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TECHNOTRENDS® NEWSLETTER

The biggest ideas that are changing everything

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5G Is Far Bigger Than Faster Smartphones

By Daniel Burrus, CEO of Burrus Research

The world has never experienced as much uncertainty as it has today. The global pandemic has disrupted business, government, healthcare, and education on a global level. This extreme disruption is far more than institutional. It's been personal, disrupting how we all live, work, and play.

At the same time, because businesses and organizations of all sizes were forced to change, technological innovation has been accelerating beyond exponential levels, jumping ahead five and, in some cases, ten years or more in a matter of months, creating massive new opportunities that crisis managers are failing to notice.

For example, 5G is a transformational jump ahead and it's happening now, yet most will miss the multibillion-dollar opportunity 5G represents because we think we know what it is and what it does. Think again!

In order to see the magnitude of the opportunity I'm about to cover, it's important to start by adjusting our mindset.

> *But in this new world of hyper-disruption, you will either be the disrupted or the disruptor; there is no in-between.*

Let's face it. It's easy to look at game-changing new technologies such as 5G and decide it's safer to wait and see what will happen and how others might use them. But in this new world of hyper-disruption, you will either be the disrupted or the disruptor; there is no in-between. Having a wait-and-see strategy can put you out of business fast. Worse yet, it can put you out of business slowly as you become increasingly less relevant as others rapidly pass you by. So what should you do? Focus on what you can be certain about!

Strategy based on uncertainty has high risk; that's why so many wait when it comes to applying new technologies. On the other hand, strategy based on certainty has low risk and high reward. When people have high levels of certainty, they have the confidence to make bold moves, and they know if they don't actively innovate, others will.

But how can we have the confidence to leverage technologies such as 5G and others, and better yet, how exactly do we identify these certainties? This is where my Hard Trend Methodology comes into play.

All trends fall into one of two categories: They are either Hard Trends that are based on future facts that will happen, or they are Soft Trends that are based on assumptions of what might happen. And when you attach a strategy to either a Hard Trend or Soft Trend, it bursts into actionable life.

The advantage of a Soft Trend is that it can be changed. The advantage of a Hard Trend is that you can identify disruptions before they disrupt and create a strategy to become a positive disruptor, creating the transformations that need to happen to increase your relevance and competitive advantage. This simple yet powerful methodology has transformed planning, innovation, and risk management for hundreds of innovative companies worldwide.

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TECHNOLOGY NEWS HIGHLIGHTS

Advances in AI

Researchers have developed an artificial intelligence (AI) system that is capable of scoring 90 percent on an 8th grade multiple choice science test. Unlike traditional AI systems, which rely on massive datasets to understand the world, the new system (known as Aristo) combines technologies for language processing, information extraction, knowledge representation and reasoning to develop a "commonsense" approach for answering open-ended questions.

But, although Aristo excels at retrieving information and making logical connections, it isn't remotely comparable to a human. For example, questions that required students to interpret pictures of diagrams were removed for the purposes of testing since the AI system doesn't have the skills to visually interpret them. Aristo is also no match for the human brain when it comes to parallel processing of multiple related functions. Recreating these capabilities would require thousands of CPUs and enormous amounts of power.

So, for the time being, the best systems will leverage the power of what AI does best – searching through vast amounts of data and calculating probabilities – while relying on human expertise for complex processes that require intuition, creativity and the ability to synthesize past experience with current information.

For information: The Allen Institute for Artificial Intelligence, 615 Westlake Avenue North, Seattle, WA 98109; phone: 206-548-5600; email: ai2-info@allenai.org; Website: https://allenai.org/

Self-Driving Semis

A leading developer of self-driving cars and a leading manufacturer of semi-trucks have teamed up to produce what will likely be the first autonomous semis.

Alphabet's Waymo Driver has literally gone through billions of miles of simulation and millions of miles of road testing to become recognized as one of the leading autonomous technologies in the industry. Based on 3-dimensional map data that includes traffic lights, stop signs, curbs, sidewalks, lane markers and road profiles, the system starts out with a comprehensive image of the driving area.

Sensors and cameras can scan up to three football fields away in all directions for temporary objects, vehicles and pedestrians. And software predicts what will happen next based on the speed and trajectory of a scanned object to determine safe driving speeds and steering maneuvers.

The plan is to incorporate this SAE Level 4 self-driving system into Daimler's Freightliner semis, although industry experts predict that we may eventually see the same capabilities in other Daimler brands, like Mercedes-Benz. No time frame for the upgrade has been released.

For information: Waymo LLC, Website: https://waymo.com/tech/ Freightliner Trucks – A Division of Daimler; Website: https://freightliner.com/

Plastic-Metal 3D Printer

A new printer has been developed that enables the production of plastic-metal hybrid parts on a single printer. The advancement could pave the way for more reliable and complex parts for 3-dimensional electronics, robotics and other applications.

In traditional fused filament fabrication (the most widely used 3-D printing process), parts can be printed using either plastic or metal. However, because of the different melting points, it's impossible to make parts using both metal and plastic simultaneously. Instead, plastic parts are soaked in a solution containing palladium (Pd). Once coated with Pd, the object is submerged in an electroless plating bath where dissolved metal ions are deposited onto the surface. A major drawback of this process is that the coating is non-uniform and adhesion is poor.

The new printer employs a dual nozzle that can extrude either standard melted ABS or ABS that already contains palladium chloride ($PdCl_2$) selectively within a printed object. In this way, specific areas can be selected for plating. The researchers have found that the new technique eliminates the need for etching of the plastic prior to plating, and when Pd is loaded directly into the raw material, adhesion is also much higher.

For information: Shinjiro Umezu, Waseda University, 1-104 Totsukamachi, Shinjuku-ku, Tokyo, 169-8050, Japan; Website: https://www.waseda.jp/top/en/ or https://www.waseda.jp/top/en/news/73810

Seaweed Cow Feed

Methane production from livestock accounts for up to one-third of agricultural greenhouse gas emissions.

So researchers in Australia have been looking at alternative feeds to reduce the source of all that gas – burping. As early as 2016, they found that, when added as a supplement to a typical diet at levels of less than 5 percent, a strand of seaweed called Asparagopsis taxiformis could reduce methane production in milk cows by up to 95 percent by reducing the microbes in their stomachs that cause them to burp.

More recent studies are being conducted in beef steer to determine whether similar results can be obtained. In addition, further research is underway to see if seaweed additives affect the quality of the milk or steaks coming from the animals, and whether the compounds can be made shelf-stable when exposed to heat or light.

They are also looking at ways to sustainably produce A. taxiformis and maximize the concentration of the chemicals that produce the desired effect.

Although the overall reduction in greenhouse gas emissions sounds incrementally small, it is estimated that methane warms the earth up to 86 times as much as carbon dioxide. In other words, burp-free cows could have a big effect on climate change in the long term.

For information: Nick Paul, University of the Sunshine Coast, Seaweed Research Group, Queensland, Australia; phone: 617-5459-4533; email: npaul@usc.edu.au; Website: https://www.usc.edu.au/ or https://www.usc.edu.au/research/animal-and-marine-ecology/seaweed-research-group

Global Internet

SpaceX recently expanded its beta test of Starlink – a satellite-based service designed to provide high-speed internet anywhere on the planet.

With nearly 900 satellites already in place, it is working with rural organizations to bring its "Better Than Nothing Beta" program to remote areas in the United States and Canada, with global coverage targeted for 2021.

In partnership with Microsoft, Starlink is planned to connect with the Azure cloud computing network to offer computing capabilities in remote areas where service was previously unavailable.

The company has estimated it will cost $10 billion to complete the network; however,

the annual revenues are projected to be as high as $30 billion.

For information: Starlink: Website: https://www.starlink.com/

Mouth Bacteria and Metastatic Cancer

It has recently been discovered that a common bacteria, which resides in normal, healthy gums, may have a role in the metastasis of certain types of cancer, including colon, esophagus, pancreas and breast.

Known as Fusobacterium nucleatum, the microbe is a normal component of the oral microbiome, but poor dental hygiene, uncontrolled diabetes and other conditions can cause it to spread, leading to conditions like periodontitis, tonsillitis and appendicitis.

The link to cancer was first discovered nearly a decade ago when the DNA of F. nucleatum was found to be present at higher levels in colon tumor tissue than in normal tissue.

It has also been linked to poorer prognosis, chemotherapy resistance and metastasis in various types of cancer.

But in the last year, it has been confirmed that the bacteria is not just a warning sign. When colon cells are invaded by F. nucleatum, they have been found to produce two inflammatory proteins that promote metastasis, and may actually accelerate it.

These results underscore the importance of the microbiome in battling cancer as well as promoting it.

It's already been shown that some immunotherapies work better when beneficial microbes are present. And the fact that F. nucleatum is attracted to sugar on tumor cells could someday be exploited to carry therapeutic drugs directly to a malignant target.

Understanding this delicate balance is fast-becoming an important component in fighting cancers.

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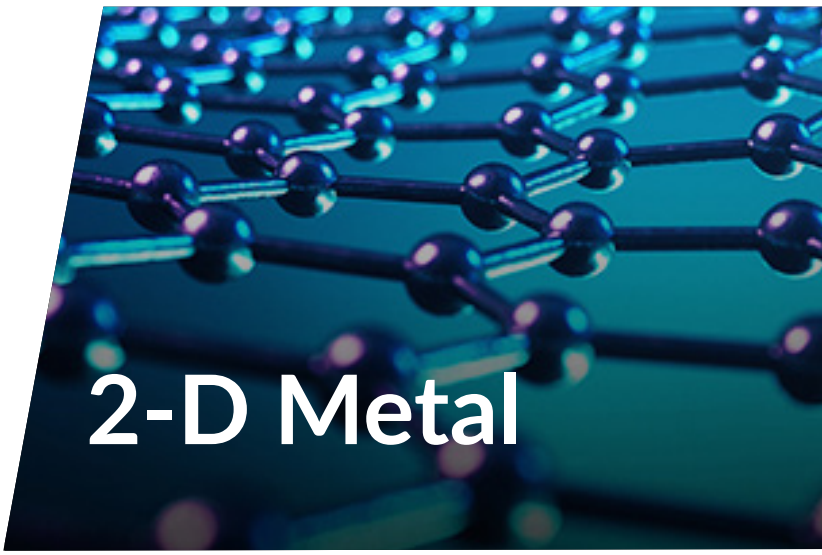

2-D Metal

Scientists have developed an alternative to graphene that can be synthesized using

bacteria.

Called molybdenum disulfide (MoS2), the new material is only a few atoms thick, but unlike graphene, which acts as an electrical conductor, MoS2 is actually a semiconductor, making it extremely useful for manufacturing various types of electronic devices like diodes, transistors and integrated circuits.

The bacterium, Shewanella oneidensis, is one of a class of organisms that can "breathe" anaerobically (without oxygen).

In such an environment, rather than transferring electrons to oxygen atoms, the bacteria transfer electrons to metals. Although it took some trial and error to find the best combination of materials, when placed in an airless bottle, the nanoparticles were created over the course of two weeks.

Most importantly, the reaction occurs at room temperature, making it a desirable alternative to other synthesis processes that require harsh environments.

For information: Shalya Sawyer, Rensselaer Polytechnic Institute, 110 Eighth Street, Troy, NY 12180; phone: 518-276-6000; email: sawyes@rpi.edu; Website: https://www.rpi.edu/ or https://www.ecse.rpi.edu/~ssawyer/

CRISPR Caution

CRISPR-Cas9 has been heralded as a powerful tool for repairing genetic mutations. But a recent study reveals that it can have serious side effects when used in embryos.

CRISPR acts like a genetic scissors to remove specific regions of DNA that contain a mutation. A new section of intact DNA can then be spliced in, editing the genetic makeup of the cell. The technique has been used successfully to treat conditions such as hereditary blindness in individual patients. However, when used on embryos, eggs or sperm, where changes are capable of being passed on to future generations, large chunks of DNA were adversely affected, wreaking genetic havoc on the cells and producing serious abnormalities.

A handful of experiments involving human embryos have already been condemned by the medical community, and most researchers agree that the risks of using CRISPR in reproductive genetics are too great.

For information: Dieter Egli, Columbia University Irving Medical Center, 630 West 168th Street, New York, NY 10032; phone: 212-305-2862; Website: https://www.columbia.edu/ or https://www.cuimc.columbia.edu/news/study-identifies-pitfall-correcting-mutations-human-embryos-crispr

5G Is Far Bigger Than Faster Smartphones

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There are several categories of Hard Trends, but the most powerful is technology. 5G is not only a Hard Trend future fact that will happen, but it represents a transformational platform for the creation of unlimited new products and services.

When 4G was introduced, within only a few years, new, multibillion-dollar businesses were born thanks to the new capabilities of 4G over 3G.

What is happening right now is even bigger! 5G is a transformational jump ahead. Within 24 to 48 months, new multibillion-dollar businesses will form, tapping into 5G's new revolutionary capabilities.

At this point, 5G is already available and rapidly growing on a global scale, starting in the largest cities where most businesses and people are. And with smartphone manufacturers now offering 5G versions of their phones, 5G usage will rapidly increase in dense populations and will spread outward from there. The businesses that get ahead of the curve will be best placed to reap the benefits.

It's important to understand that we will all benefit from 5G with faster downloads, enhanced video streaming and video conferencing, as well as new virtual experiences.

But in the short term, 5G will be transformative for asset-intensive, data-driven industries that depend on ubiquitous connectivity to support their 24/7 operations.

Over the years I've written about what's called Industry 4.0, in which autonomous robotics, machine-to-machine connected intelligence, and A.I.-enabled augmented thinking, to name a few, are now using 5G to elevate and accelerate the transformation of systems and practices. Across sectors including manufacturing, mining, energy, transportation, and smart city initiatives, there is an increased demand for bandwidth, minimal latency, and enhanced security, and leading businesses are already benefiting from 5G private wireless networks.

Because 5G dramatically elevates the capabilities of video conferencing, augmented reality (AR), virtual reality (VR), the Internet of Things (IoT), artificial intelligence as a service (AIaaS), autonomous vehicles, telesales, telehealth including remote diagnostics and surgery, and much more, multibillion-dollar companies that do not exist today will form within 48 months.

5G is not the communications infrastructure of the future. In many critical ways, it has already arrived, and the businesses that are harnessing its power have started to race ahead.

Yet Nokia's 5G Readiness Report, which I highly recommend, found that only 15% of enterprises are currently investing in 5G implementation and 57% plan to invest within the next five years. In other words, they will miss one of the biggest opportunities of the decade.

Another interesting statistic in the report shows that 50% of companies are at the midway level on 5G readiness. In other words, they are getting ready to use 5G – in some form – as an engine for growth. Meanwhile, those already applying it or looking to expand further are growing considerably faster than their peers. Clearly, being ready to apply 5G to grow is very different than applying 5G to grow now.

In the past, the cost of saying "no" to technology-enabled innovation was relatively cheap; after all, the pace of digital disruption was relatively slow. Today, the risk of saying no, or waiting to see what will happen when faced with the certainty of 5G's exponential growth, means a loss of relevance and of competitive advantage. My advice: don't miss one of the biggest opportunities of the decade.

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