

April 2020
VOL. XXXVI, NO. 4

Daniel Burrus'

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TECHNOTRENDS® NEWSLETTER

*The biggest ideas that are
changing everything*

IN THIS ISSUE

Anticipate and Think Exponentially

Emergency Ventilators

Dengue Virus "Trap"

Flexible Armor

Non-Stick Bandage

Electronic Nose

Electric Semis

Peering Into the Past

Contactless Delivery Vehicles

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Anticipate and Think Exponentially

By Daniel Burrus, CEO of Burrus Research

Technology-driven change has been accelerating and will continue to accelerate at an exponential rate. Processing power at the chip level may not continue to double every 18 months as Moore's Law predicted it would for the past 35+ years, but the computing ecosystem in the cloud will! And now that quantum computing has recently entered an early phase of application, exponential change will itself accelerate. In other words, the pace of change and disruption are not slowing down; they are speeding up. It has never been more important to turn accelerating change into a personal and business advantage!

Anticipatory Mindset Takes Advantage of Exponential Tech

Over the decades, I have flown over six million miles consulting and speaking to leaders around the world, and I have come to realize that mindset is everything! The CEO of Sears, who is closing over 100 Sears stores nationally, has a different mindset than the CEO of Amazon, who is opening over 100 physical retail stores nationally. Some people think the good old days are behind us, while others think they are ahead. Some see scarcity, while some see abundance. Some are optimistic, while some are pessimistic. And some are reactionary, while others are anticipatory.

Consider my many writings on anticipation and the importance of an anticipatory mindset. I have discussed at length about the importance of paying attention to the Hard Trends that are shaping the future both inside and outside of your organization and to use those future facts to become a positive disruptor as opposed

to becoming the disrupted. My Anticipatory Model and methodologies are built on solid foundations, proven to be true time and time again when examining how predictable digital disruption is, and how identifying disruptions before they disrupt provides a major advantage over agile, fast reactors to disruptions and problems.



We as humans have a tendency to think in a more linear fashion about disruption and change

Because exponential change, driven by the Three Digital Accelerators (computing power, bandwidth, and digital storage) that I highlighted as far back as the early eighties, will continue to speed up, we need to implement an exponential mindset, or more precisely, exponential thinking in order to take advantage of the increasing pace of change. But what exactly is exponential thinking?

We as humans have a tendency to think in a more linear fashion about disruption and change, where something disrupts our work flow or industry and thereafter, we react to it and try to move forward in a "lead from behind" fashion with a "wait and see" attitude. Exponential thinking is much different.

Consider exponential thinking to be more like multiplication, where we take two, multiply it by two, and get four. Then, we take four and

continued on page 8

TECHNOLOGY NEWS HIGHLIGHTS

Emergency Ventilators

Amid the COVID-19 pandemic, a shortage of ventilators is one of the most pressing needs facing hospitals worldwide. It has been estimated that the COVID-19 pandemic could result in a worldwide ventilator shortage of 300,000 units or more. While conventional ventilator production is ramping up, it will likely fall short of meeting the demand in time, while costing billions of dollars.

In response, engineers at universities across the country have created alternative designs that can be assembled and deployed rapidly and inexpensively. In general, they are based on the automatic actuation of a manual resuscitator. Following are links to information for just a sampling of these open source designs, which are being posted online.

PLEASE NOTE: These designs are intended

for implementation only by experienced clinical engineers to expand access to ventilators on an emergency basis. Since automatic ventilation requires continuous, direct monitoring of multiple parameters (including volume, pressure, rate, and inspiration/expiration ratio) they should only be used in a healthcare setting under the supervision of a clinical professional.

MIT Emergency Ventilator (E-Vent) Project Massachusetts Institute of Technology

Website: <https://e-vent.mit.edu/>

Illinois RapidVent Ventilator

University of Illinois at Urbana-Champaign

Website: <https://rapidvent.grainger.illinois.edu/>

Bag-Valve-Mask (BVM) Ventilator

Georgia Tech

Website: <https://news.gatech.edu/2020/04/06/simple-low-cost-ventilator-builds-available-resuscitation-bags>



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Dengue Virus "Trap"

Researchers recently developed a method for identifying the dengue virus that is faster and more cost-effective than traditional laboratory testing. The technique should also be more sensitive, enabling diagnosis even before symptoms develop.

The surface of the dengue virus contains proteins (also called antigens) that attach to the cells of the organism it infects. These proteins are arranged on the spherical surface in a specific pattern that may vary from virus to virus. The researchers constructed a DNA scaffold that mirrors that pattern (in this case, a five-pointed star) and placed molecules that the antigens will bind with at strategic locations. Once the scaffold is attached, the star fluoresces to signal the presence of the dengue virus. The test can be performed in about two minutes at a cost of about 50 cents.

Multiple points of attachment make the bond very strong, and because the DNA star specifically targets viruses with that pattern, precision is very high. The same principle can be adapted to other viruses and even other cells, such as cancers. Techniques like this could prove to be instrumental in the fight against COVID-19.

For information: Xing Wang, University of Illinois at Urbana-Champaign, Micro and Nanotechnology Laboratory, 208 N. Wright, M/C 249, Urbana, IL 61801; phone: 217-333-3097; Website: <https://illinois.edu/> or <https://mntl.illinois.edu/news/article/34897>



Flexible Armor

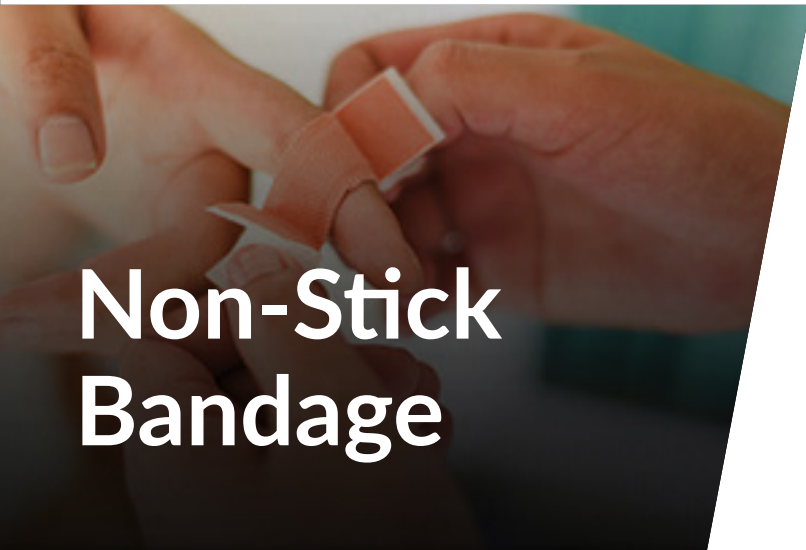
Although many advancements in protective gear have been made in recent years, elbows, knees and fingers remain the most vulnerable spots in any type of armor. Now engineers have designed a material that is tough enough to provide protection, yet flexible enough that it doesn't inhibit joint motion.

As is often the case, the engineers took their inspiration from nature – specifically a species of sea mollusk called chitons. These rather inconspicuous creatures are covered with overlapping scales of calcium carbonate to defend against predators. The team studied individual scales down to the nanometer while also looking at chemical composition, crystalline structure and how they function together mechanically. Although the largest of the chiton scales are only a couple of millimeters wide, high-resolution x-rays enabled engineers to create a three-dimensional image of their geometry. Then they used this information to 3-D print physical models (including some prototype kneepads) and evaluate how different configurations would behave under stress.

Results suggest that the new armor would provide protection against lacerations while offering good flexibility. Applications for these types of materials would be vast –

from military armor to athletic gear and even industrial protective equipment.

For information: Ling Li, Virginia Polytechnic Institute, Department of Mechanical Engineering, 635 Prices Ford Road, Blacksburg, VA 24061; phone: 540-231-6045; email: lingl@vt.edu; Website: <https://vt.edu/> or <https://view.joomag.com/momentum-the-magazine-for-virginia-tech-mechanical-engineering-vol-4-no-4-winter-2019/0870263001578944902?short>



Non-Stick Bandage

In the quest for a coating that will keep blood from adhering to medical devices, researchers recently stumbled across a new type of bandage material – one that not only detaches more easily, but also promotes quicker clotting.

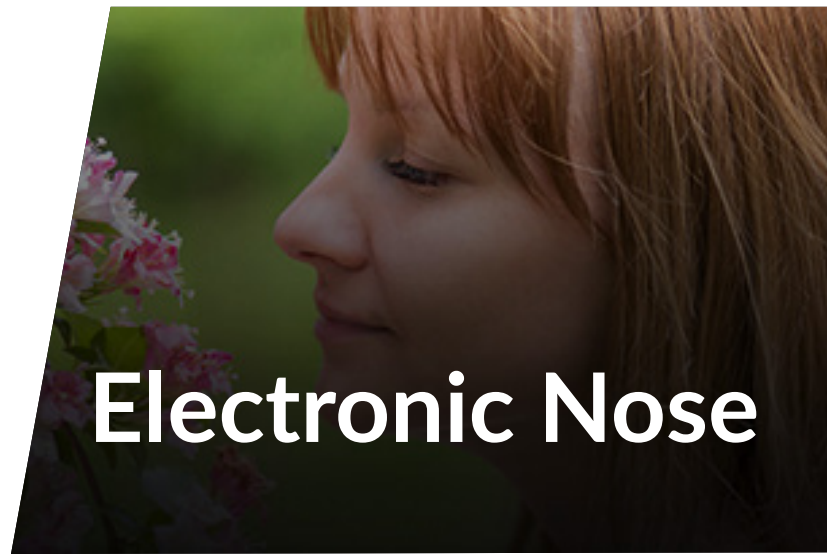
The new material is a superhydrophobic mixture of carbon nanofibers and silicone. When sprayed onto conventional cotton gauze, the bandage stays dry, making it easier to pull off of the wound without reopening it. What researchers did not expect, however, is that the mixture also enhanced the production of fibrins – mesh-like proteins that form at the surface of a wound to aid blood clotting. This characteristic seems to be directly related to the nanofiber structure, since reducing the nanofiber content reduces fibrin production, but further study is needed to fully understand the mechanism.

In addition to the new material's use as

a wound dressing in trauma situations, the developers are looking at hemostasis applications – for example, to seal blood vessels during a surgical procedure. The team has filed a patent for the technology.

For information: Choon Hwai Yap, National University of Singapore, 21 Lower Kent Ridge Road, Singapore 119077; phone: +65-6516-6666; email: bieyapc@nus.edu.sg; Website: <http://nus.edu.sg/> or <https://bioengineeringcommunity.nature.com/users/263613-choon-hwai-yap/posts/57180-superhydrophobic-biomaterial-makes-an-ideal-gauze-rapid-bleeding-stoppage-and-easy-removal-after-healing-prevents-infections>

For information: Torben Daeneke, Royal Melbourne Institute of Technology, School of Engineering, 124 La Trobe Street, Melbourne, Victoria 3000, Australia; phone: +61-3-9925-8969; email: torben.daeneke@rmit.edu.au; Website: <https://www.rmit.edu.au/>



Electronic Nose

A new chip has been developed that can identify a chemical by smell after a single exposure to it. Known as Loihi, the chip goes beyond typical deep learning architectures to more closely mimic the way the human brain operates.

Loihi falls into a category of what are known as neuromorphic chips. Instead of requiring a large number of previous data sets and time-consuming training, neuromorphics employs “one-shot” learning. With regard to the sense of smell, the human brain can smell something once and immediately recognize it again. In fact, mammals can learn hundreds and even thousands of

smells without forgetting those they previously learned.

When this principle is applied to electronics, it eliminates the power-hungry training process that artificial intelligence (AI) systems require. It also means that the system does not require retraining every time a new sample is encountered, enabling detection up to a thousand times faster than existing methods.

The latest version of Loihi is a 768-chip, multi-board system representing the equivalent of 100 million neurons. Systems like this could one day be used to sniff out hazardous chemicals and explosives, or even aid in diagnosing medical conditions.

For information: Thomas Cleland, Cornell University, 278E Uris Hall, Ithaca, NY 14853; phone: 607-351-9797; email: thomas.cleland@cornell.edu; Website: <https://www.cornell.edu/> or <https://news.cornell.edu/stories/2020/03/researchers-sniff-out-ai-breakthroughs-mammal-brains>

are excellent candidates for upgrading to electric. In fact, much of the testing is being conducted at the ports of Los Angeles and Long Beach, which see about 14,000 trucks per day, many of which make relatively short daily hauls.

While the up-front cost is slightly higher than that of a conventional truck, operating costs are estimated to be lower – \$1.26 per mile as compared to \$1.38 per mile for diesel. According to the Environmental Protection Agency, medium- and heavy-duty trucks also account for about 8 percent of greenhouse gas emissions, making electric an attractive alternative for the environment.

There are approximately 2 million semis and tractor-trailers operating in the United States today, and they are being replaced at the rate of about 200,000 to 300,000 per year. But the fact that some manufacturers have already stopped taking orders due to the high demand speaks for itself.

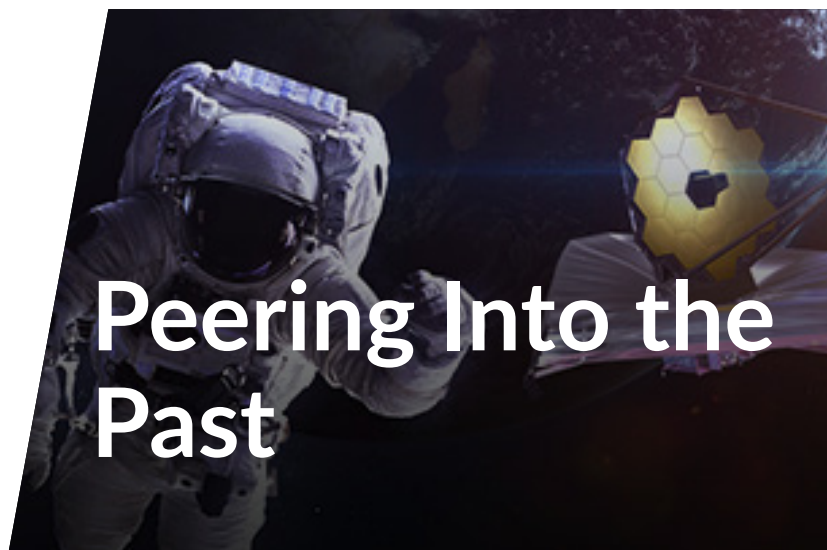
For information: Daimler Freightliner; Website: <https://freightliner.com/e-mobility/> Nikola Motor; Website: <https://nikolamotor.com/one> Tesla; <https://www.tesla.com/semi> Peterbilt; Website: <https://www.peterbilt.com/electric-vehicles> Xos Trucks; Website: <https://xostrucks.com/>



Electric Semis

The next big wave of electric vehicles could very well be big rigs, as startups and established manufacturers alike begin to transition from diesel to electric motors.

Although they may not be ready for long-haul, cross-country runs, heavy-duty semis that are used for regional hauling



Peering Into the Past

The National Aeronautics and Space Administration (NASA) is putting the

finishing touches on a 25-year project to launch the largest telescope ever built early in 2021. Dubbed the James Webb Space Telescope (JWST), the \$9.6 billion telescope is designed to orbit one million miles above the Earth and observe objects billions of lightyears away.

The main feature of JWST is the mirror, which measures more than 21 feet (6.5 meters) in diameter (seven times the size of the Hubble Telescope mirror).

Constructed of strong yet lightweight beryllium and coated with a microscopic layer of 24 karat gold polished within nanometers of accuracy, it reflects 98 percent of infrared light onto a secondary mirror. From there, it is beamed to four instruments for analysis – one of which is a near-infrared spectrograph that can observe up to 100 objects simultaneously.

Because infrared waves are created as the universe expands, analyzing these waves will allow scientists to see farther into the universe.

The mirror is made up of 18 different sections that will fold up to fit inside a 16-foot diameter Ariane rocket fairing. The 14,000-pound mirror will then unfurl once it reaches orbit – two to three weeks after its launch from Guiana Space Center next March. It will carry enough fuel to operate for up to 14 years, however, scientists are already working on a robotic fueling mission to extend the life of the project.

*For information: National Aeronautics and Space Administration;
Web site: <https://jwst.nasa.gov/content/about/launch.html>*



Contactless Delivery Vehicles

A second autonomous delivery startup has been approved by the state of California to test its driverless and passenger-less vehicles on public roads.

The permit covers not only light-duty delivery vehicles such as midsize trucks and cargo vans, but also vehicles weighing less than 10,000 pounds, such as passenger cars.

The latest vehicle to be approved is the Nuro R2. Because it doesn't require a human safety driver, the manufacturer was able to eliminate some of the features that would normally be found in a passenger-carrying car – like side mirrors, a rear window and even the windshield. But unlike human-driven vehicles, its rear cameras are operating at all times to enhance safety.

The coronavirus pandemic has helped to fast-track approvals by underscoring the need for contactless delivery services.

In some areas, grocery delivery has extended to two weeks or more, and a system that requires no human intervention is a plus when trying to maintain physical distancing.

For information: Nuro; Website: <https://nuro.ai/product>

Anticipate and Think Exponentially

continued from page 1

multiply it by two to get eight, and so forth, as opposed to linear thinking, where we take two, add two to it and get four, but thereafter add two to four and only get six as a result, falling behind drastically.

Thinking One-Dimensionally in a Multidimensional World

Yet despite the above facts, we're still predominantly using linear, one-dimensional thinking when we consider how to apply exponential technology. If we continue to apply one-dimensional thinking to exponential technology, we squander the true benefits of the new technology. Exponential thinking is multidimensional, not just horizontal 2D. Think of it as adding vertical 3D and 4D thinking as well. If we're going to benefit from exponential technology, we need to think multidimensionally as opposed to the one-dimensional behaviors we exhibit when presented with a groundbreaking digital improvement to our organizations and our lives.

How does being anticipatory help this cause? By learning to identify the Hard Trend certainties that will happen, we gain the confidence to make innovative bold moves because we see a new dimension to personal and business risk. The risk of not innovating becomes greater than maintaining the status quo.

Take, for example, a simple software that has been a constant in our lives for decades: Microsoft Word. I'll bet you didn't know that there are over 4,000 selectable features in Microsoft Word! I'll also bet that you likely only use maybe a dozen or two of those thousands

of features.

This is exactly what linear thinking has done to us. We always feel compelled to do what we did before because it's comfortable. We ask our IT helpers: "How do I get the classic view?" But that comfort is really just a form of legacy thinking in disguise, fostering what anthropologists would consider to be a sort of avoidance relationship with the future. We acknowledge many new features exist, but we find comfort in only mastering a few and pegging ourselves to a job or set of tasks that stay within those parameters.



Learning to use the new features, the newest version of a seemingly old-school software like Microsoft Word can allow us to do things we didn't know we could do and transform how we write and communicate in a more efficient and powerful way. If we're truthful about wanting to grow our organization or our careers, the advantage is most likely found in the new features.

Exponential Technology in the Real World

While exponential thinking might seem simple to some, other individuals have written at length about exponential technology without ever focusing on the mindset of the user. The two go hand in hand, so how can one fully

understand what exponential technology can do without applying exponential thinking?

You can't! If you go exponentially fast in the wrong direction, you'll get there exponentially faster. Doing things faster without understanding direction leads us astray. I compare this to being anticipatory by way of paying attention to the Hard Trends that are shaping the future of your industry and the Soft Trends that you can change. If you're functioning in a reactionary way without ever understanding the predictable disruptions heading your way, you'll always be behind the curve and in some cases, it could be catastrophic, as opposed to being anticipatory, understanding what will be used to disrupt, and leveraging that to become a positive disruptor before becoming the disrupted.

Companies often fail because they're just using the exponential tools provided to us in this highly technologically advanced era we find ourselves in, as opposed to first understanding and learning how to utilize those tools in an exponential way. Also, the knowledge that every piece of technology isn't exponential is vital as well. Exponential technology is a platform for unlimited growth, driven by those Three Digital Accelerators as mentioned above.

A great example of this is the cloud. It is an incredibly useful technology; however, it is essentially nothing until someone applies it to their organization's workflow or utilizes it in conjunction with something they've created.

Artificial intelligence is another great example of exponential technology. It is a platform with infinite applications.

To compare these digital concepts to something more timeless, consider the piano. A piano today has the same number of keys as Beethoven's piano or even the first piano ever; however, that does not limit us in the ability to create new music. It has infinite possibility

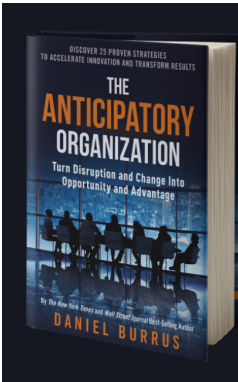
when one applies exponential thinking to it by way of creating a song that hasn't been written before.

Anticipate and Think Exponentially

The problem today is that, to some degree, linear or legacy thinking is like a break slowing innovation and positive change. When something new is introduced, we often approach it with a process we have developed over time, much like music and the piano example where we fear veering from said usage of a tool and hide behind a familiar way of utilizing it.

One thing to always keep in mind is the fact that change is the only constant, and life is quite ambiguous. If you focus all your energy on just one simple thing, eventually you get better and better at just that one thing. Before you know it, something new and disruptive renders your one area of expertise less relevant, and you've now dated yourself to when that specific area, much like a style of music, was prominent. What if your area of expertise disappears in the future? Will you be out of business?

Approach every piece of exponential technology with an anticipatory mindset using exponential thinking, much like you approach disruption with an anticipatory mindset in order to become a positive disruptor.



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