates: the nanowires are so small that atomic forces make them stick when they touch."

A far cry from today's laborious chip-building techniques.

Even Smaller.

But even these possible changes to the chips that increasingly power our societies could turn out to be a mere drop in the bucket -- in the bucket of quantum computing, that is, where it isn't merely molecules or atoms that provide the storage and computing capabilities for our information, but it's the *"quantum states of electrons, such as their energy levels or their nuclear spin, [which will] perform calculations and store data."* As improbable as this idea may seem, of using elements smaller than even atoms to do our bidding, Erick Schonfeld gives us some insight into work being done in just this area by IBM scientists, in the Dec. 5 Business 2.0

(<http://www.business2.com/articles/web/0,1653,35998,FF.html>).

And remember, what we take for granted today seemed equally outrageous just a few years ago. (For a consumer electronics example, could you, just a few years ago, have realistically expected a tiny 6.5-ounce pocket device that would hold 1,000 songs and run for 10 hours on a charge? Yet that's today's \$400 Apple iPod - <http://www.apple.com/ipod/>).

Spinning...

So we are indeed on-track to get more out of Moore; potentially a LOT more than Moore had ever envisioned, by completely "changing the rules" in one (or more) directions. And while the "numbers game" of microns and nanometers and atomic layers (now down to three for certain insulating layers), and "quantum spin," can easily make our heads spin, these worlds-of-the-tiny are going to be putting a very new spin on our electronics over the next years.

If you're thinking of creating a product that could do amazing things, if only CPUs could be faster or use less power, or if we could store more data in a smaller space -- then just wait awhile. And given what we've seen in just the past two issues, perhaps not a very long while at all.

Don't Blink!



[Back to Table of Contents](#)

The Fashionable Borg?

Speaking of the "revolutionary," no one (at least not most of us) wants to look like the half human, half machine Star Trek "Borg."





But according to the Nov. 24 Wired News (<http://www.wired.com/news/print/0,1294,48572,00.html>), brought to our attention by reader Kenneth LaCrosse, scientists at the University of Texas are working towards being able to graft a microelectronic circuit directly onto a neuron! (Similar work is also taking place at the Max Planck Institute (<http://www.nytimes.com/2001/12/10/technology/10NECO.html>) and at other research labs.)

They're far from ready to "plug us in" -- they have many steps yet to go before significant "direct connects" are feasible. But this line of research is fascinating, and a pretty good hint of things to come, as described by Brian Korgel,

"We can now take a semiconductor and position it where we want it on a cell. We can interface microelectronic materials with cells."

They did run into an interesting roadblock in this process; current semiconductor manufacturing techniques don't have the precision to align an electronic quantum dot with just the right location on a neuron. So Korgel and Christine Schmidt simply changed the rules -- they co-opted peptides, a biomolecule, to connect with exactly the right protein on the surface of the neuron!

If this process turns out to be successful, what might it eventually mean to us? "Bio-prosthetics," for one thing, where artificial limbs might work as naturally as real ones. But derivatives of this primary research could be even more interesting, according to Korgel:

"On a more basic level than the actual brain, you may be able to make a substrate, put nerve cells on those, grow them and then put semiconductor dots on different nerve cells -- and then use those nerve cells as a computer."

Shuning Nie, a quantum dot chemist at Indiana University, sums the potential of this work up nicely:

"These are fairly far-out ideas. But we are talking about interfacing semiconductor nanostructures and biology. It's a big field."

Which would change a whole lot of rules.

Changing The Rules!

Computing advances are not going to be confined to faster CPUs and smaller memory -- "computing" will continue to completely redefine our world in ways that today are science fiction. Just as today's computing was very much the science fiction of just a few years ago.

Again, Don't Blink!



[Back to Table of Contents](#)

Your Feedback is Important!

I'd like to understand your interest in *The Harrow Technology Report*, how you make use of it, and the value you feel it provides to you, your career, and to your company.

Please send your comments to me at Jeff@TheHarrowGroup.com .

I look forward to hearing from you!

Spread The Word!

And, if you know of other folks who might find value in "*The Harrow Technology Report*," I'd appreciate your letting them know that they can subscribe at <http://www.theharrowgroup.com/signup.asp> .

Jeff Harrow

[Back to Table of Contents](#)

The Wayback Machine.

I still remember Rocky & Bullwinkle's "Wayback Machine;" the show used it to teach us kids a bit about history in a way that was far more engaging than a dry classroom lecture (<http://www.rockyandbullwinkle.com/>). We may not (at least yet) be able to zip back to view events earlier in our world's history, but now the Internet Archive (<http://www.archive.org/>) lets us do exactly that for the history of the Web!

In conjunction with Alexa, the Internet Archive has amassed 100,000 gigabytes (100 terabytes) of Web pages (five times the amount of information in the Library of Congress), growing at the rate of 12 terabytes each month! And these archives of the Web are available to us all at <http://web.archive.org/> . Might this change how we think about traditional "libraries"?

The Wayback Machine works like this. Say you wanted to explore the history of a particular Web page -- simply type it's address into the Wayback Machine, and it will present you with a calendar showing each day on which it recorded a copy of the page, ready for your click.

And what a prize this fount of knowledge is! For example, I typed in the address of Dragon Systems (www.dragonsys.com) to explore it as it was before it was bought by the now defunct L&H. The Wayback Machine instantly presented me with more than 50 different versions of their home page, ranging back to as early as 1996.

Of course I expected that most of the links on these pages would be long dead -- clearly, it's unlikely that a six-year-old link would still be valid on the company's current site. But I was very pleasantly surprised -- the Wayback Machine also recorded most of the "link pages" as well, and altered their addresses so that I could click around a Web site just as if I were back in 1996! (Did you, perhaps, need an old driver or instruction manual...?)

Something Old = Something Very New!

This is a view into the history of business and social aspects of our global society that we've never had before. For example, with some exploration, we can track how a politician might have changed his or her stance on an issue over the years. Or as described by the director of the Internet Archive, Brewster Kahle, he was able to explore the history of the Heaven's Gate cult, which performed the California group suicide in 1997.

And this is just the very beginning of where such a resource might lead. Imagine if the Web were not six, but sixty years old. Or six hundred. And that we had this level of historical detail to explore. We have, in fact, begun this very journey.

Indeed, as computing and storage continue their inexorable improvements and miniaturization, I can foresee the day when all TV and radio programs are similarly recorded and indexed for later exploration. And the images from the growing number

of public surveillance cameras. And, eventually, even the 24x7 experiences of people going about their daily lives, perhaps through the lens of "eyeglass cameras" and the like (see <http://www.informationweek.com/story/IWK20011218S0004> , with thanks to reader David Breed.)

Be Careful Out There...

The Internet Archive should also remind us that *NOTHING* that we say or do or write on the Internet is ephemeral -- we should assume that it's been captured and recorded. And if it's something we're not proud of, it may well come back to haunt us. (For example, if you've ever posted something to an Internet Newsgroup, you (and anyone else) can probably still read your long-departed words, since Google has now made the past twenty years of Newsgroup articles but a click and a Search away -- see http://www.google.com/googlegroups/archive_announce_20.html , as brought to our attention by reader Michael Engle.)

Future historians are going to have SO much fun!!

[Back to Table of Contents](#)

A SuperSize Holiday Gift To Berlin.

Finally, you've probably seen one -- those large, high-density color graphic displays at sports stadiums; they do such a wonderful job of showing graphics and full motion video that your home TV might need therapy for a serious inferiority complex. But short of New York's Times Square and a few other places, really large displays are just too expensive to litter the landscape.

Germany's Chaos Computer Club, however, decided that their city of Berlin needed a large display, and they've taken a rather

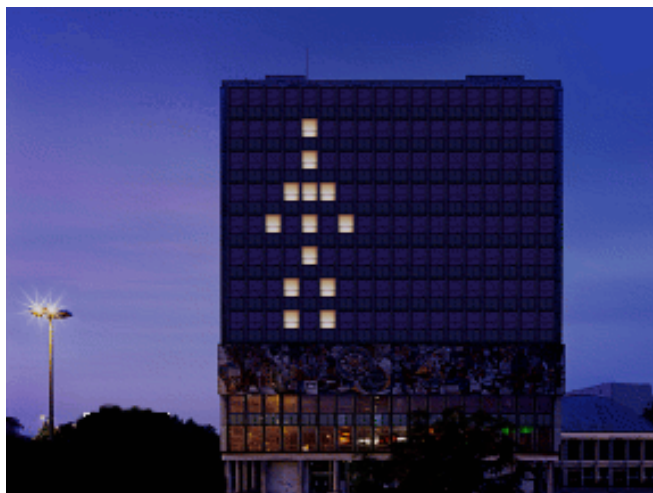
untraditional and bargain-basement approach to giving Berliners a holiday present called "BlinkenLights."

(<http://www.blinkenlights.de/>).

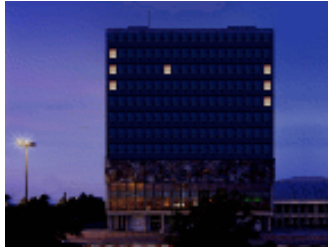


Using a minimalist approach, they've positioned 144 computer-controlled 150-watt lights behind the windows of this building, yielding a monochrome display of 18x8 pixels.

Now this might not seem very impressive, or even useful at first, compared to those beautiful high-density color stadium displays, but add in the computers that drive this minimalist display, plus "interactivity" via cell phones, and BlinkenLights is able to provide a building-sized canvas that *YOU* can use to display "love letter" movies to your significant other,



and even play a real-time interactive game of Pong for the city to see! (<http://www.blinkenlights.de/interactive.en.html>)



Details are at <http://www.blinkenlights.de/interactive.en.html> , and as you can see from this animated picture, this building-sized if simple display yields impressive results. (A gallery of examples of what the building has been playing, each one designed by a "user," is at <http://www.blinkenlights.de/gallery.en.html> .)

It's also impressive that this project went from conception to "first movie" in just four weeks, demonstrating how a group of talented volunteers can make a, er, SuperSized, very positive impact on their city!

[Back to Table of Contents](#)

Happy Holidays! And, Just The Beginning...

Well, I don't have a building-sized display to use to wish each of you a very happy holiday season in this last issue in 2001, but the sentiment is there just the same.

2001 has been a trying year in many ways, which has brought out both the worst and the best of human nature. It's also demonstrated incredible evolutionary and revolutionary advances in computing, memory, and storage, to the point where each can now be done (in the research labs) using but single molecules or less, or even the stuff of life (DNA) itself! And as we learned earlier in this issue, the boundaries between Man and machine may be thinning as scientists learn to meld neurons and

silicon.

These are the latest examples of the ongoing magic that has brought us from a world of gas lamps and horse-drawn wagons, to an interactive, interconnected World Wide Web that does bring our world closer together. And even to cell phone-driven, building-sized love letters. Yet this is just the beginning. The very beginning, of where this technological road has yet to take us.

I hope that you will continue to join me as we explore and understand and extrapolate and experience this incredible journey, as The Harrow Technology Report begins 2002 with its first issue on January 7.

Happy Holidays!

Jeff

About "*The Harrow Technology Report*"

"The Harrow Technology Report" explores the innovations and trends of many contemporary and emerging technologies, and then draws some less than obvious connections between them, to help us each survive and prosper in the Knowledge Age.

"The Harrow Technology Report" is brought to you by Jeffrey R. Harrow, Principal of The Harrow Group.

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