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Daniel Burrus'

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TECHNOTRENDS® NEWSLETTER

*The biggest ideas that are
changing everything*

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The Promise of Blockchain Technology

By Daniel Burrus, CEO of Burrus Research

Bitcoins were introduced in 2009 to great fanfare. But it's the means with which Bitcoin transactions are handled that have gotten most of the attention lately—and justifiably so.

Although there had been predecessors, Bitcoins were framed as the first form of cyber currency, meaning the system involved a peer-to-peer transaction network that operated directly between users without an intermediary.

Shortly after Bitcoins were introduced, I labeled them a Soft Trend—one whose future was looking good, but not a future certainty. In that same article, I labeled cyber currency a Hard Trend that would continue to grow. I also predicted there would be many more cyber currencies.

Since then, I've seen no need to change either designation, as the future success of Bitcoins remains promising but uncertain. Additionally, there are now more than 100 different cyber currencies.

showed no signs of slowing down and represents a Hard Trend that will continue to grow. The rapidly evolving technology of blockchains holds enormous promise for game changing disruption across any number of industries and fields.

As a headline in O'Reilly Media presciently noted in early 2015: "The blockchain is the new database — get ready to rewrite everything."

Blockchain Explained—Security in Numbers

For those who may be unfamiliar with the term, blockchains are a system of decentralized transaction records. By decentralized, I mean that a blockchain can be used to create a transaction without any input from any sort of controlling entity.

Here's a simple example. Currently, most people use a trusted middleman such as a bank to make a transaction. But a blockchain effectively eliminates the need for a third party, thereby allowing for direct connection between all involved parties.

A blockchain employs cryptography to keep exchanges secure. It also incorporates a decentralized database—also known as a "digital ledger"—of transactions that everyone on the network can see. This network is essentially a chain of computers. Every one of those computers must approve an exchange before it can be verified and recorded.

In one of its most widely known applications, blockchains can send and receive digital forms of currency, such as Bitcoins. But, unlike other forms of transactions, the system can't be accessed by just

Blockchain technology holds enormous promise for game-changing disruption

At the same time, something of equal or perhaps even greater importance was taking place. As Bitcoins struggled to gain widespread acceptance and use, blockchains--the enabling technology with which Bitcoin transactions are handled--were gaining far more traction.

Unlike bitcoins, the development of blockchains has

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TECHNOLOGY NEWS HIGHLIGHTS

Gene Therapy Guarantee

The ultimate goal of gene therapy is to permanently cure genetic disorders by making a one-time correction to the faulty portions of a patient's DNA. Recently, a new treatment called Strimvelis was cleared for marketing in Europe that may actually live up to that challenge. In fact, the company is so confident that the drug comes with a money-back guarantee.

Strimvelis was developed to treat severe combined immunodeficiency due to adenosine deaminase deficiency (ADA-SCID), a rare disease that severely compromises the immune system in children and frequently proves fatal within the first year of life.

In a study involving 18 children, 15 were cured without further intervention, while three required additional treatment, including enzyme replacement therapy and/or stem cell transplantation. However, all 18 of the original

subjects are alive today, the first having received Strimvelis more than 13 years ago.

At a price of 594,000 euros (about \$665,000), the cost of the treatment seems high, and indeed, Strimvelis is one of the most expensive one-time treatments to ever be sold. But considering that the cost of a bone marrow transplant can easily reach \$1 million, and other treatments such as enzyme injections can cost upwards of \$250,000 per year, not to mention the costs associated with caring for a sick child, the price tag isn't outrageous.

Strimvelis will only be available at Ospedale San Raffaele in Milan, Italy, a clinical research hospital that provides advanced specialty care for some of the most complex health issues.

For information: GlaxoSmithKline PLC, GSK House, 980 Great West Road, Brentford, Middlesex TW8 9GS, United Kingdom; phone: +44-(0)20-8047-5000; website: <http://www.gsk.com/en-gb/>

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New Form of Light

Planck's constant is a fundamental physical constant that relates the energy of a single photon of light to the frequency of its wave. It has long been thought that all light possessed an angular momentum (the degree to which a beam of light rotates around its own axis) that is a multiple of this constant. But a new form of light has been discovered in which the angular momentum is only half that value — a breakthrough that could have a profound impact on the study of light for applications like secure optical communication.

In the 1830s, at the same institution, researchers had discovered that when a ray of light passed through certain crystals, it became a hollow cylinder. The current researchers used this phenomenon to generate screw-like beams of light. Using a special device, they were able to measure variations in the flow of angular momentum of the beam caused by quantum effects, revealing a shift in each photon equal to one-half of Planck's constant.

This discovery challenges our understanding of some of the most basic principles of physics, and illustrates once again that the more we learn, the more we realize just how little we know!

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Algorithm for Sound

Last month, we reported on a new level of computer artificial intelligence (AI) that used Turing learning to identify the rules governing patterns of movement in a robot swarm without prior input. Now a team of MIT researchers is applying the same kind of deep learning to generate realistic sounds using AI.

To develop the algorithm, the researchers fed approximately 1,000 videos of an estimated 46,000 distinct sounds into an AI system that analyzed the pitch, loudness and other qualities of the sounds generated by various different objects as they were hit, scraped and prodded. A drumstick was used throughout this phase of the experiment to provide a consistent method for producing the sounds.

The system was then presented with silent video clips of objects being struck to see whether or not it could simulate an appropriate sound. Results showed that it could accurately distinguish between a vast array of sounds, from a low-pitched thud to a high-pitched click and from short, tapping sounds to long, slow waves. And when human subjects were asked to compare actual recorded sounds to those generated by the algorithm, they selected the fake sound twice as often as a baseline algorithm.

This research represents an important first step in integrating sight and sound to mimic the way humans actually learn and interact with the world.

It could also eventually lead to new insights into a more intuitive theory of physics and the physical world.

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Solar in Disguise

At least two companies are making headlines with a new approach to designing solar panels that makes them indistinguishable from common construction materials. These new designs will not only appeal to homeowners interested in maintaining the aesthetic of their existing home, but could also enable historic buildings — where traditional collectors are often disallowed — to reduce their carbon footprint.

Dyaqua, a family-run Italian company, started taking sample orders for their “invisible” solar panels on Indiegogo in preparation for wide-scale production. The panels are not really invisible, but are constructed using a special polymeric compound that is opaque to the eye yet allows enough light in to power a photovoltaic module mounted underneath. They blend with the original architecture, and can be made to resemble concrete, slate, stone, terracotta and even wood so they can be installed on roofs as well as walls, floors and even driveways. Although they are only about 25 percent as efficient as traditional panels, the fact

that they can cover virtually any surface more than compensates for the lower efficiency.

Tesla also announced their new solar roofing product, which only sacrifices about 2 percent in terms of efficiency. The quartz glass tiles look as good as or better than existing materials and last two to three times longer. They will be available in four styles, each of which achieves a different aesthetic, and will be able to generate adequate energy to power a household when used in combination with their Powerwall 2.0 battery units. The first installations will begin in the summer of 2017.

*For information: Dyaqua; phone: +39-0444-1326195; email: info@dyaqua.it; website: http://www.dyaqua.it/_en/
For information: Tesla Motors, 3500 Deer Creek Road, Palo Alto, CA 94304; phone: 650-681-5100; fax: 650-681-5101; website: <https://www.tesla.com/energy>*



Giant Leap for Brain Research

The Wolfson Brain Imaging Centre at the University of Cambridge recently became the first institution in the world to have three of the most powerful imaging systems available today installed in a single location, giving them unprecedented ability to study brain development and function.

The first is a 7 Tesla (7T) magnetic resonance imaging (MRI) scanner that will be able to distinguish details in the brain as small as a grain of sand. In comparison to current MRI systems, which have a field strength of

3T and a resolution of 2-3mm, the new scanner will be able to detect structures down to 0.5mm in size. This will allow clinicians to differentiate structures within the cortex (the grey matter that gives us our thoughts) and see how they interact as a network. It will also enable them to detect changes that occur with Alzheimer's and dementia at a much earlier stage.

The second system is a combination positron emission therapy and magnetic resonance (PET/MR) scanner, which will allow researchers to map chemical changes that occur as a result of structural abnormalities.

The third is a hyperpolariser, which enables highly sensitive, real-time measurements of an individual's response to treatment. Patients with the same type of cancer will respond differently to the same drug because of the underlying genetics of their tumor. Using the hyperpolariser in combination with MRI, doctors will know within hours whether a treatment is working, and make adjustments if needed.

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than 1 billion people worldwide, water is a scarcity; one in three people do not have the daily minimum (7 cups) of water to survive; every day, nearly 1,000 children die for a lack of clean drinking water; and nearly 10,000 people die from waterborne diseases or dehydration daily.

But a new device, developed in collaboration with UC Berkeley and the National Peace Corps Association, aims to change these statistics by generating clean water anywhere in the world.

WaterSeer is an inexpensive, low-tech device that extracts water directly from the atmosphere without the need for external power, costly chemicals or maintenance.

The collection chamber is buried six feet underground, where the metal sides are cooled by the surrounding soil.

A helical turbine funnels warm air into the chamber; as the air cools, water vapor forms on the sides and is captured in a reservoir. A simple hose and pump are then used to bring the water to the surface.

WaterSeer can reportedly generate up to 11 gallons of clean water per day, even in arid regions. Multiple generators may be grouped together to provide enough water for an entire community.

Best of all, it costs only \$134, and for every unit sold in the U.S., the company will donate one to be sent to an area of the world where clean water is scarce.

For information: VICI Labs LLC, 1800 Alexander Bell Drive #400; Reston, VA 20191; email: waterseer@vici-labs.com; website: <http://waterseer.org/>



It's difficult for many of us to imagine life without an abundance of clean, safe water. But for more



Space Power

Wireless charging systems may sound like nothing new, but at least one firm in Japan has much bigger ideas than charging your smartphone. In fact, the goal is to someday transmit large amounts of electrical power from space-based solar arrays to earth-based receivers via microwaves. The benefit is that the collectors would not be affected by weather and could operate continuously. But let's take a step back to where the technology stands today (which is fairly impressive in and of itself).

A prototype system was unveiled at an electronics show last month that utilizes flat antenna (called "rectenna") tuned to 5.8 GHz. To date, tests have shown that the system can successfully transmit power over a distance of about 50 meters. The power losses, however, were considerable, harvesting only 340 watts out of the 1.8 kilowatts pumped into the system.

Even so, the technology is expected to continue to progress, and short of the ultimate goal of transmitting power from space, there are many uses for shorter range systems, including transmitting power around factories to enable machines, sensors and workstations to be reconfigured without the need for new power cabling. It could also be used to divert emergency power from airborne balloons to areas hit by natural disasters.

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Digital Tailoring

The most fastidious dressers know that, when it comes to fit, nothing comes close to a tailor-made suit. But repeated visits to a shop — for initial measurements and follow-up fittings — are a time-consuming luxury that most people can't afford.

So some entrepreneurial tailors in Southeast Asia have developed a smartphone app that could greatly expand the market for custom-made clothing.

Called UKYS, the iOS app combines body measurements with client photos taken according to precise instructions to generate a comprehensive body metric in much the same way a seasoned tailor would.

Users can then choose from a variety of customizable features such as overall design, fabric, cuff style or collar style, and the garment is tailored and shipped to the customer.

The app recently claimed first prize at a competition organized by the U.S. Embassy in Viet Nam. It has also drawn attention from some big names in the textile and garment industry as the next big thing in custom tailoring.

For information: UKYS, First Floor, Saigon Export Center, 96 Nguyen Hue, District 1, Ho Chi Minh City, Viet Nam 700000; phone: 888-666-3310; email: help@ukys.com; website: <http://www.ukys.com/>

The Promise of Blockchain Technology

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anyone. Users can send digital payments only to other participants in the same blockchain network. That means only those who use the blockchain can establish and enforce rules and approved procedures—a powerful form of security.

By bypassing older forms of transaction networks involving a controlling entity, it's up to everyone on the blockchain to determine whether a particular transaction is legitimate or not. That means if someone tries to tamper with a ledger entry, the rest of the network will disagree on the integrity of that particular transaction and will not incorporate it into the larger blockchain. In and of itself, that's a genuinely revolutionary form of security.

The Game Changing Opportunity in Financial Transactions

What has me and so many others so excited about the future of blockchains is the scope of their potential use. On the surface, it's obvious that blockchains offer enormous opportunity in purely financial transaction applications. If nothing else, the system is designed to prevent fraud and other crimes through the security that only a global form of approval can afford.

That in and of itself offers enormous game changing opportunities. Currently only a very small proportion of global gross domestic product—roughly \$20 billion—is held in blockchain form, according to a study by the World Economic Forum's Global Agenda Council.

But, the forum's research suggests that isn't likely to last long. Projections hold blockchain use will increase significantly in the next decade as banks, insurers and technology firms recognize and embrace the technology as a way to boost transaction speed, bolster security and trim expenses.

That's already taking place. For instance, Swiss banking giant UBS in mid-2015 announced plans to open a technology lab in London to explore how blockchain technology can be used in financial services. The British government has also earmarked £10 million to support research in digital currencies technology.

Nor is opportunity limited to implementing blockchain technology. Banks such as HSBC, Santander and BBVA have launched corporate venture funds to make equity investments in financial technology companies.

More Than Just Money

Even if they were limited to financial transactions, blockchains would represent a genuinely game changing move away from conventional means of paying for goods and services. But, the truth is blockchains are also a platform that can be used in multiple ways in many industries and other areas with equally significant results. For instance:

- **Data Storage**—Current storage services using cloud technology are centralized, meaning that users have to put their faith in a single cloud provider (akin to sellers and consumers placing their faith in a bank of some other form of intermediary). Blockchains will let users store data and information via a decentralized platform, improving security and lessening reliance on any one provider. Additionally, systems are being developed through which users can rent out unused space—a data storage version of Airbnb!
- **Voting**—No one who has ever worked in a polling place recalls the tedium of counting paper ballots with any sort of fondness. Unfortunately, electronic balloting has its own drawbacks, such as verifying accuracy during recounts. On the other hand, a blockchain voting network is inherently more reliable, since changing one vote would require changing countless other votes at the same time. In fact, a blockchain voting network has already been used—Denmark's Liberal Alliance employed a blockchain for

internal voting back in 2014.

- **Military Use**—Military organizations such as the U.S. Department of Defense and NATO are actively investigating use of blockchains. Among other applications, they're interested in messaging platforms capable of transferring information and data by way of a secure decentralized protocol. Further, the blockchain will ensure security across multiple channels.
- **The War on Terrorism**—In May 2015, the Isle of Man implemented the first government-run blockchain project, leveraging blockchain technology to create a registry of digital-currency companies operating on the island. Among other uses, the system will counter money laundering and help prevent terrorist financing, since the flow of money can be traced specifically to the person or group involved in the transaction.
- **"Smart" Contracts**—The basic idea behind a smart contract is that it implicitly self-manages the fulfillment of the agreement—in this case, verified programmatically via the blockchain, instead of some sort of third party. In effect, two or more parties agree on terms, program those terms into the blockchain and, from there, allow for payments and other transactions once those terms are fulfilled and validated by the blockchain.
- **Regulation**—Because a blockchain cannot be changed or manipulated without a majority of participants agreeing to do so, the technology underlying a blockchain might be used in place of a variety of regulations, such as those mandated by Know Your Customer (KYC).
- **Identity Management**—Labeled the first comprehensive blockchain-based identity service, Onename allows users to create tamper-proof digital identities for themselves. These profiles are called Passcards, and are designed to replace conventional user names and online passwords.
- **The Music Industry**—Blockchains may also turn the digital music industry on its ear. In October 2015, Ujo Music unveiled a prototypical system with a downloadable single by artist Imogen Heap—a working example of how the music industry might operate using a blockchain-based technology. In a nutshell, artists and rights holders

register works and relevant ownership information on the blockchain; consumers purchase directly, with payments delivered automatically and instantly using smart contract technology. Again, no intermediary need be involved.

Just as important as the transaction itself, artists may also publish policies for how their music may be used. That's an anticipatory form of thinking that proactively addresses a current prevalent headache in which artists often must pursue legal action to stop unauthorized forms of use. Further, it opens up opportunities for new business models, apps and other products, so long as the user abides by the artist's stated guidelines.

More Reasons for Excitement

Currently, blockchain use is largely restricted to private forms of transactions. But, looked at in an anticipatory way of thinking, blockchains could be used for anything that requires proof of identification, the exchange of goods or verification of contract terms and other agreements. Talk about the opportunity for disruption!

Nor does blockchain use have to be the sole purview of powerful governments or organizations and companies with a worldwide reach. For instance, local governments could employ blockchains for secure and efficient tax collection. What about immigrants, migrants and others looking to send money back home to families in countries where conventional banking networks are spotty or even non-existent? Blockchains could be developed to allow for fast and secure movement of funds (consider the implications of that for immigration and workforce policies.)

One executive involved in the development of blockchains summarized its potential in a framework we can all appreciate: "Check it on the blockchain" will be the phrase of the twenty-first century. It will be as commonplace as people saying "Google that."

Like the headline I cited at the outset of this article put it—when it comes to blockchains, get ready to rewrite everything.



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