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TECHNOTRENDS[®]

NEWSLETTER

*The biggest ideas that are
changing everything*

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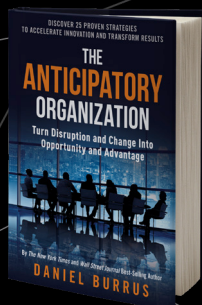
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Daniel Burrus' Top 20 Technology-Driven Hard Trends Shaping 2018 and Beyond

By Daniel Burrus, CEO of Burrus Research

There has never been a shortage of trends. The real problem for you is figuring out which ones will happen so that you know where to place your strategic bets. I have been publishing a list of top trends since 1983, as well as speaking and writing about their future impact, and if you have read any of my seven books or thousands of articles over the decades, you know they have been highly accurate. The reason for this is the methodology that I developed back then, which separates what I call Hard Trends, the trends that will happen, from Soft Trends, the trends that might happen. Knowing their distinctions can make all the difference, and the following Top 20 List is no exception.

“*They will all impact our lives, both personally and professionally*”

I have been writing about each one of these technology trends for many years, but for one to make it on my Top 20 list, it has to be developed enough for you to apply it to exponentially grow your business. Each is growing at an increasingly exponential rate. As such, they will all impact our lives, both personally and professionally, in the coming year and beyond.

These trends highlight enormous, game-changing opportunities in a broad array of applications and industries. As you read through them, look for opportunities for you to leverage them and become a positive disruptor.

1. Artificial Intelligence (AI), Advanced Machine Learning and Cognitive Computing Applications

Cognitive computing applications grow rapidly. Advances in machine learning and artificial intelligence (AI), such as Google's DeepMind and IBM's Watson, coupled with networked intelligent machines and sensors will create a giant leap forward thanks to exponential advances in computing power, digital storage and bandwidth. AI will increasingly become embedded in our applications and processes. Also, thanks to better sensors, increasing machine intelligence and Siri-like voice communications, advanced automation and intelligent robotics will increasingly work with humans in new and productive ways. As AI is applied to vehicle-to-vehicle (V2V) communications, we will see acceleration in the use of semiautonomous and fully autonomous vehicles.

2. Adaptive and Predictive Cybersecurity Systems

Business, government and education have moved cybersecurity from an underfunded back-office activity to a major initiative going forward. With the rapid growth of connected technologies such as the Internet of Things (IoT) and semi-autonomous as well as fully autonomous vehicles, security systems will move beyond reacting faster to include adaptive security systems using AI and other advanced tools, such as behavioral analytics. This will add a level of predict and prevent, allowing us to stop many, but sadly not all, attacks before they start.

3. Big Data and the Use of High-Speed Data Analytics

“Big data” is a term that describes the technologies and techniques used to capture and utilize exponentially increasing streams of data. The goal is to bring enterprise-wide visibility and insights

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TECHNOLOGY NEWS HIGHLIGHTS

3-D Pill Printer

A new 3-D printer has been developed that can fill a patient's prescription with custom-dose pharmaceuticals in about ten minutes.

Dubbed AutoCompounder, the device will not only save pharmacists time, but could eventually be used to combine several drugs in a single dose, making it easier for patients to keep track of their medications.

While conventional compounding equipment is too expensive for most pharmacies, the cost of an AutoCompounder will be comparable to a typical capsule-filling device.

The pharmacist mixes the active pharmaceuticals with the manufacturer's proprietary polymer and fills the printer's disposable cartridge. The dosage and quantity are then selected and the "printing" process begins. When finished, the machine even cleans up. The automated process

takes about one-third the time needed to fill gel capsules by hand, while freeing up the tech for other tasks.

In addition to being able to customize the dosage, AutoCompounder is highly accurate and consistent from pill to pill. It can produce either tablets or gummies, and verifies the contents with each batch.

The innovative pill printer is about the size of a laser printer (2 x 2 x 2 feet) and will reportedly sell for about \$5,000, plus a monthly subscription fee for formulary updates, maintenance and software. Mass production is anticipated to begin within a year.

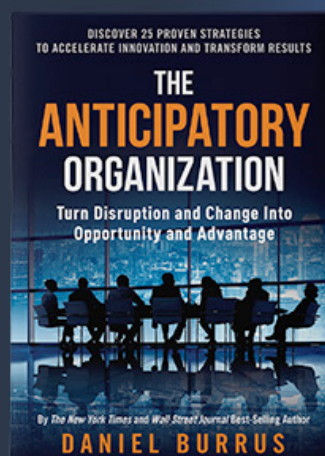
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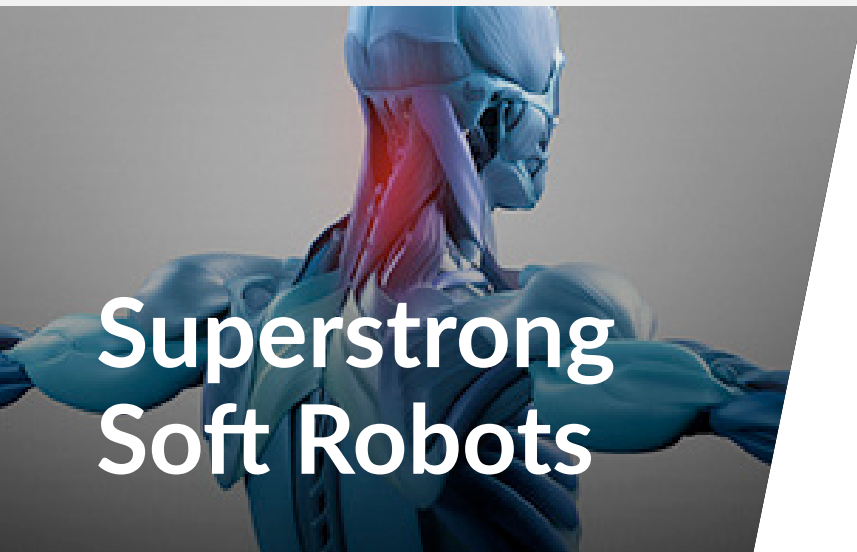
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Superstrong Soft Robots

Harvard researchers have developed a new approach to designing artificial muscles that could revolutionize soft robotics by using air or water pressure to lift up to 1,000 times their own weight. And unlike previous soft robots in which material selection has often resulted in a trade-off between softness and strength, the new “muscles” can be made more robust without sacrificing performance.

Each actuator has an inner skeleton, the shape and composition of which determines how the structure moves – for example, a metal coil or a sheet of plastic that’s folded into a specific pattern. The “skeleton” is surrounded by air or fluid, which is sealed in a plastic “skin.” A vacuum applied to the inside of the skin then causes it to collapse, creating tension that drives the motion. Some of the prototypes that have been developed are capable of contracting down to 10 percent of their original size, and one 2.6-gram “muscle” was demonstrated to lift a 3-kilogram object.

Since the movement is determined by the design of the skeleton, there is no need for a control system. This makes the new muscles more compact and lightweight, while greatly simplifying the algorithms to drive them. They are inexpensive to make – costing about one dollar in materials and ten minutes to construct. And the design is scalable; that is, the performance holds up whether they are a few millimeters or several meters in size, making them adaptable for

a variety of applications, from the surgical suite to the construction site.

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Earbud Hearing Aids

A new iOS app that is compatible with Apple® headphones could be an inexpensive solution for people with moderate hearing loss. Originally developed to tap into a recent trend of using smartphones to augment hearing, the app tests a person’s hearing in each ear and adjusts the amplifiers accordingly. The app allows users to adjust volume and balance, amplify or limit weaker signals, and equalize treble/mid/bass sounds in a 24dB range to adapt to hearing preferences. The concept works well in certain environments where a person may have trouble hearing, such as in a lecture hall. The phone can be placed near the lectern while the user listens from several rows back. But when it comes to real-time conversation, processing delays to remove unwanted background noise can make them awkward to use.

The market for assistive hearing devices is expected to grow substantially with the passage of recent legislation that basically ordered the Food and Drug Administration to create a new class of over-the-counter hearing aid devices.

In comparison to traditional hearing aids, which can cost thousands of dollars, “hearables” can be marketed for a few hundred dollars (not including the cost of the smartphone).

The app, known as Fennex, is currently free, and works with EarPods or AirPods. Certain enhancements to further reduce feedback and improve noise filtering may result in users being charged for these special features in the future.

For information: Fennex AG, Bunishoferstrasse 280, 8706 Meilen, Switzerland; email: fox@fennex.io; website: <https://www.fennex.io/>

bills and receive deposits. But instead of being tied to a bank, all transactions are recorded in a public, decentralized network. Although the service is available to anyone, for individuals who have no bank – and no authenticated identity that will allow them to get one – the card can be a lifesaver. Allowances are distributed in the form of a prepaid Mastercard, which can be used like a debit card to pay for goods and services at retail terminals or online. And as with all blockchains, transactions are stored and verified in a virtually incorruptible database. In two years, the program has grown to several thousand users, and the company hopes to soon be offering the service to refugees throughout Europe.

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Blockchain for Refugees

Blockchain technologies like Bitcoin have demonstrated how value can be transmitted from person to person without the need for financial and corporate middlemen. Now, this revolutionary technology is being used to assist asylum seekers as they struggle to become established in a new country.

Many of us have no idea what it's like to be uprooted from our home, with no money and no official identification. Governments willing to help have found that distributing cash is expensive, inefficient and not secure. But a program launched by an online payments startup has successfully addressed these challenges in Finland.

A Moni account operates just like a bank account, enabling people to make purchases, pay



“Virgin” Stem Cells

Embryonic stem cells can theoretically heal any type of tissue, offering potential treatments for a wide range of diseases. However, because they come from fertilized eggs, which have the potential for human life, some believe that sacrificing them for medical use is unethical. Now researchers have found that stem cells extracted from unfertilized eggs could yield some of the same benefits, bypassing the ethical dilemma.

A phenomenon known as “virgin birth” occurs in nature in certain species of animals – from

aphids and worms to sharks and Komodo dragons – through a process known as parthenogenesis, in which the female forces the eggs to divide without needing to be fertilized. Although this does not occur naturally in mammals, scientists in a laboratory setting have been able to coax human eggs into dividing for up to a few days. After that, they die off, but stem cells extracted while they are still viable act just like stem cells taken from fertilized eggs and are able to become any type of cell.

So far, six Parkinson's patients have been injected with the parthenogenetic cells. Preliminary results show some improvements in symptoms, however the effectiveness of the treatment will need to be measured with a larger placebo-controlled trial. Because fertilized cells have different patterns of chemical "imprinting," the "virgin" stem cells may not have the same capacity for regenerating. Regardless, their capacity for becoming dopamine-making neurons has been successfully demonstrated in animals, suggesting that symptoms associated with low dopamine levels in the brain (like tremors) should be able to be lessened using the new treatment.

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thing are all made up of four molecules, known as bases: adenine (A), cytosine (C), guanine (G) and thymine (T). In groups of three, these bases form codons, which, in turn, make up the building blocks for all of the amino acids (and subsequently all of the proteins) found in nature. A total of 64 codons can be formed from these four bases. But scientists recently announced that they have added two more "letters" to the genetic alphabet, bringing the total number of potential codons to 216.

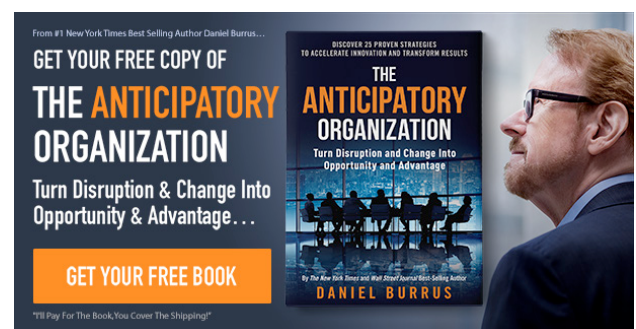
Some thirteen years ago, two synthetically engineered bases called "X" and "Y" were developed in the lab. In 2014, they were moved from the test tube into an E. coli cell, where the bacterium successfully copied the six-base DNA and passed it on to its offspring cells. Recently, the team was able to use the altered DNA to generate new proteins with chemical bonds unlike those previously seen in DNA.

This revolutionary development illustrates that the genetic code is expandable, adaptable and could have evolved in any number of ways. With new building blocks, it may be possible to create proteins that can do new things – such as developing improved therapies for cancer and autoimmune disorders or microorganisms that can break down pollutants into safer chemicals. Work is already underway by another team of researchers to recode E. coli with up to four artificial bases.

For information: Floyd Romesberg, Scripps Research Institute, Romesberg Lab, 1050 North Torrey Pines Road, La Jolla, CA 92037; phone: 858-784-7291; email: romesberglab@mac.com; website: <http://www.scripps.edu/romesberg/index.html>

Adding to the Genetic Alphabet

The genes carried on the DNA of every living





Artificial Ovary

Many women experience weight gain and loss of bone density with the onset of menopause. Hormone replacement therapy (HRT) can help, but also increases the risk of heart disease or breast cancer in some women. This may be due to the fact that HRT is generally limited to one or a combination of three primary hormones – estrogen, progesterone and testosterone.

Recently a team of researchers developed an implantable capsule made from ovarian tissue that can supply a full range of ovarian hormones to mediate the changes that occur during menopause. Rather than relying on a specific dose of hormones each day, the implant relies on the body's feedback mechanisms to control how much of each hormone is released.

The implant was compared to traditional HRT in rats that had their ovaries removed. Initially, it was noted that removing the ovaries caused a drop in estrogen and progesterone, but other hormone levels soared. While HRT did nothing to mediate these other levels, in rats with the bioengineered ovary, all levels remained more normal. In addition, although all of the test subjects had less fat gain and bone loss than those receiving no treatment at all, the effect was greater in those rats that received the implant. The next step will be to see if the artificial ovary has a similar effect on humans.

For information: Emmanuel Opara, Wake Forest Baptist Medical Center, Medical Center Blvd., Winston-Salem, NC 27157; phone: 336-713-1297; email: eopara@wakehealth.edu; website: <http://www.wakehealth.edu/Research/>



Drug-Sniffing Robofish

The next weapon in the fight against antibiotic resistance may be a robotic fish. Designed to monitor levels of pollutants in water, it can swim through lakes and streams to provide critical information on threats to our water supply due to industrial pollution and farming.

A prototype will soon be deployed in the lakes near Michigan. Antibiotics are a category of pollutant that is receiving lots of attention. Although it's clear that levels of antibiotics in the water supply are increasing, little is known about how they spread or where they originate.

The robofish will be able to help pinpoint where they are coming from by monitoring levels in different parts of the lakes.

The device, known as the Gliding Robotic Fish, was awarded a patent by the United States Patent and Trademark Office in August 2017. The patent covers its unique navigation and propulsion system.

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Daniel Burrus' Top 20 Technology-Driven Hard Trends Shaping 2018 and Beyond

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that enable making rapid, critical decisions. Using advanced cloud services, high-speed data analytics will increasingly be employed as a complement to existing information management systems and programs to identify actionable insights from a mass of big data. Separating good data from bad data will also become a rapidly growing service.

4. Advanced Cloud Computing Services

Businesses of all sizes will increasingly embrace new variations on public, private, hybrid and personal mobile clouds. This represents a major shift in how organizations obtain and maintain software, hardware and computing capacity to cut costs in IT, human resources and sales management. Not all clouds are created equal. Some are optimized for IoT applications, while others are designed for different levels of security and speed.

5. Virtualization of Storage, Desktops, Applications and Networking

The virtualization of hardware and software will see continued acceptance through growth in both large and small businesses as virtualization security improves. Hardware-as-a-Service (HaaS) is increasingly joining Software-as-a-Service (SaaS), creating what some have called "IT as a Service." In addition to the rapid growth of virtual storage, virtualization of processing power will continue to grow, allowing mobile devices to access supercomputer capabilities and apply them to processes such as purchasing and logistics. These services will help companies cut costs, as they provide access to powerful software programs and the latest technology without the expense of a large IT staff and time-consuming, expensive upgrades.

6. Virtualization of Processes and Services (On-

Demand Services)

The virtualization of processes and services will increasingly be accessed by companies needing to update and streamline existing services, and to rapidly deploy new services. The rapid growth of Collaboration-as-a-Service, Security-as-a-Service, Networking-as-a-Service and many more is giving birth to Everything-as-a-Service.



7. Blockchains and Cryptocurrency

Introduced as a means of transferring bitcoins, blockchains are fast gaining traction in any number of areas. A system that enables secure, digital direct transfers, blockchains decentralize transactions by eliminating the middleman, thereby allowing for direct connection among all involved parties. In addition to currency, blockchains can be used to transfer contracts, insurance policies, real estate titles, bonds, votes and other items of value. They provide increased transparency and, as a result, distributed trust. Given their security and lower cost, blockchains create a platform that will impact limitless products and services, thereby enabling innovation and growth. Look for applications in healthcare, supply chain and finance to grow rapidly. In 2017, the average person discovered bitcoin thanks to its meteoric rise in value, as well as other coins such as ethereum, used for initial coin offerings (ICOs), and litecoin, to name a few. The crypto genie is now out of the bottle, and thanks to bitcoin trading, bitcoin ATMs and bitcoin mania, we will see blockchains and cryptocurrency increasingly become part of our lives.

8. Augmented Reality (AR) and Virtual Reality (VR) Apps and Devices

Augmented reality (AR) will quickly become more common by adding just-in-time information to our physical world. Simply aim your smartphone camera at a crowded street to find the stores that have the exact products you're looking for. Better yet, we will soon be using conventional-looking glasses that allow wearers to overlay data on their fields of vision, providing useful information about what they're looking at. By contrast, virtual reality (VR)—using oversized headsets to provide an immersive, computer-generated 3D environment with which the wearer can interact—will grow more slowly due to the need for more time-intensive software design and the need to shut out the real world in order to use it. With headsets dropping in price, increasing numbers will want to experience it. Commercial growth in VR will focus on more specific industries. For instance, it's already being used by architects and designers to show potential clients specific features of buildings prior to actual construction. But that's just the beginning. AR and VR will soon shift from a single-user to a multi-user social experience.

9. Smart Virtual e-Assistants and Voice-Enabled Devices

The use of smart e-assistants is accelerating, offering what is rapidly becoming a mobile electronic concierge available on any smart device, including phones, tablets, televisions and cars. Stand-alone audio assistants such as Amazon Echo and Google Home will expand rapidly into business and governmental applications. Soon retailers will have a Siri-like sales assistant, and soon many of us will be using an e-personal health assistant that taps into the real-time health data from a smart watch to predict potential problems and offer suggestions.

10. IoT Becomes Increasingly Intelligent

Machine-to-machine (M2M) communications using chips, microsensors and both wired and wireless networks will join networked sensors to create a rapidly growing IoT, sharing real-time data, performing diagnostics and making virtual repairs, all without human intervention. By 2020, there will be well over 50 billion "things" talking to each other, performing tasks and making decisions based on

predefined guidelines using AI. Not all data need to come back to the mother ship to create high value. Edge computing will increasingly be used to tame the massive amounts of data IoT will create.



11. 3D Printing (Additive Manufacturing) of Finished Goods

Personalized manufacturing of finished goods using 3D printing will grow exponentially. 3D printers build things by depositing material, typically plastic or metal, layer by layer, until the product is finished. Originally designed to print prototypes, they are increasingly being used to print final products, such as jewelry, iPhone cases, shoes, car dashboards, parts for jet engines, prosthetic limbs, human jaw bones, blood vessels, organs and much more. This allows companies to manufacture one-of-a-kind or small runs of items quickly, locally and with far fewer costs.

12. Smarter Smartphones and Tablets Drive Mobile Process Innovation

The vast majority of mobile phones sold globally have browsers, making a smartphone our primary computer. This signals a profound shift in global computing, allowing businesses of all sizes to transform the ways in which they market, sell, communicate, collaborate, educate, train and innovate using mobility. An enterprise mobility strategy that puts mobile first is rapidly becoming mandatory for organizations of all sizes. The next phase is to embed a layer of AI in everything.

13. Mobile Apps for Business Process Innovation

As we increasingly transform business processes using mobility, use of mobile apps for purchasing, supply chain, logistics, distribution, service, sales and maintenance will grow rapidly. There will be an increasing focus on business app stores within companies, giving the company a competitive advantage and giving users access to the personalized information they need on their mobile devices anytime and anywhere.

14. Mobile Banking and Payments

Mobile banking, using smartphones as eWallets, is already being used in an increasing number of countries. Use is finally taking off on a larger scale in the U.S. thanks to an increasing number of phones with secure mobile banking apps, Near-field communications (NFC) chips, biometric identification and the use of tokens where no credit card or personal information is exchanged.

15. Wearables and Applications

Wearables will increasingly be used for both personal and business applications. Apple, with its smartwatch fitted with health sensors and software, joins Google, Samsung, Microsoft and others in a battle for market share. More complex software and applications will drive further innovation and sales in other wearable technology. One example is a patch that can be attached to the skin for remote disease management, diagnostics and general health via wireless transfer.

16. Social Business Applications

"Social" takes on a new level of urgency as organizations shift from an Information Age "informing" model to a Communication Age "communicating and engagement" model. Social software for business will reach a new level of adoption, with applications to enhance relationships, collaboration, networking, social validation and more. AR and VR will increasingly play a role. Marketers and researchers will employ social search and social analytics to measure real-time sentiment of large groups of targeted people.

17. Visual Communication for Business

Visual communication takes video conferencing to a new level thanks to free programs like Skype, FaceTime, Zoom and others for video communication

on phones, tablets and home televisions. Businesses of all sizes are rapidly embracing this as a primary relationship-building and communications tool.

18. Enhanced Location Awareness for Retail

Location awareness using in-building systems allows customers with smartphones to navigate stores and quickly find what they are looking for. This, combined with geo-social marketing and AR, will drive the creation of more business-to-consumer apps. In addition, geospatial visualization combines geographic information systems (GIS) with location-aware data, radio-frequency identification (RFID) and other location-aware sensors (including identifying the current location of users from the use of their mobile devices) to create new insights and competitive advantage.

19. Drones Reach a New Height Adding AI

The number of applications for drones will continue to expand rapidly. Drones have already proven to be of high value for search and rescue, and are rapidly being applied to many industries. For example, agriculture uses drones to check crops, fences and cattle; utility companies use them to look for downed power lines; and real estate agents use them for aerial photography. The explosion of hobby drones will drive innovation for both personal and industrial applications. AI will be increasingly integrated, expanding capabilities far beyond today's applications.

20. Energy Storage and Microgrids

Energy storage starts to become a reality as companies such as Tesla begin to sell their smart battery systems (SBS) to businesses and homes that generate some of their own power using solar, wind or other systems. In addition, as first-generation hybrid vehicles get too old for the marketplace, there will be millions of batteries that will still hold enough of a charge to be repurposed into inexpensive energy storage systems. This will enable a national network of smaller and more secure smart microgrids.

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