PSC
Planetarium Science Center
newsletter
6th year | 3rd edition
Planetarium Science Center
Science For All!

SPRING 2013

In this edition...

TECHNOLOGY and US

By: Sara Khattab

Humans lived for millennia without the luxury of supreme technology we have today. However, they have always sought the tools that can make their life easier, using the simplest materials available. With the application of technology, time-consuming processes can be executed with ease and in less time; technological development has thus never stopped, and will never stop to evolve and reinvent itself.

Now, we are surrounded with incalculable types of technology; just by looking around you can name at least five types of technologies. If you are at home, I expect you will have a landline telephone, a mobile, a laptop, in addition to a diversity of electrical appliances. Can you leave all of these hi-tech instruments and experience your grandparents' life?

I doubt! In fact, I am one of those people who spend most of their time holding their smartphone. Actually, I cannot live without my smartphone even though one day not so long ago I had a simple mobile and I was happy. To that end, in this issue, we have a number of articles in the "Science in Our Life" section, in which we examine how technology has invaded our lives, with all its advantages and disadvantages.

Naturally, we discuss how the technological revolution has helped Man reach outer space, delve into the nano-scale world, and has led to developing numerous health-tech gadgets that can lead to great leaps in medicine. We also tackle the controversy of "Genetic Engineering", explore the potential of "Techno-Food", and investigate the possibility of "The Return of the Woolly Mammoth", as well as "The Dawn of the Robots".

Pondering the history of technology, we examine the history of papermaking "From Papyrus to E-Paper", and investigate how peaceful technology was used negatively in wars, and vice versa, throughout history.

As always, we hope you will enjoy the selections we offer yout; we also look forward to receiving you feedback at PSCeditors@bibalex.org.

COMPUTER Addiction Prevention

By: Prof. Dr. Mohamed S. Abougabal
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The advent of computer technology had a great impact on our lifestyle; most essential daily services are now automated in all e-ready countries, which necessitates the early exposure of children to the usage of computers.

Unfortunately, technology is not properly introduced to children at an early age; instead, they abuse the usage of computers. Over years, children may grow into introvert, antisocial, restless, impatient, nervous, and poor face-to-face communicators who prefer to communicate via machines.

Scientists agreed that the challenge is not to just own computers at school; the real challenge is suitable and proper exposure of children to computers, according to the different age groups and capabilities. The most efficient procedure to expose youngsters to computers is via their school teachers and/or parents, who are trained to teach the proper usage and programming of computers to young children.

Adapted from the American, European, and Japanese experience, a methodology of introducing computers "**Train the Trainer**" was successfully experimented in Alexandria, in a private English school, on 12 school teachers and approximately 1200 boys/girls in different grades. This methodology aims at the early discovery of programming talented children as it will assist in developing creative and logic thinking, communication skills, in addition to team working habits.

Teachers and/or parents should be trained on all computer tools and applications; they should learn how to use Internet security tools to allow children's access to specific sites—for example, the school's webpage and educational sites. Children, 4-10 years of age, should not be exposed to computers more than one hour per week. During this hour, the child can play educational games; all violence games should be strictly avoided.

In the next stage, children, 10-14 years of age, can be allowed to use computers up to two hours per week. To avoid any psychological barrier with computers, children at this age should know the components of the computer. They can also be introduced to programming language and problem-solving techniques using flow charts. Usage of ready-made packages serving the educational curriculum is highly recommended.

Under parental control, high school students should be allowed to use computers for only three hours per week. They can search the Internet, develop their programming skills, and learn more about the basics of computer operation, logic circuits, storage retrieval and communication of data.

It is highly recommended that talented students, at this stage, participate in international informatics Olympics. Many Egyptian organizations are starting to encourage these students through sponsoring their participation in such events.

Nowadays, with all the smartphones, laptops, and tabs, it is difficult to convince children not to spend a lot of time using the computer. It is very important to fill children's time with other activities such as sports, reading books, or painting; we cannot just forbid them from using computers without giving them anything to else to do.

It is important to have fun in life; however, you cannot let this fun become something that takes over your life. It is important to take a step back and look at what you are doing to yourself and your children.

By: Maissa Azab

Watching my sister's 2-year-old grandchild using the smartphone several months ago when he was even younger, I was both amused and amazed. Little Omar browses the homepages of his mother's or father's iPhone, finds the folder containing the applications they downloaded for him to play with, opens it and selects the game of his choice, then plays.

Ironically, that happened when I still did not own a smartphone myself, not just because I had never been a technology geek, nor was I ever fascinated by owning the newest equipment on the market. For me, a mobile phone was enough of a breakthrough on its own; having the ability to reach and be reached anytime, anywhere was hi-tech enough for me for years.

I never used my mobile to download or listen to music, not even to take photos except rarely. Yet, in just a few months of owning a smartphone after years of pondering it and being egged on by my friends and colleagues, I have become quite dependant on it. This has been proven just a couple of days ago when it slipped from my hand, fell and broke; it has only been two days without it as it gets fixed and I feel deprived!

It is really amazing how we get addicted to technology. I mean, the mobile was not all that common in Egypt in 1999 when I first owned one, which means I lived 23 years of my life without it; yet, with its entry into our lives it has become simply indispensable. Today, with the advent of the smartphone, simply connecting by phone anywhere, anytime is no longer enough; one now feels isolated if one cannot use Email, Google, Facebook, whatsapp, or even play a game anywhere, anytime.

All this has gotten me thinking about life without technology; how technology has progressed in all aspects of life, and how much more it can progress; what has been the impact of technology on life, and how it is expected to impact in the future. Just to begin this theme, my colleagues explore many aspects of technology in this issue of the newsletter, which we intend to follow with continuing pieces on the subject in our soon to be launched online magazine: SCImagic.

Hope you enjoy the issue and please await the launch of SCImagic.

The fascination with exploring is an inherent human instinct; we are always eager to better understand the world we live in. Outer space with its galaxies, stars, planets, and other celestial objects, has thus always been one of the mysterious concerns of humans.

By observing the Sun and Moon, ancient astronomers were able to measure the day, month, and year. Since ancient times, the movement of celestial objects has been attached to agricultural and religious events, and was related to natural phenomena. The only tools available to observe these celestial bodies were the eyes and human logic, which sometimes led to incorrect conclusion.

The methodology of ancient astronomers predated the scientific methods developed by Galileo and Newton later on. However, the methods applied by the ancient Egyptians, Mayans, Babylonians, and others laid the foundation for modern astronomy.

An Eye on Outer Space

Galileo was not the one who invented the telescope; however, he was the first to use it systematically to observe when celestial objects and record his discoveries. It was not until 1608 when Hans Lippershey, a Dutch lensmaker, introduced a new tool using glass lenses to study the heavens; the "spyglass". The instrument, later named the telescope, soon became the astronomer's most essential tool and one of the essential instruments of the scientific revolution.

A year later, Galileo Galilei, Italian physicist and astronomer, improved the telescope's design, producing a variable-focus instrument that increased the size of the observed objects eight times. Just like the first telescope, Galileo used a convex main lens with a concave eyepiece; this type of telescopes was the prototype for today's refractor telescopes.

Although Galileo's telescope was small and the images were fuzzy, he was able to see mountains and craters on the Moon, as well as a ribbon of diffuse light arching across the sky, which would later be identified as the Milky Way. Galileo's telescope was soon refined to magnify objects 20 times; using this refined telescope, he spotted four Moons of Jupiter, and discovered the edges of Saturn's rings and spots on the Sun's surface.

With advancing technology, astronomy flourished with the development of bigger and more powerful telescopes, then specialized instruments that could peer into the distant reaches of space and time, such as radio, infrared, ultraviolet, X-ray, and Gamma-ray telescopes.

Eventually, enlarging telescopes no longer improved the view of space. In 1946, Lyman Spitzer, a Yale University Professor and Researcher argued that a space telescope would offer great advantages over ground-based telescopes. He explained that telescopes function through collecting and magnifying visible light that is given off by stars or reflected from the surfaces of other celestial objects, but the Earth's atmosphere blurs and distorts this light. Furthermore, the atmosphere blocks X-rays emitted from high-temperature phenomena in stars and other objects; even the most precise and advanced on ground cannot escape this phenomenon, but a telescope in orbit can.

Later in the 1970s, the European Space Agency (ESA) and the National Aeronautics and Space Administration (NASA) worked together to design and build what would become the Hubble Space Telescope. Designed to be visited periodically by astronauts, who take new instruments and technology to make repairs; in 1990, this space telescope was carried into orbit by a space shuttle, Discovery.

The unprecedented images that Hubble delivered represented the fulfillment of a 50-year dream; and more than two decades of dedicated collaboration between scientists, engineers, contractors, and institutions from all over the world. One of the most technologically advanced pieces of equipment that humans have put into orbit, for more than 15 years, Hubble has helped researchers make important discoveries about our universe, giving them insight into the history and fate of our universe.

Space-Tech Saga

By: Sara Khattab

The Race to Outer Space

Following World War II, space exploration served as a dramatic arena for a Cold War competition between the United States and the Soviet Union. Both sides sought to prove the superiority of its technology; the launch of the first man-made object to orbit the Earth, the first living being in orbit, and the first Moon-landing were the main goals of the Space Race.

The Space Race effectively began in 1957 with the Soviet launch of Sputnik 1, the world's first artificial satellite, which was about the size of a beach ball and took only 98 minutes to orbit the Earth. Sputnik 1 provided information on the density of the atmosphere; it also tested radio and optical methods of orbital tracking and determined the effects of radio wave propagation through atmosphere.

Months later, the Soviet astonished the world with launching Sputnik 2, carrying the first dog, Laika, into orbit. After five to seven hours into the flight, no vital life signs were being received from Laika; by the fourth orbit it was evident that Laika had died from overheating and stress.

Following the Soviet, in 1958, the United States launched Explorer 1, which carried small scientific equipment that eventually discovered the magnetic radiation belts around the Earth. The Explorer program continued as a successful ongoing series of lightweight, scientifically useful spacecrafts.

The Space Race heated up when the Soviet cosmonaut Yuri Gagarin became the first man to orbit Earth on the spacecraft Vostok 1, on 12 April 1961. The craft consisted of a spherical cabin attached to a service module that carried chemical batteries, orientation rockets; the main retro system. The manual controls on the spacecraft were locked prior to launch, and the entire flight was under the control of ground personnel.

The United States responded by putting Alan Shepard into space aboard Freedom 7, on 5 May 1961. Weeks after Shepard's flight, President John Kennedy promised the world that the United States would land men on the Moon before 1970. Before risking people's lives, NASA sent unmanned spaceships, to ensure they could land safely. On the other hand, the Soviet Union also flew several unmanned Cosmos missions; most aimed at gathering data on a prolonged time in space.

On 20 July 1969, Apollo 11 landed the first humans, Neil Armstrong and Buzz Aldrin, on the Moon. Armstrong spent nearly two-and-a-half hours outside the spacecraft, Aldrin slightly less; together, they collected 21.5 kg of lunar material for return to Earth. The Soviets made four unsuccessful attempts to launch a lunar landing craft between 1969 and 1972.

By landing on the Moon, the United States won the Space Race, leading the Soviet Union to seek other ways such as space stations to display their spaceflight capabilities. A space station is a spacecraft designed to support a crew and remain in space for an extended period of time, and to which other spacecrafts can dock.

Space stations are used to study the effects of long-term space flight on the human body, as well as to provide platforms for greater number and length of scientific studies than available on other space vehicles. All space stations have been designed with the intention of rotating multiple crews, with each crew member staying aboard the station for weeks or months, but rarely more than a year.

What has followed the Cold War is an era of cooperation between the United States and now Russian Space programs to build and operate the International Space Station (ISS). The ISS serves as a space environment research laboratory in which crew members conduct experiments in biology, physics, astronomy, metrology and other fields. The station is suited for the testing of spacecraft systems and equipment required for missions to the Moon and Mars.

In the 21st century, other nations joined the United States and Russia in the Space Race. Competitions between countries for national pride and between companies for profitable markets will provide incentives for the development of new space technologies and lay the foundations for the future of space exploration.

For an example, on 21 June 2004, "SpaceShipOne" made the first ever privately funded manned spaceflight. A new airline has been set up to offer private tourist flights into space, using a new version of this space plane; it was planned that tickets will be available for flights, starting around 2012.

Throughout history, humans have sought to discover what is beyond Earth. With the continuous development in technology, humans were not only able to observe the celestial bodies through telescopes; they also sent space shuttles, satellites, and even human beings to explore outer space. Now, it is expected that in the not so distant future, people will spend their vacations floating in space.

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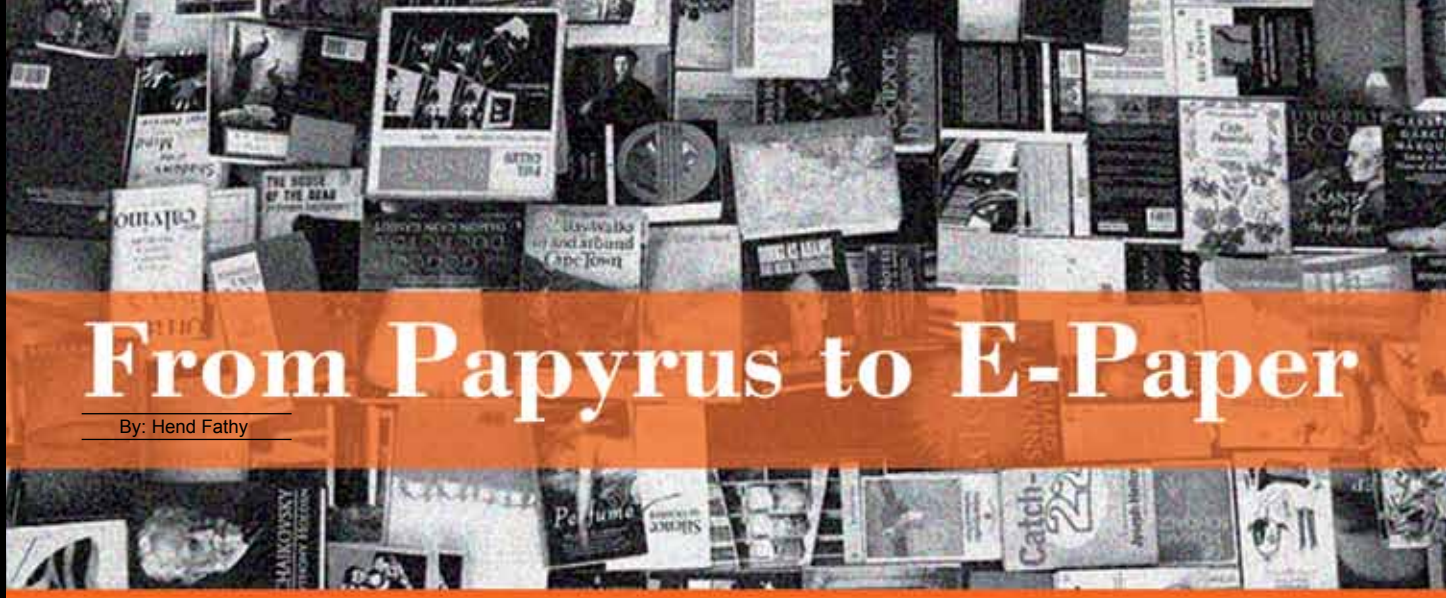

From Papyrus to E-Paper

By: Hend Fathy

Imagine the long human journey on Earth without documentation. Then, imagine documentation without paper, and see how much we could have missed. At the very beginning, written records were carved on stone, clay, or wax. It was then, around 5000 years ago, that the Ancient Egyptians introduced writing on papyrus, the very first version of paper. Since then, paper has gone through various stages of development, and is now available in various types and forms.

Papyrus

The word "paper" we use nowadays is derived from the Ancient Egyptian invention, papyrus, which is the first paper-like writing surface in human history. Ancient Egyptians made papyrus from a plant of the same name that grew in swamps around the Nile River.

After peeling the outer fibers, the core of the triangular, tall, thick multi-layered stalks of the papyrus plant were sliced and soaked in water to remove their sugary content. They were then dried, flattened and placed side by side in two layers; one vertical and one horizontal. After that, the sheets were pressed and smoothed to be ready as a writing surface; no glue was needed to hold the split stalks together thanks to natural gum in the plant. The sheets were finally joined end-to-end to form papyri rolls.

The introduction of papyri revolutionized record-keeping and the accessibility of the written word, making it possible for us to look back and explore ancient times. Because of its importance, papyrus paper making was a state monopoly in Egypt, and the method of its production was a closely guarded secret. Nevertheless, it later became the main writing material used throughout the Greco-Roman Empire, though most records were still kept in Egypt owing to its dry climate that best preserved them.

Parchment

In the 2nd century BCE, at the ancient Greek city of Pergamum—currently Bergama in Turkey—parchment was introduced as a new writing surface. Parchments were made of processed animal skin—chiefly sheep, goats, and calves. Finer types of parchment made from the skin of newly-born animals were referred to as vellums; however, the two terms are currently used interchangeably.

The animal skin was dried under tension—usually stretched on a wooden frame—after it was cleaned, de-haired and scraped. Then, it was polished smooth using pumice, and treated with talc or chalk as a final preparation for writing.

Parchment had many advantages over papyrus; it was stronger and more durable. Also, the raw-material needed for making it—animal skin—was readily available everywhere and not limited to one geographic location or certain climatic conditions.

Parchments and vellums were the standard writing surfaces of Medieval European scribes. They were used in producing all the famous manuscripts and codices(1) of that time. In the Arab world as well, parchment remained the preferable choice for copying the Qur'an, and other important literary and scientific works.

Paper: A Journey through Time and Space

From the Far East to Europe via the Middle East

Paper, as we know today, was invented in China during the Han Dynasty (206 BCE – 220 CE). Historical records show that Cai Lun, an official at the Chinese Imperial Court, reported the invention of paper to the Chinese Emperor in the year 105 CE.

Lun's paper used texture rags, bamboo fibers and the inner bark of mulberry trees. The fact that all these raw materials could be easily found at a very low cost in large quantities made it possible for mass production. The substances were soaked, pounded, washed, boiled, strained, and bleached. The mix was then left to drain in a refinery frame and dried. Although Chinese paper was far more flexible than papyrus and parchment, it was so thin and translucent that they could only write on one side.

Papermaking gradually spread by the end of the 7th century to Bangladesh, India, Japan, Korea, Nepal, and Pakistan, with no major changes in the making process. During the war between the Chinese Tang Dynasty and the Arab Abbasid Empire, the secret of papermaking was obtained from Chinese prisoners captured by Arabs in the Battle of Talas, in 751.

The Arabs revolutionized the paper industry, making sheets thicker and much finer in quality; they introduced Linin as the basic raw material in papermaking instead of bark and bamboo. Arabs set up the first paper mills—operated by either humans or animals—in history in Baghdad, Cairo, Damascus, and Samarkand; their production was distinguished by its stout substance and glossy surface.

From there, the paper industry moved to Europe where the first paper mill was built in the 11th century. From the 13th century onwards, papermakers in Italy—Europe's dominating paper-producing center from where the workmanship spread to other European countries—tried to improve the technique applied by Arabs.

The Italians harnessed water power to operate paper mills. They also introduced the process of sizing, or coating paper with different substances to add strength or stiffness, or to reduce absorbency.

In the 17th century, the Dutch invented the "Hollander beater"—an important milestone in papermaking development—that replaced mills and became the technology that divided papermakers into traditional versus modern camps. The "Hollander beater" consisted of an oval tank containing a heavy roll that revolves against a bedplate; it could produce in one day the quantity of paper paste a mill produced in eight days.

The Papermaking Revolution

The 18th century witnessed the establishment of larger-scale papermaking operations and the introduction of sophisticated machinery. In 1799, the French J. L. Robert built the first paper machine, which was handle operated. This machine produced seamless lengths of paper with squeeze rollers instead of the traditional single hand-made sheets; it was further developed in England by Bryan Donkin and by the Fourdrinier brothers.

A major advance in papermaking was in the 19th century when the serious shortage of raw textile materials necessitated the search for alternatives.

In 1843, Saxon Friedrich Gottlob Keller introduced wood cellulose pulp as a major element in the paper industry. This milestone was soon followed by an alternative idea to turn wood into paper; namely a chemical pulp patented in 1854 by Hugh Burgers and Charles Watt. Chemical wood pulps were developed using soda and sulfite, which are responsible for paper brightness, strength, and permanence.

That century also witnessed the invention of more advanced machinery. Machines were continually improved with the rise of the Industrial Revolution, making the production process fully automated, and leading to a considerable spread of paper production worldwide. Furthermore, in the second half of the 19th century, machines designed for particular paper products appeared, such as the Yankee Machine for tissue paper production.

Same as anything else, papermaking technologies advanced rapidly and dramatically during the 20th century and the 21st century. New raw materials were developed, such as mechanical and Deinked Pulp (DIP)(2), some paper types even necessitated their own raw material supply. For example, banknote paper is primarily made of cotton mixed with other textile fibers to make it more resilient and more resistant to wear. New paper types were introduced: printing papers such as Light Weight Coated (LWC)(3), wrapping paper, writing paper, drawing paper, banknote paper, and others.

Another revolutionary change modern technology introduced is the astounding drop in paper prices. Nowadays, paper can be enameled, creped, waterproofed, waxed, glazed, sensitized, bent, folded, molded, dissolved, and recycled.

E-Paper

Computer technologies introduced advanced word processing applications where the user inputs data through keyboards; can save, edit and format it, and even print it if required. These applications, in addition to the Portable Document Format (PDF) software, have given access to billions of documents, papers and books in softcopy formats, saving huge amounts of natural resources, money and avoiding environmental impacts associated with paper production.

The last technological advance in papermaking comes with the introduction of Electronic Paper. Though the technology behind it was pioneered in the 1970s, E-Paper is still not widely into the market. E-papers are fine, bendable, and foldable plastic display surfaces that, unlike other display surfaces, reflect rather than emit light, making it more comfortable to read.

These papers are created by placing tiny plastic containers—each containing white and black particles—between two flexible plastic sheets. The white and black particles have opposite charges; when charged, particles can be separated to opposite sides generating black text or a picture against a white background. Nowadays, E-papers provide full-color ability; the power requirements for E-paper displays are also much lower than for traditional displays.

Despite the long journey paper has gone through, technology has only transformed that ancient craft into a highly technical industry; the basic operations have not really changed to this day. Paper has been used as raw material for huge projects. Think of the huge countless number of books, academic and scientific papers, dictionaries, and periodicals; not to mention plans, maps, and many other informative documents that would not have existed without paper. Paper remains the best and most prevalent way to view and store information, and to disseminate human knowledge and experience.

Glossary

(1) **A codex** is an ancient manuscript text in book form.
(2) **Deinking** is the industrial process of removing printing ink from fibers of recycled paper to make pulp.
(3) **LWC** stands for Lightweight Coated Paper; a light weight; two-side coated printing paper commonly used in magazines, flyers, and catalogues.

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Forget smartphones and laptops; Google has officially revealed its newest and perhaps biggest innovation: Google Glasses; a pair of "smart glasses" that are set to replace all your bulky technological gear.

Straight out of a science fiction movie, these "Terminator-style", augmented-reality glasses are designed to display real-time digital information right in front of your eyes, and on top of your view of the world; one that is enhanced and supplemented through computer-generated information and superimposed graphics.

The idea is to provide you with smartphone-like applications without the need to take your eyes off the real world. The Google Glasses—really a sleek solid metal frame that runs across the browline with a small heads-up display mounted on the right side—weighs just as much as normal sunglasses, responds to voice command and a full array of motion sensors. They are equipped with a powerful processor and memory, a battery built in one of the frame arms, an integrated camera that can capture images and videos, GPS, Internet connectivity, and instant access to social networks.

The camera takes instant pictures and videos of the world as you see it, whilst allowing the device to monitor the world in real-time, providing you with relevant overlaying information about your surroundings such as weather, locations, surrounding buildings and your friends who might be nearby.

With these smart glasses, directions to your required destination or a text message from a friend will appear literally before your eyes. Once you look out your window, a weather forecast will appear on the small screen right on top of your eyebrow.

When you see something you would like to share with friends, the images your glasses shoot will go to their Google+ social-media accounts. While you are walking down to the train station, a live train departure board pops up in front of you. If you need to buy something on the go, just say the name of the item and online stores will appear right before your eyes.

The possibilities are immense; with Google's arsenal of real-time, mobile, location-aware services—Search, Maps, Places/Hotspot, Navigation, Offers, Product Search, Translate—that could all be built into the Android based glasses, one could only imagine what the end result would be.

Prototypes of Google Glasses have already been sold to a selected group of developers earlier this year at the Google I/O Conference, who lined up to collect their prized gadgets for USD 1500 each. The reason they were especially invited to try out Google's invention is to come up with more ideas and applications for its use, provided they maintain a shroud of secrecy about the new product.

"This is a new technology and we really want you to shape it," said company co-founder Sergey Brin at the Google Conference in San Francisco. "We want to get it out into the hands of passionate people as soon as possible."

Google hopes to have the smart glasses ready to be sold to consumers by early 2013, at a price comparable to the price of Smartphones today. Just enough time to save up for your own pair of futuristic technology.

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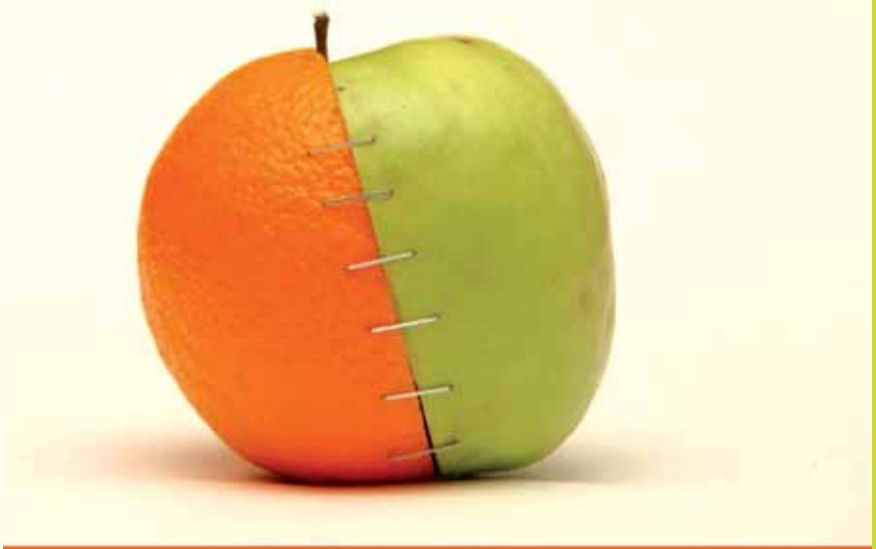

Genetic Engineering
The Controversy

By: Moataz Abdelmegid

If we try to explain the meaning of genetic engineering in layman terms we will start by saying that "Engineering" is the act of building or making something, while "Genes" are the building units of the living being's body. Accordingly, we can say that "Genetic Engineering" is the science of altering the map of the body in order to enhance its properties.

Imagine if you knew every detail about plants, animals and human beings; details such as: What they are made of? How they grow? How they change? Then, imagine that you learned how to change and manipulate these details to add better properties or remove undesirable ones. This is how scientists believe they can use genetic engineering to make the world better; plants can be made to grow faster and bigger so that there will be food for everyone in the world; human cells can be cloned and altered so that diseases can be cured or avoided altogether; and so forth.

Genetics 101

In order to understand how genetic engineering works, it is best to start with some basic biology. The first step is to understand the meaning of the "Chromosome" and the "DNA".

Chromosomes are the storage place for all genetic information; they resemble bundled up knots and loops of a long thin thread: the DNA. DNA is the abbreviation for Deoxyribonucleic Acid; a specific acidic material that can be found in the nucleus of the cell. The genetic information is written in the form of a code, almost like a music tape; to ensure the thread and the information are stable and safe, DNA is formed of a twisted double stranded thread known as the double helix.

When a cell multiplies it will also copy all the DNA and pass it on to the daughter cell. The totality of the genetic information of an organism is the "genome". Human cells, for example, possess two sets of 23 different chromosomes; one set from the mother and the other from the father. The length of DNA contained in one human body is approximately 60,000,000,000 kilometers; this is equivalent to the distance to the moon and back 8000 times!

ABC Genetic Engineering

Genetic engineering simply works by physically removing a gene from one organism and inserting it into another, giving it the ability to express the trait encoded by that gene. It is like taking a single ingredient out of a recipe and adding it to another recipe.

The process of adding a specific trait to an organism that does not have this trait includes 5 basic steps:

1. Locating an organism that naturally has the desired trait;
2. Extracting the DNA from that organism, which in this analogy is like taking out the entire cookbook;
3. Locating the one desired gene (ingredient) and copying it from the thousands of genes that were extracted, in other words cloning the gene;
4. Modifying the gene slightly to work in a more desirable way once inside the recipient organism;
5. Delivering the new gene, the transgene, into cells of the recipient organism, known as transformation.

Why Genetic Engineering?

Recently, genetic engineering applications have increased rapidly. Generally, all applications depend on the manipulation of organisms to produce useful products, which is something humans have been doing since the beginning of recorded history. Selective breeding of domestic plants and animals, for example, is a kind of biotechnology, though a very slow kind. What is different about modern genetic engineering is that we can modify organisms more rapidly and radically.

The first commercial use of genetic engineering was a relatively simple one; to manufacture particular kinds of proteins, such as insulin, in abundance, which would otherwise be tedious and costly to produce.

Insulin is the hormone that is involved in the regulation of blood sugar; people who suffer from diabetes are unable to produce enough insulin, and are thus regularly treated by insulin injections. The question is how to economically provide the large amounts needed of insulin.

Many years ago, farm animals, such as cows and pigs, were the only source to produce insulin. The organs of these animals were harvested and used to provide insulin through a rather tedious and costly process. Furthermore, the insulin of these animals, though very similar to human insulin, was not identical to it and did not always work with certain individual cases.

Now, thanks to genetic engineering, producing insulin in large amounts, at a reasonable cost, is a relatively simple process by inserting the human insulin gene into a certain type of bacteria. This process was first developed by Herbert Boyer, in 1978, when he took a version of the human insulin gene and inserted it into a special bacterium called "*Escherichia coli*" to produce synthetic, but very similar to human, insulin. In fact, almost all insulin used in medical treatment now is manufactured by genetically-modified bacteria.

The gene responsible for producing insulin is "cut out" from the human cell by using a special enzyme called "restriction enzyme". A plasmid—a small DNA molecule that is physically separate from, and can replicate independent of, chromosomal DNA within a cell—is then extracted from a bacterial cell; a second "cut" is created

using the restriction enzyme, then the gene is inserted into the plasmid by attaching both of the "sticky ends" of the gene into it. At that point, the hybrid plasmid is re-inserted into the bacterial cell where it will replicate to make the new DNA for the cell and many more daughter cells will be cultured.

The insulin produced by this method has a much lower cost and a much higher purity than the one produced without the aid of genetic engineering. Today, there are dozens of medically important proteins manufactured in the same way, and hundreds are under research and development.

In the field of agriculture, on the other hand, dozens of transgenic crops are now in common commercial use. These crop species contain desirable traits that were absent in the original crops. For instance, new genes were inserted to improve resistance to insects, other genes were inserted to increase growth, while others are inserted to improve the nutritional value of the plant, and more. To learn more about that, read our piece "Techno-Food", page 08.

Genetic Engineering in the Balance

Despite all the wide useful applications of genetic engineering that are currently present and play a very effective role in our lives, some people have concerns about genetic engineering, including ethical, religious, ecological, and economic concerns.

Opponents of genetic engineering cite various worries and fears that include: What constitutes proper and improper human use of animals? Should we eat food that was genetically manipulated using human genes? How does this affect religious, or any other groups with strict dietary laws? How do we know that a genetically-engineered food plant will not produce new toxins and allergies? What are the effects on the environment and on wildlife? How great are the potential risks involved in releasing genetically-modified organisms into the biosphere without knowing all the possible consequences? Are we going to reach a stage where genetic engineering is used for recreational purposes? Will genetic engineering be used, or is it already being used, in biological warfare?

Organizations such as Greenpeace—an organization devoted to the preservation of the environment—are completely against the use of genetically-modified organisms. Greenpeace fears that genetically-modified organisms will integrate themselves with organic organisms producing new forms, and thereby permanently changing the environment and the ecological system.

It also opposes the production of genetically-modified foods, which from their point of view, is merely a means through which business entities can experiment with and exploit our food supply for profit. Moreover, it mentions that there is much unknown about the effects of genetic engineering to be applied safely to our food sources.

On the other hand, experiments in 1987 by the Committee of the National Academy of Sciences—an organization devoted to the pursuit of scientific and technological advancement—

have already concluded that genetically-modified food posed no risk of damage to the environment.

Religious controversies are also often aroused especially when it comes to genetic engineering in human beings. While genetic engineering can be used to treat or prevent diseases, it also raises the moral question of whether doing so is "right".

Many people oppose the idea of selective breeding as a practice of mating two organisms to emphasize attractive qualities in them. However, when applied to plants and animals, selective breeding does not cause as much of an uproar as it does when applied to human beings. Nevertheless, the idea of forcing people with certain IQ levels, for example, to mate in order to produce highly intelligent offspring seems unacceptable.

The pro party would answer by stating that this is something that people already do voluntarily, as we all seek potential mates by looking for qualities attractive to us, and if they are positive qualities, then we hope that they will be passed onto our children.

In their point of view, genetic engineering is thus just a technological means of doing something that we have already been desperately trying to achieve, which is seeking self-improvement or the fulfillment of one's full potential as a value that is deeply rooted in human cultures. They believe that it is an honorable pursuit to attempt to have children that do not have any diseases and live a perfectly healthy life.

The truth is it would be difficult for any average person to answer any question related to genetic engineering from a perfectly neutral point of view because one's own views would color any attempted explanation regarding the controversy. People who have fears believe that genetic engineering should be kept in laboratories, inside test tubes, and not be allowed on large scale applications; while people who are strongly supportive believe that genetic engineering is undoubtedly going to shape our future.

There is no doubt that ethical, religious, and ecological concerns about genetic engineering are sure to become more pressing as this technology continues to spread and develop during the coming years. These concerns can be discussed fairly and intelligently only if people are willing to educate themselves about the science involved, and listen to one another's points of view.

This vigorously debated issue will always be a subject to discussion; as long as this technology forges, the debate will never be off the table. Nevertheless, no one can deny the great contribution that genetic engineering added to all scopes of modern science as we know it, and that the role it is going to play in shaping our future has now become an unavoidable fact.

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History of Science Museum

Visitors INFO

Opening Hours
Saturday to Thursday
[from 10:00 to 15:00]

Guided Tours Schedule
Saturday to Thursday
[10:30 + 11:30 + 12:30 + 13:30 + 14:30]

- Museum entry fees are included in all Planetarium show tickets.
- For non-audience of the Planetarium, Museum entry fees are EGP 0.50.
- Museum Tours are free for ticket holders.

ALEXploratotrium

Visitors INFO

Discovery Zone

Opening Hours
Saturday, Sunday, Monday, Wednesday and Thursday: [From 09:30 to 15:30]
Tuesday: [From 09:30 to 12:30]

Guided Tours Schedule
Saturday, Sunday, Monday, Wednesday and Thursday: [09:30 - 11:00 - 12:30 - 14:30]
Tuesday: [09:30 - 11:00]

Entry Fees
Students EGP 2
Non-students EGP 4

Listen and Discover

- For the list of shows available at the "Listen and Discover" and the schedule, please consult the Center's official website: www.bibalex.org/psc.
- For reservation, please contact the PSC Administrator at least one week before the desired date.

Show fees
DVD shows:
Students EGP 1
Non-students EGP 2
3D shows:
Students EGP 2
Non-students EGP 4

Techno-Food

By: Hend Fathy

Technological advances and breakthroughs are popping up in fractions of seconds, with promises to enhance quality in each and every facet of life, and food is no exception. The emerging food technologies address different issues from global food crisis and malnutrition, to environmental impacts, and even luxury. Let us examine some examples that demonstrate how technology introduces smart solutions that meet our increasing demands and decreasing resources.

Smarter Solutions

Eradicating hunger was one of the eight Millennium Development Goals set following the UN Millennium Summit in 2000. Billions and billions of dollars are thus invested annually on food technology research and applications, aiming to meet the increasing demand of a non-stop-growing population. Both genetic engineering and nanotechnology have shown highly promising aspirations for achieving food security, although many of them have not yet reached those in need.

Nowadays, some countries are growing genetically-modified crops that resist pests and diseases, tolerate climatic factors and herbicides treatment, and above all carry higher nutritional values. For example, with ten times the amount of added vitamin A, the newly-introduced "Golden Rice" is expected to help solve the problem of malnutrition in the developing world.

With a gene adapted from the daffodil flower, the rice grains produce a beta-carotene compound that our bodies turn into vitamin A, the deficiency of which affects millions of people annually, causing blindness and even death.

The recently emerging nanotechnology had a lot to present, offering benefits in food safety, storage, packaging and nutrition. For example, research teams developed different types of antimicrobial and antibacterial food films made of nanoparticles of zinc, calcium, magnesium oxide, and titanium dioxide. Vulnerable foods, such as cheese and sliced meat, showed higher resistance to spoiling using these films.

Sky-High Food

By the fifties of the current century, the world population would reach over 9.5 billion. Unless we think out of the box, we are to face dramatic shortage in food, arable land, and fresh water. Dr. Despommier of Columbia University developed an innovative and smart solution; vertical farming.

Vertical farming transfers agriculture from horizontal farmlands to vertical skyscrapers in rural areas, where most of the Earth's population will be living in the decades to come. Instead of implanting seeds in soil, vertical farms would rely on hydroponic[1] systems, which are sufficient to grow almost all terrestrial plants.

A vertical farm project needs bringing together multi-disciplinary technologies needed for minimizing waste and energy use, facilitating recycling, and developing high-tech irrigation systems. Accurate monitoring systems are also needed to ensure the needed temperatures are maintained for different crops.

The key advantage of vertical farming is space, for one indoor acre produces an equivalent of 4 to 6 acres outdoors. Furthermore, similar to green houses, different crops can be grown all year round as the operation systems control temperature and humidity levels.

Using sophisticated water recycling systems, vertical farming would contribute to saving fresh water, 70% of which is nowadays used for traditional irrigation, rendering it unusable for drinking as a result of contamination with fertilizers, herbicides and pesticides.

Further to this, it would not even necessitate using pesticides as long as the building is carefully monitored. Vertical farming is also likely to eliminate the pollution caused as food is trucked or shipped across borders to reach the consumers; alternatively, people will get their freshly harvested foods from the farm next door.

The major criticism directed to vertical farming is that it would eliminate jobs of conventional farmers. However, thousands would be required to build, operate, and maintain these vertical farms, let alone harvesting and packing the grown plants. Dr. Despommier further suggests that lands used for horizontal farming could be forested, constituting a major counterweight to global warming.

Ctrl + P: Dinner is Served

Back home, hungry and exhausted after a long working day, you only need to warm up your printer, select your favorite meal and print your dinner. A 3D printer is a machine that builds physical objects—dot by dot and layer by layer—similar to how conventional printers lay down colors on a piece of paper, but in three dimensions.

A research team at Massachusetts Institute of Technology (MIT) is already ready with a 3D food printer prototype which uses "food inks" syringes filled with a variety of tasty ingredients to build meals up. Foods that cannot be readily extruded from a syringe such as meats and vegetables are ground and mixed with other liquids to create novel food inks. Though still underdevelopment, 3D printing will definitely revolutionize printing industry, and most importantly, our perception of food and cooking.

Once the 3D printer gets an order, the printing process starts with feeding different ingredients, originally stored refrigerated in canisters, into a mixing chamber. The mixture is then extruded and deposited in layers of various and complex combinations of ingredients. During deposition to the service tray, the ingredients are cooked, or cooled, in tubes attached to the printing head.

The most distinguishable property of 3D food printers is their ability to control the nutritional value of the printed meal; thus customizing the products to exactly meet the needs of different individuals. They can also turn ingredients of high nutritional value into entirely novel sets of tasty flavors that would otherwise be unimaginable through traditional cooking techniques; not to mention adding healthier ingredients to produce fried fast foods that youth and children are addicted to.

Another ambitious attempt to 3D-print foods is at Cornell Creative Machines Lab (CCML). The project manager, Jeffrey Ian Lipton, has developed a new technique that allows the printer to produce different textures of foods, instead of injecting them as straight lines.This property would allow us to produce porous structures whose absorbent quality can be controlled; hence, making the food more juicy or deeper-fried. Researchers at CCML have also produced cakes that, when sliced, reveal special messages buried within, such as dates or logos.

Though still of a very high cost, 3D printers will transfer cooking and food from domestic kitchens into the realms of the digital world. Food and art will come together, allowing chefs, restaurants and food industrialists to develop distinguished brands, and providing us with an endless menu of food printouts.

WikiWrapper: Bon Appétit

Food and beverage packages constitute a big portion of the plastic wastes covering our planet and abusing the health of our ecosystems. Yet, foods will always need containers to keep them fresh and protected. Harvard University scientist Professor David Edwards, from the School of Engineering and Applied Sciences, has an innovative and tasty solution: making packaging as delicious as the goods held inside.

Yes, with the introduction of edible packaging technologies, dubbed WikiCells, after you finish your drink, you can have the bottle for dessert. A WikiCell acts like the protective peel of an orange or a coconut shell. It is a soft skin that holds and protects foods and drinks, such as ice cream, yogurt, cheese, juice, and pudding, keeping them fresh to the same extent as ordinary plastic containers.

The WikiCell has two layers of packaging. The primary soft layer is similar to the grape wrapping and is always edible. This layer is made of three main components: natural food particles such as chocolate, nuts, and seeds; a nutritive calcium; and a natural molecule like chitosan(2). When the three components are mixed together, they form an electrostatic gel layer that keeps water inside the food or drink.

The second layer is a protective shell, which may or may not be edible. In cases where it is inedible, the outer layer can be simply peeled off and thrown away without constituting a threat to the environment, as it is completely biodegradable.

WikiCells can mimic the taste of the food inside, thus maximizing the experience of the strawberry-ice cream consumer when he/she munches up its strawberry tasting wrapper. On the other hand, edible wrappings can play an independent part of the tasting experience through adding a completely different taste of its own.

Although the hygiene of these edible packaging has raised skeptics doubts, Professor Edwards says people can wash their WikiCell products before consumption just like they wash fresh fruits and vegetables.

In the near future, WikiCell production machines will be available in restaurants and food factories. Juice and ice creams will shortly be available through WikiBars, which will allow the public to sample and experiment with edible wrappings. The first WikiBar is already serving a curious hungry crowd in Paris, and many others are expected to appear this year.

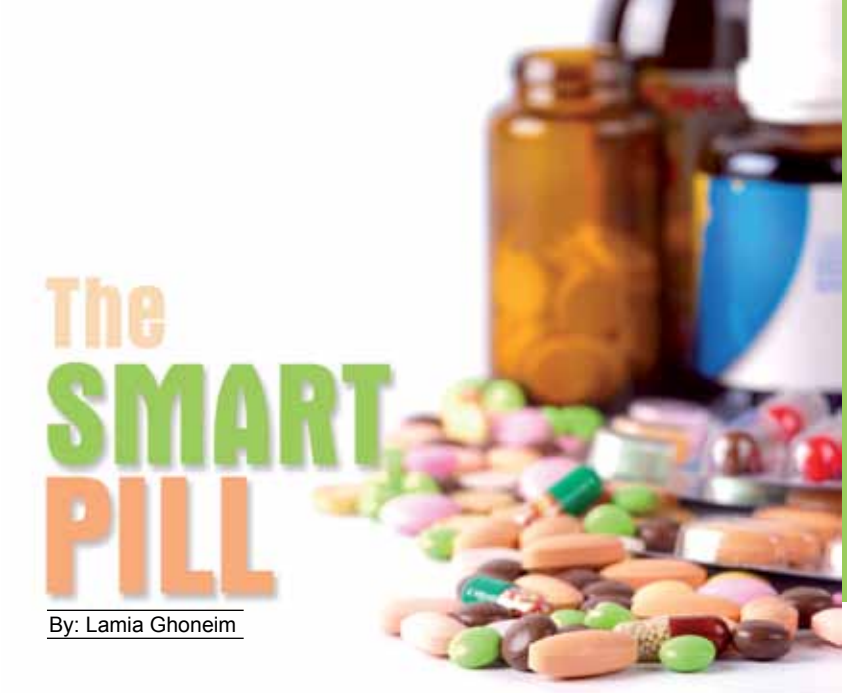
Future food technologies still hold more and more smart and far-fetched methods and applications to feed our bodies and amaze our brains. In the few decades to come, the notion of smart, high-tech, and environment friendly foods will become absolutely realistic and easily achievable. However, this will require various kinds of scientific and technological innovations, huge financial resources, and official government support.

The world's decision makers should remember that the deadline for achieving the new millennium's goals is only two years from now, 2015, and that only science and technology can save millions from starving to death.

Glossary

(1) **Hydroponics** is a method of growing plants applying mineral nutrient solutions in water, without soil. When the required mineral nutrients are introduced into a plant's water supply artificially, soil is no longer required for the plant to thrive.

(2) **Chitosan** is a sugar that is obtained from the hard outer skeleton of shellfish, including crab, lobster, and shrimp.



The SMART PILL

By: Lamia Ghoneim

I recently watched a movie entitled "*Limitless*" about an unknown writer, who has a persistent case of writer's block, then discovers a pill; an experimental drug named "NZT", which enhances his mental abilities and makes him tap into his unutilized brain power, completely transforming him.

Success, fame and fortune inevitably follow his transformation; despite the pill's serious side-effects, the protagonist manages to overcome them, and the movie ends with him being the laser-focused genius super-hero of our dreams.

However, this is not about the movie or how the story ends; it is about the dream and the power fantasy of becoming more than what you truly are. This is about the promise of a smarter, more enhanced version of yourself, delivered to you via a single pill.

Is it possible? I found myself wondering why not; we are after all in an age of unprecedented technological advancement, seemingly unlimited in its possibilities. If technology can make us look younger, live longer, and offer us new organs, why cannot it make us smarter?

Apparently it can. I just was not paying attention to the amount of cognitive enhancing drugs that have emerged on the pharmaceutical market, now readily available for those of us who seek to become more intelligent.

Whether we should be using them or not is a matter of personal opinion, that and whole bunch of moral and health complications.

Smart pills—more precisely cognitive enhancers—include a variety of controlled substances, presumably available only by prescription. They consist of stimulants such as "dextroamphetamine" (sold as Dexedrine and Adderall), "methylphenidate" (Ritalin, Concerta), and Modafinil (Provigil), all originally designed to treat psychiatric and neurological disorders such as Attention Deficit Hyperactivity Disorder (ADHD) and narcolepsy*; however, when used by otherwise healthy individuals, they can significantly boost cognitive functions.

By mimicking brain neurotransmitters, norepinephrine, and dopamine, those stimulant drugs produce an effect that is similar to the effect of the drug portrayed in the film, albeit less dramatically powerful. They boost alertness, increase concentration, decrease distractibility, and improve memory and wakefulness, making you laser-focused on the task at hand, until mission is accomplished, at which point you are fired up to tackle something else, from organizing your closet by color to solving complex trigonometry equations.

It is thus not surprising that a staggering 7% of American university students reported having taken stimulants "non-medically" at least once. Moreover, they are not the only healthy "users"; fighter pilots on critical missions and time-pressed writers have been known to use wakefulness drugs, as Modafinil, to boost alertness and meet deadlines. Even the military has a history of encouraging—and sometimes even ordering—soldiers to take Ritalin or Modafinil.

So why do not we see those stimulants advertised on billboards promising to make little geniuses out of each and every one of us? If they are so good, why are not we all using them?

To name a reason, they can lead to a rebound effect, in which the problem being treated worsen. Sleep disturbances, high blood pressure, emotional instability, visual hallucinations, insomnia, and depression are just a few known side effects.

So as much as I yearn to be a super-hero genius who undertakes challenges like there is no tomorrow, I think I have to pass on those enhancers. For now at least, until something safer comes along.

Disclaimer: The information here is intended for informational purposes only; we do not, in any way, encourage the use of performance enhancing drugs or any other drugs without professional medical advice. For information on any of the drugs discussed in this article, please seek the advice of your medical provider.

Glossary

***Narcolepsy**: is a sleep disorder that causes excessive sleepiness and frequent daytime sleep attacks.

By: Jailane Salem

Human beings have developed great ways of taking care of their bodies and creating tools to stay healthy. From an early time, medicine has been an important aspect of social life; many people dedicated themselves to the study of herbs and their medicinal qualities, while others focused on discovering methods in order to improve people's health.

We have come a long way from the times when drilling a hole in someone's skull was believed to help them get rid of migraines and mental disorders; thanks to technology, every day, a new improvement is made in health care, and great leaps are being made, not only in medicine, but in medicinal tools as well. For every health related problem people face, there are scientists out there trying their best to discover a solution.

HEALTH-TECH GADGETS

Healthcare Texting

One of the problems facing people in poorer countries is the unavailability of doctors and healthcare units. Many people live in rural areas with no facilities nor access to healthcare for emergency cases. This is why a company, the "Medic Mobile", is trying to change this by applying a simple method to provide those in need with the care they deserve.

Medic Mobile was an initiative started by students who had volunteered in a hospital in Malawi. They started using a free software application called "FrontlineSMS" to coordinate community health workers at St Gabriel's Hospital.

Those students were not doctors, but they wanted to improve healthcare. They figured that, by using simple tools, such as mobiles that people already own, they could boost those people's chances of having better access to health care, and improving their quality of life. They connect people with health workers; through texting, doctors can figure out if the symptoms a patient has needs hospitalization or not.

Hence, in a remote village where a patient would have previously suffered in silence and passed away, now a health worker could reach them with the needed medicine, or they could be transported to the nearest hospital. It is also a way for doctors to keep track of how their patients are doing; thus lowering the risk of a relapse going untreated.

This idea has taken root in more than thirty organizations that are applying this technology to improve health services in more than fifteen countries. For example, in remote villages in Nepal, where pregnant women had no access to healthcare, through Medic Mobile technology, they are able to contact doctors, and those who have high risk pregnancies can have easier access to healthcare, lowering their chances of complications.

GPS Shoes: Alzheimer's Tracking Device

How many times have we seen a poster asking for help in finding a missing elderly person? Many times an Alzheimer sufferer would forget who and where they are and wonder away from home and get lost. Persons inflicted with Alzheimer's are at great risk if they get lost; that is why a new brand of shoes has been created containing within them a Global Positioning System (GPS) tracking device.

Shoemaker Aetrex, with the help of GPS device makers GTX, is now selling GPS Shoes. The transmitter, embedded in the base of the right heel, tracks the user's location in real time and sends that data, at specified intervals, to a central monitoring station. The monthly tracking plan covers having that data sent to a personalized tracking website for caregivers to monitor should the user ever leave a specified zone.

Instant Flu Diagnosis

The swine and avian flu scares are still fresh in everyone's mind, even though it has been a while since their outbreaks caused waves of terror across the world. Although H1N1 flu (aka Swine flu) is no longer the center stage on television, we can only wait and see what new epidemic will lead to a media circus.

Nevertheless, many people were indeed affected by the H1N1 flu that swept across the globe; one of the issues was getting diagnosed quickly in order to start a treatment plan. It seems scientists are up to the task; a microfluidic chip has been built, rivaling in accuracy the gold-standard diagnostic test known as "RT-PCR"[1], but is faster, cheaper, and disposable.

Researchers basically miniaturized the RT-PCR test into a chip the size of a standard microscope slide and analyzed two types of nasal specimens as accurately as the lab-scale method. The chip is made of a top column that extracts RNA from signature proteins associated with the influenza A virus, a middle chamber that converts the RNA into DNA, and a climate-controlled lower channel that replicates the DNA enough times to be detected by an external reader.

Researchers are currently working on improving the chip and reducing its production cost to USD 5, as well as deliver a quick result in the span of an hour. As many people who get the flu do not go to the hospital or seek medical help, this chip will lower the risk of them developing complications, since they will know that they have the flu and therefore seek medical help. On the other hand, if they believe they have the flu and their test turns out to be negative then they do not have to go through extensive tests just to find that out.

Crab-like Robot

Imagine having a seafood dinner and getting hit by an amazing idea that could help lives? This is what happened when two scientists, Lawrence Ho and Louis Phee, were having a signature Singaporean dish, chili crab, for dinner. They observed the crab's pincers and admired its ability to pick up sand, which shows how precise its movement can be; they thought they could apply this idea to remove early stage stomach cancer.

They worked together, creating a mini-robot that mimics the shape and movement of a crab's pincers. The robot is attached to an endoscope, with a small camera to provide visual feedback. It has the ability to go down a patient's throat and remove cancerous tissue by having the pincer hold the cancerous tissues, and then the hook slices them off, coagulating blood to stop any bleeding.

This idea was developed in 2004 and so far Ho and Phee have used the robot to help remove early-stage stomach cancer in five patients in India and Hong Kong. With the use of the robot, the surgery that used to take a long time, and would leave a scar where the incision would be, now takes a fraction of that time.

Not only that, the use of the robot lowers the risk of infection present in open surgery and offers patients the choice of opting for a non-invasive procedure. "Our movements are very huge and if you want to make very fine movements, your hands will tremble ... but robots can execute very fine movements without trembling," said Gastroenterologist[(2)] Lawrence Ho.

It has not become commercially available yet; however, the scientific duo are hoping to make the crab-like robot available in the coming years. The researchers said "Many things are a certain way because they have evolved and adapted to certain functions ... we created something that followed the human anatomy and borrowed ideas from nature and incorporated the two". This goes to show that inspiration and solutions are all around us; all we have to do is pay close attention.

Injectable Devices

If you think crab-like robots are gadgets out of a science fiction novel, how about surgical devices that can be injected into the bloodstream? Researchers are, in fact, coming closer to actually realizing this idea.

Some implantable devices, such as pacemakers, have been around now for quite some time; however, devices are now becoming much smaller that they can pass through our bodies and be able to deliver drugs and perform diagnostics.

The major problem that researchers faced was the size of the battery, because they were not small enough to enter and travel through the bloodstream. Researchers in Stanford Integrated Biomedical Systems have been working on creating a battery-less device that is powered wirelessly via electromagnetic radio waves that are received from outside the body through a tiny antenna on the device.

One of the researchers on the project said: "We operate the device near a magnet—we imagine the patient lying on a magnetic table—and use radio waves to tell the prototype how to use its electrodes. The electrodes send electrical current through the surrounding fluid, creating a net force that moves the device. With an upward magnetic field, a counterclockwise electrical current pushes the device forward, and a clockwise current pushes it backward.

By making circuits that create opposing forces on each side, we can also turn the device left or right. With our relatively weak magnet, the prototype moves 0.5 cm per second in a dish of saline. If it were in the bloodstream—cleaning out your arteries, for example—you would need a stronger magnet to overcome the flow of blood; but that is still a ways off. In the near term, we imagine using the device to image the Gastro-Intestinal (GI) tract; there, it would not need to travel as fast. It could reduce the cost of cancer screenings, and it would be a welcome alternative to at least one traditional method: colonoscopy."

Not only tiny robots are being developed to flow in your bloodstream, so can newly-created cameras. Usually, when one has to get their insides examined, a tube is shoved down your throat, which is quite an unpleasant experience. Hence, a team of researchers in Japan recently successfully tested a remote-controlled, self-propelled capsule camera that can examine the human stomach and colon.

The camera is like a fish-shaped mermaid and is 4.5 cm long, electromagnet-powered capsule with a fin-like tail. The camera can be controlled and can take two images per second. The Japanese research team believes the device could be used to image the entire digestive tract, including the small intestine.

There is still a long way to go before the devices are ready for clinical use; however, advances made so far will revolutionize the medical field, and we may soon be injecting, rather than implanting, devices.

Inspector Pill

Doctors are always telling their patients how important it is for them to follow their instructions and to take their medicine on time, but one of the biggest problems is patient compliance. They tend to forget to take their medications on time, and this is why a new pill has been created to solve this problem.

Instead of carrying out the traditional role of preventing or curing illness, this pill monitors your insides and relays the information back to your healthcare provider. The pills are made by Proteus Digital Health, and have sand-particle-sized silicon chips with small amounts of magnesium and copper on them.

After they are swallowed, they generate voltage as they make contact with digestive juices. That signals a patch on the person's skin, which then relays a message to a mobile phone given to a healthcare provider. The pills are still being tested, but the producing company is looking to release it on the market soon.

Maneuverable Wheelchairs

Many people rely on wheelchairs to move around, but available wheelchairs are usually quite limiting, and do not allow its user a full array of movement. To remedy this situation, Japanese researchers led by Masaharu Komori, Associate Professor of Mechanical Engineering at Kyoto University, recently demoed the Personal Mobility Vehicle, as a prototype for next-generation wheelchair.

The Permoveh (its shorter name) has four wheels instead of just the usual two; what makes it special is its ability to move not just forward and backwards but also sideways and diagonally. The vehicle can move in any direction when the user operates a hand-held control.

Each wheel has rollers in them; when the wheelchair moves forward only the wheels move, but when it moves sideways the rollers only move; and when moving diagonally,

both wheels and rollers move. The wheelchair is designed to allow users to navigate through tighter spaces more easily.

The wheelchair is still in its testing phase, but the team working on it wants to make it available in three to five years after they make it lighter, more compact and more cost effective. This wheelchair will allow people with special needs more freedom in movement.

While great wheelchairs are being developed, not everyone who uses them can use their hands to operate them, because some suffer from high-level spinal-cord injuries and therefore rely on a sip-and-puff technology to operate the wheelchair. This technology requires the user to sip or puff precise amounts of air pressure into a straw, to make the wheelchair move.

A new gadget is being developed to allow users an easier approach in operating the wheelchair. A prototype dental retainer developed at the Georgia Institute of Technology was developed in order to allow users to use their tongue to maneuver the wheelchair.

The Tongue Drive System is built as a small retainer that fits along the roof of the mouth, and uses sensors to track the movement of a tiny magnet on the user's tongue, thereby allowing the user to issue commands by pointing his/her tongue in different directions. The magnetic field sensors are mounted onto the four corners of the retainer, which contains the circuitry, a lithium ion battery and induction coil to charge the battery, and a moisture-resistant cover.

To move the wheelchair the device transmits output signals wirelessly from the sensors to an iPhone for example, which has the software that interprets the tongue commands. The prototype is still being tested on a limited number of users but the researchers hope to move to larger clinical trials soon.

With new and creative healthcare solutions being developed all the time, and with devices being tailored to help facilitate lives, providing easier and healthier solutions for a wide diversity of medical issues, the future looks promising.

Just the thought of how ideas for such innovative and groundbreaking solutions are conceived; whether it be shoes that help track Alzheimer's patients, or dinner-inspired surgical tools; assures us that we would never run short of ideas to improve and innovate technology that will better the future of humanity.

Glossary

(1) **RT-PCR:** Reverse Transcription (Real-Time) Polymerase Chain Reaction is a test that can identify the presence of influenza viral RNA in respiratory specimens.

(2) **Gastroenterologist:** A physician specialized in the treatment of the digestive system diseases.

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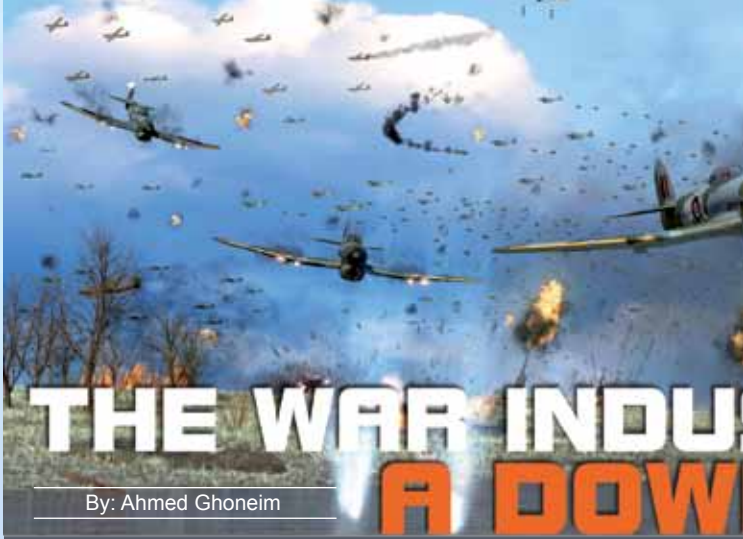

THE WAR INDU... A DOW...

By: Ahmed Ghoneim

Almost everybody knows that Alfred Nobel, creator of the Nobel Prize, the most prestigious award worldwide in both sciences and humanities, initiated the prominent award out of guilt over inventing dynamite. Less people might know that Albert Einstein was quoted saying "I made one great mistake in my life—when I signed the letter to President Roosevelt recommending that atom bombs be made; but there was some justification—the danger that the Germans would make them".

The universal fact is that, ever since the American Civil War, technology has played a huge role in warfare. Many ideas that were thought up with no particular intention or for peaceful reasons have been used to kill people. However, the opposite is also true; the concept "Swords to Ploughshares" describes converting what was once harmful, deadly war technology to peaceful civilian technology.

Instant Intelligence

Before the invention of the telegraph, most long-distance communication techniques were visual, open-air signals subject to visibility limitations and weather conditions.

Early into electricity research, it was observed that it travelled very fast. In 1746, Jean-Antoine Nollet, a French physicist, gathered about 200 monks in a circle, asked them to hold an iron wire that connected them all, and then plugged it in a battery. He noticed that all the men reacted at almost the same time, which peculiarly proved to him that electric current flows fast.

Using this knowledge, an anonymous writer, with initials C.M., wrote a letter to *Scots Magazine* in 1753 suggesting the use of electricity to transmit messages. His idea was to have a wire for each character to be sent, sending a signal through them in the desired order.

At the time, the only form of electricity was static, and the connected wires would be tested by a small metal ball—known as a pith ball in labs—that deflected as a result of the static electricity. This system and similar ones were tested a lot, but were very impractical; it would be a tedious job to employ at least 35 wires at the same time—26 wires for the letters of the alphabet and 9 more digits.

It took a tragedy and a man with the right kind of company to reach the modern telegraph as we know it. While working as a painter in Washington, Samuel Morse received a letter that told him his wife was dying. By the time the letter had gotten to him, and the time it took him to return home, she had already been buried. Devastated by this, and inspired after having met a friend who taught him about electromagnetism, he came up with the idea of a single-wire telegraph.

The idea was to send all signals through that wire, with the problem being how to distinguish each signal as a certain character. The answer was to send combinations of long and short signals, now known as dots and dashes, where each character would be interpreted as a different combination. This was called the Morse Code.

STRY:
NSIDE OF TECHNOLOGY

Industrial War

Lasting for four years (1861-1865), the American Civil War between North and South was won by the North, largely owing to the technological advancements of the North forces.

Two years into the war, their industrial society was in possession of the largest telegraph network in the country, 35,000 km of railroads—as opposed to only 14,000 km in the South—as well as repeating rifles. Those rifles were a major technological advancement in weapons in that, for the first time, they could fire more than one bullet before needing a reload.

The Northern forces even used hot air balloons for reconnaissance, creating the Union Army Balloon Corps, who used hydrogen gas generators to fill up the balloons.

World War II was the deadliest conflict in the history of mankind. It involved nearly every country in the world. In a frantic desire to win the War, every party invested lots of effort in technological research; scientists and engineers made some of the most important discoveries and inventions during the time of the War.

Not having many ethical boundaries, doctors in Nazi Germany conducted cruel experiments on their prisoners; one of these was the freezing experiment. Placing the test subject in freezing water until their body temperatures dropped severely, Nazi doctors would perform measurements on various parts of the body and vital signs. This resulted in many deaths, their findings were startlingly insightful on the state of humans in hypothermia and how to revive them efficiently.

On the other hand, jet aircrafts were a marvel in that they were much faster than older aircrafts at higher altitudes. Initially conceived by Frenchman Maxime Guillame, the jet engine was mainly a gas turbine—a kind of internal combustion engine that produces high-pressure exhaust—built to propel a plane forward with its exhaust.

Although the French did not initially pursue the concept further, two men, British Frank Whittle and German Hans von Ohain, coincidentally created similar designs for a jet plane. Germany was faster to produce von Ohain's design in 1939, then Britain followed in the early 1940s. By the end of the War, they were both using jet fighters.

Without jet engines, the planes we fly in today would not exist. The jet engine is also used as a rocket engine, where it is applied to spaceflight, satellite launching, and military missiles. More unusual uses for the jet engine are in ultra-high-speed cars, and as a tool to remove ice from roads and railroads owing to the high-pressure and temperature of jet exhaust.

Nuclear War

By the start of the 20th century, physics was developing rapidly. Albert Einstein, a pacifist, published a paper in 1905 that theorized the following. If a body gives off energy, its mass will decrease proportionally to that energy. The constant of proportionality is the inverse of the speed of light squared. This came to be famously known as $E=mc^2$, or the energy-mass equivalence formula. Later on, the nucleus, the central part of the atom, was discovered.

Leo Szilard, Hungarian physicist, theorized the fission chain reaction in 1934. He imagined that if a neutron was fired at an atom of a type of

Uranium, the Uranium-235, the atom will split into two atoms and fire even more neutrons. The combined mass of the resultant particles will be less than the original mass of the uranium atom; the mass difference is released as energy.

Since c^2 is a very large number, in the magnitude of 10^{16} m/s, a very small amount of mass can produce an enormous amount of energy. What is even more interesting is that the extra neutrons fired by the split atom can hit more neighboring atoms, causing a chain reaction that goes on. This was the idea of the nuclear bomb.

In fear that Germany was beginning to develop one itself, Einstein and Szilard, both refugees of the War, pushed then American President Roosevelt to authorize the creation of this bomb. It turned out in the end that Germany was nowhere near to completing one. What started as a precaution that turned out to be unnecessary was used later on to destroy two Japanese cities full of civilians.

In his speech "Atoms for Peace", American President Dwight D. Eisenhower stated that nuclear power should be used for peaceful purposes. At the same time, he was commissioning the increase of nuclear weapon production by the United States to overpower the Soviet Union. Even though his peaceful intentions are debatable, he initiated the declassification of nuclear reactor technology.

The most useful byproduct of a controlled fission chain reaction—one that will not explode—is heat; it can then be used in the same manner as burning fuel to generate electricity. Nuclear power is a clean alternative to fossil fuels; it does not pollute the air nor contribute to global warming. Nowadays, about 11% of the world's electricity is nuclear-powered. France—a country that famously has no coal, oil or gas—relies on nuclear plants for 80% of its electricity.

Even though the initial costs of a nuclear plant are high, the running costs are much lower and a lot of the nuclear material used as fuel can be reprocessed and used again. Dealing with radioactive material and their waste is very risky, though. If improperly disposed of they could lead to a multitude of health issues in contaminated areas. There have been three major nuclear plant disasters to date, the latest of which occurred at the Fukushima plant in Japan, 2011.

Digital War

One would think that something as important and beneficial as the computer must have been in the minds of people for years and been developed with the desire to benefit humanity. The harsh truth is that computers were developed for war purposes.

The Colossus, the first digital computer, was a code-cracking machine. It was used in World War II to decipher German messages that were so cleverly ciphered. It only ran the code-cracking program though, and was not reprogrammable.

Another project, the ENIAC (Electronic Numerical Integrator and Computer), was developed by the US Army also during the War with the purpose of calculating missile trajectories. This was the first fully programmable computer that is theoretically capable of doing anything a computer can do today, albeit much, much slower.

The ENIAC is a milestone in computer history. It occupied a full room, even though today it was replicated on a chip of 40mm^2 area. It should be noted, however, that a fully-functional computer, the Z3, was developed by the Nazis before the Colossus or the ENIAC, but was not a fully digital computer.

Previously, short for Radio Detection and Ranging, a radar is an invention that can detect objects' speed and position when it is not feasible or possible to see them. Developed separately and secretly by about a dozen nations before, during and after World War II, the radar had numerous wartime applications. The more frequent uses of the radar, however, are peaceful.

Aside from being still used in the military, nowadays, radars have applications in civilian air flight, where they could guide an airplane through fog and storms to a safe landing, in marine and in road transport. It is also an essential tool in weather forecasting. The microwave is also a direct descendant of the radar.

Star Wars

Following World War II, the United States and the Soviet Union were the world's two superpowers. With a desire to supersede one another without resorting to yet another world war, they competed on all fronts except for direct combat, in what came to be known as the Cold War. The result of the technological competition was a multitude of the inventions we use today.

The space race started when the Soviet Union launched the first artificial satellite, Sputnik, into the Earth's orbit. This led to a panic in the United States; in response, its Government started the Advanced Research Projects Agency (ARPA). Lots of launches from both sides followed, with the first milestone being the first human in space, Yuri Gagarin, a Soviet citizen. The final achievement, which ended the race in favor of the United States, was the Apollo 11 mission, when the first human landed on the Moon.

Satellites, a direct result of the space race, are an essential part of our modern life; they provide crucial data about the bodies they orbit. Earth-orbiting satellites provide weather information and are used in communications, television and navigation.

The GPS (Global Positioning System) was also a product of the Cold War as a direct result of the United States fearing a nuclear attack by the Soviet Union. They employed satellites, which, using a concept from Einstein's relativity theory, would help any carrier of a GPS receiver to know their location. The main goal was a military goal, but in the end the US Government opened it up for civilian use, worldwide. Today GPS is used by people everywhere in land, air and sea navigation.

Cyber War

In the 1960s, researchers at ARPA were interested to network all of the computers in their research facilities across the United States. They wanted faster collaboration and sharing of results; they created ARPANET, which initially connected four universities across California and Utah.

The network kept expanding, one step at a time; by 1970 it had reached the US East Coast; and in 1973, it was connected to a Norwegian computer. Other networks began to spring everywhere, and slowly merged into what is now the Internet.

The Internet is probably the most important invention of the Digital Age. It has changed the way people live quickly and drastically; but everything has a downside. The problem with being too connected to everything is that you are exposed to both the good computers and the bad ones. Aside from the typical virus and hacking attacks we hear of everyday, the Internet has been used as a weapon between conflicting nations.

One of the most dangerous attacks used in cyberspace is the Distributed Denial of Service Attack (DDoS). A hacker uses multiple computers—sometimes by taking control of them through a virus—to flood a target on the Internet with connection requests. This target becomes overwhelmed by the flood of requests from multiple sources that it is crippled. If it is running a website or some other kind of service, it will fail to provide it.

In 2007, Russia got into a dispute with Estonia, a previous ally. Estonian Government workers relocated a statue of a World War II Soviet soldier, which upset Russia. In response, a Russian hacker orchestrated a massive DDoS attack on Estonia's Internet. Being a country that recognizes Internet access as a basic human right and heavily relies on it, it was deeply affected.

The United States and Iran, on the other hand, are most probably involved in a fierce cyber battle that is predicted to evolve into the world's first cyber war. After Iran discovered a virus called Stuxnet that spread heavily throughout the country, and after it was realized that this virus was designed in a very specific manner as to attack the type of computers that exist in Iran's nuclear facility yet be inert on other computers, it has—speculatively—been strongly striking back. Analysts and experts agree, but cannot prove, that Israel and the US are behind Stuxnet; on the other hand, a rise in strong DDoS attacks against United States services is being attributed to Iran.

War is just a part of life; not a favorable part, but it is there, and it probably will never cease to be. Instead of feeling sorry for humanity and its nature, we should try to get the best out of it. Is it not a good kind of irony that the outcome of most recent wars was peace treaties, newfound democracies and technological achievement that has taken mankind to its most developed state?

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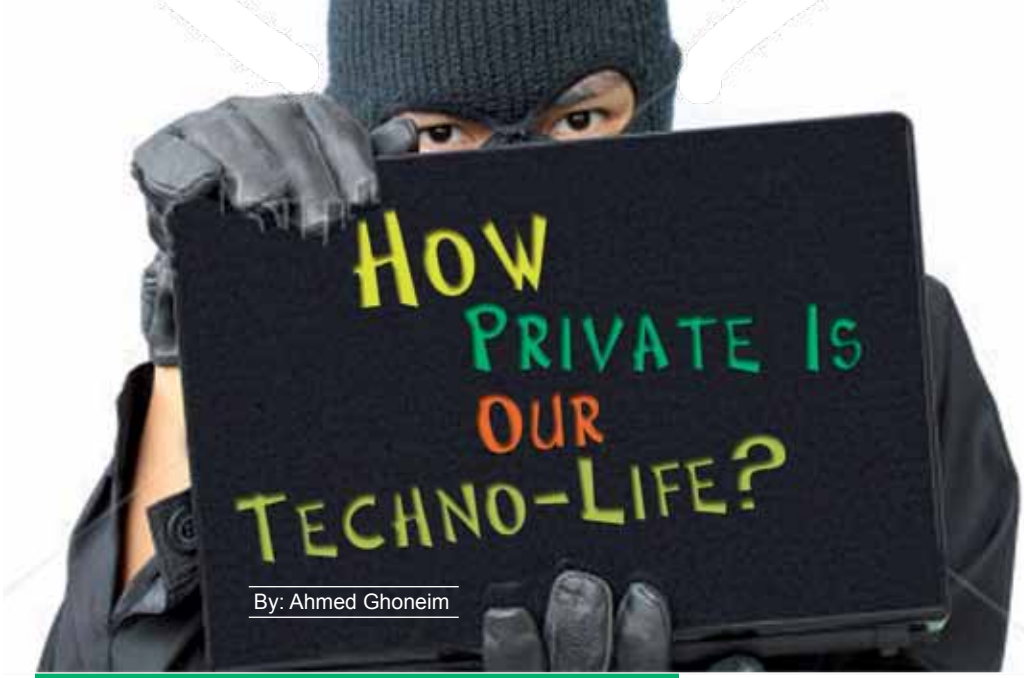

How Private Is Our Techno-Life?

By: Ahmed Ghoneim

Imagine getting arrested for hacking, even if it was not you who did the hacking, but your computer! If you were writing an article that exposes your local government or a bad employer, are you sure they would not be able to tell every key you press? Would you feel safe if your mobile phone's camera flash suddenly went off behind your back? What would your reaction be if a housefly suddenly started to act too suspicious?

Spying through Walls

In 1985, Dutch computer researcher, Wim Van Eck, published a paper that detailed how easy electronic devices can be eavesdropped on, even non-communication devices.

The fact is that wherever electricity flows, electromagnetic radiation mimicking the electric signals is emitted. This radiation is not intentional, and can be emanated as a by-product of a computer screen showing images or a USB cable transferring data. With the right equipment, any unshielded device can be eavesdropped on. If you are reading this article on your computer in a closed room, someone sitting outside your house may be able to read it with you too!

Van Eck's shocking paper led to the birth of radiation intelligence, which uses these emanations to the advantage of spies. Since most intelligence agencies do not reveal their secrets, though, we can never be sure whether or not this is really happening.

Recently, it was revealed by the security and cryptography lab in a Swiss technology institute that all types of keyboards—be they wired or wireless—can be very easily eavesdropped on. Using a computer program and a 1-meter-cable acting as an antenna, they were able to record every single key pressed on a distant keyboard.

Spying in Cyberspace

With the exploding popularity of the Internet since the mid-1990s, computer hacking became commonplace. A well-known type of program, the Trojan, was named after the famous Greek Trojan horse legend. It can spy on your computer through the Internet, meaning it can send what it finds out back to a hacker who may be anywhere around the world. It can track key presses and viewed pages, and even steal or damage files on your computer; it can take complete control of your computer and use it to hack more computers, driving attention away from the original hacker.

The fact that a Trojan can do all this to a computer is very scary. Luckily enough, security software can detect and remove a lot of these threats. What if the Trojan was already on your computer when you bought it, before you even install an antivirus? That is what Microsoft employees have discovered in some laptops sold in China. Those laptops came with a non-genuine copy of the Windows operating system installed on them. In some cases, the copies had a Trojan called Nitol injected into them. Aside from the other threats of a Trojan, Nitol could also spy on users' webcams without them knowing!

A Spy with You Everywhere

Now you must think you have heard the worst; you would be surprised by the vulnerability of the new kid on the block: the Smartphone. Every Smartphone out there also has a camera; opportunists have not overlooked that fact.

US military experts have developed an application called Plaice Raider that quietly spies on your phone. The unwitting phone owner could be providing the app creator with photos so clear that they reveal full bank account numbers, and can be used to construct a 3D model of the room the phone is in.

The app was designed to be smart enough to even discard pictures it takes that are too blurry or dark to be useful. Now the US Military have said that their purpose of making this program was demonstrating it as a proof of concept, is it?

Spy Fly

Most of us hate flying insects; with the exception of butterflies, they are disgusting and keep coming back. After reading this, you may add fear to your feelings towards them.

Our story, much like most stories of strange, yet wondrous technologies starts at DARPA (Defense Advanced Research Projects Agency). Commissioned by DARPA as part of an ongoing project to achieve the smallest-size reconnaissance drone, researchers at the University of California, Berkeley, have done something that is worthy of a fantastical spy novel.

In 2009, they successfully remotely controlled a flying beetle electronically, using a very small battery-powered radio microcontroller. The device, equipped with neural and muscular stimulators, was signaled to order the beetle to go up and down by stimulating the part in its brain that controls wing oscillation. This was through the neural stimulators, and the brain did the rest. To make the beetle turn, though, they directly controlled the muscles that moved the beetle left and right through the muscular stimulators.

As if the beetle was not small enough, DARPA came up with an even smaller solution. In 2012, they were able to control a moth; this time, they were able to actually mimic the nerves inside the moths by inserting probes coated with carbon nanotubes and gold, which matched the moth nerves' electrical properties.

The implications of such developments are pretty obvious: easier spying. What would the next step be? Micro-cameras attached to the insects, perhaps? Scientists working on the moth were even reported as asking neurobiologists for advice on trying this out on humans.

As it turns out, our increasingly high-tech lives have the potential to be not so private. Spy movies we grew up watching and loving, yet convinced ourselves were only fiction, are getting closer and closer to reality. Modern technology has successfully blurred the divide between science fiction and real life. The only thing we can do now is get ready to be amazed.

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By: Sally Gad

Communication CONNECTIN

The Internet is a unique interactive mass medium of communication that single-handedly combines features and services formerly provided exclusively by the telephone, the telegraph, books, newspapers, radio and/or television.

Although some welcome the Internet as an ultimate solution to everything, others fear its curse. Through this groundbreaking medium, and its related technologies, content and advertising can reach billions of people instantaneously and simultaneously, which for the most part has transformed almost every aspect of our way of life—private, social, cultural, economic and political—to the better. More importantly, they seem as if together they will be as universal and prevalent as electricity.

Nevertheless, it has been criticized of causing addiction among users who spend hours each day "surfing"; hours during which they are away from their family and friends, which can ultimately result in depression and isolation, and further weakening of neighborhood and community ties.

The truth of the matter is that the Internet is the latest in a series of life-altering technological advances that have changed the world in fundamental ways. It could thus be enlightening to review how people initially reacted to and then made use of earlier technological breakthroughs.

In doing so, we realize that each new technological advance in communications over the past 200 years—the telegraph, telephone, radio, motion pictures, television, and most recently the Internet—was met at the beginning with concerns about its potential to weaken community ties.

To begin with, the telegraph had a profound effect on life in the 19th century. Thanks to Samuel Morse's telegraph, a message from London to New York could be sent and received in just minutes, and people could learn of events in distant parts of the world within hours or days instead of weeks or months.

The connection of Europe and America, in 1858, through the transatlantic cable was hailed as "the event of the century" and was met with incredible fanfare. Books proclaimed that soon the entire globe would be wired together and that this would create world peace. According to one newspaper editorial, "It is impossible that old prejudices and hostilities should longer exist, while such an instrument has been created for the exchange of thought between all the nations of the Earth".

On the other hand, governments feared the potential of such immediate communication between individual citizens. Tsar Nicholas I of Russia, for example, banned the telegraph as an "instrument of subversion". Similar raptures and fears have often been expressed, in our time, about the Internet as well.

The closest parallel to today's Internet users were the telegraph operators, an "online" community numbering in the thousands who spent their working lives communicating with each other over the wires, but who rarely met face to face. Many of these working relationships blossomed into romances and even marriages.

Later, the telephone, invented accidentally by Alexander Bell in the 1880s while working on a multichannel telegraph, transformed the telegraph into a point-to-point communication device anyone could use, not only a handful of trained operators working in code.

The effect was to increase regular contact between family, friends, and business associates, especially those who lived far away to be visited easily in person, and this had the overall effect of strengthening local ties. Nevertheless, concerns continued to be raised that the telephone would harm the family, hurt relationships, and isolate people. Magazines of the time featured articles such as "Does the telephone break up home life and the practice of visiting friends?"

The radio, on the other hand, freed communication from the restriction of hard-wired connections, and was especially valuable where wires could not go, such as for ship-to-shore and ship-to-ship communication.

However, its broadcast capability of reaching many people at once was a frightening prospect for governments of the time. When Marconi got off the ship in England to demonstrate his new invention to the British, customs officials smashed his prototype radio as soon as he crossed the border, "fearing that it would inspire violence and revolution".

Eventually, however, radio brought the world into everyone's living room and so eliminated distance as a factor in news dissemination like never before. Indeed, it did soon prove to be a powerful propaganda tool for dictators and democratically elected leaders alike.

The television had the greatest actual, as opposed to feared, impact on community life, because individuals and families could stay at home for their evening entertainment instead of going to the theater or social club.

Sociologist Robert Putnam documented the dramatic decrease in community involvement since the introduction of television in the 1950s. This negative effect of television has been the basis for contemporary worries that Internet use might displace time formerly spent with family and friends.

The Internet combines, for the first time in history, many of these breakthrough features in a single communication medium. Like the telegraph and telephone, it can be used for person-to-person communication; like radio and television, it can operate as a mass medium; moreover, it can serve as a fabulous global library as well.

The variety of functions that the Internet can serve for the individual user makes it "unprecedentedly malleable" to the user's current needs and purposes. However, the Internet has other critical differences from previously available communication media and settings; two of these differences have been the focus of most psychological and human-computer interaction research on the Internet.

First, it is possible to be relatively anonymous on the Internet, especially when participating in chat rooms or newsgroups. This turns out to have important consequences for relationship development and group participation.

Second, Computer-Mediated Communication (CMC) is not conducted face-to-face but in the

Technology: G PEOPLE?

absence of nonverbal features of communication such as tone of voice, facial expressions, and influential interpersonal features such as physical attractiveness, skin color, gender, and so on. The absence of these features affects the process and outcome of social interactions.

The Internet does not make its users depressed or lonely, and it does not seem to be a threat to community life; quite the opposite, in fact. If anything, the Internet, mainly through e-mail, has facilitated communication and thus close ties between family and friends, especially those too far away to visit in person on a regular basis.

The Internet can be fertile territory for the information of new relationships as well, especially those based on shared values and interests, as opposed to attractiveness and physical appearance as is the norm in the off-line world. In any event, when these Internet-formed relationships get close enough, people tend to bring them into their "real world"; that is, the traditional face-to-face and telephone interaction sphere. This means nearly all of the typical person's close friends will be in touch with them in "real life" on the phone or in person, and not so much over the Internet, which is misleading to the media stereotype of the Internet as drawing people away from their "real life" friends.

With high-speed computing and encryption technology, the Internet already plays a significant role in crime and terrorism by enabling private communication across any distance without being detected. To that end, we quite rightly have been warned that repressive regimes may harness the Internet and all of the databanks that connect to it to increase their power over the

population. A step in this direction called for the technology to monitor the content of Internet traffic to be built into the Internet's very infrastructure.

In conclusion, people are not passively affected by technology, but actively shape its use and influence. The Internet has unique, even transformational qualities as a communication channel, including relative anonymity and the ability to easily link with others who have similar interests, values, and beliefs. Research has found that the relative anonymity aspect encourages self-expression, and the relative absence of physical and nonverbal interaction cues facilitates the information of relationships on deeper bases.

At the same time, however, these "limited bandwidth" features of Internet communication also tend to leave a lot unsaid and unspecified, and open to inference and interpretation. Not surprisingly, then, one's own desires and goals regarding the people with whom one interacts have been found to make a dramatic difference in the assumptions and attributions one makes within that informational void.

By: Shahenda Ayman

The Invasion of the Smartphone

In this age of cutting-edge communication technology, who does not aspire to own a Smartphone? Our society was introduced to the Smartphone several years ago; however, over the last couple of years, it has become "indispensable", in many cases rather "addictive", to a large portion of the population, including myself.

The Smartphone makes life much easier indeed. One no longer has to sit in front of the computer for hours to follow up on one's work, check one's emails and answer them, perform financial transactions, learn the latest news, read a book, watch videos, or even play. Now, it is all in our pocket.

As a matter of fact, Smartphones can now act as a remote control for almost every aspect of our lives. To name a few examples, soon we will no longer have to go to doctors to monitor our health, or hire guards to protect our homes, among several more applications under development that can make life even much easier.

At the International Consumer Electronics Show*, dozens of companies showed off home accessories that work with Smartphones; many also displayed wearable devices that can help people monitor their health through their phones. Some of these products are provided by large companies, such as AT&T, that said in March it would begin selling a wireless security system called Digital Life that will allow people to use tablets or phones to monitor and control locks, alarms, security cameras, lights, thermostats, and even coffee pots in their homes through a mobile application.

Other products, by several other companies, take advantage of a Smartphone's sensors and connection to the Internet to monitor consumer health. iHealth is a device that enables people to track their blood pressure with an application. At the Electronics Show, a wireless glucose meter was introduced, the Smart Glucometer, which allows diabetics to check their blood sugar levels. A user puts a blood sample on a test strip, pops it into an accessory attached to a Smartphone, and an application gives a reading of the blood sugar level.

Not Smart Enough?

Despite all these positive and amazing new features and options that Smartphones provide us, with the rapid increase in Smartphone users, Smartphone addiction is becoming a new worrisome problem. Noticing the rapidly increasing number of people walking in the streets, sometimes even those driving, with their heads downwards, Smartphone in hand, and feeling my own inclination to do so myself, I decided to write about this bewildering aspect of technology.

These "addicts", including myself, glance up occasionally to make sure that they are not going to crash into someone or something, then they return to their phones to continue surfing, texting, chatting with friends, tweeting, or posting on Facebook as they walk. Attached to my Smartphone, frequently and involuntarily checking it, despite being part of this scene, it is an alarming one, simply because it can very easily lead to dangerous accidents as a result of lack of concentration.

Moreover, although Smartphones satisfy social communication needs to an extent, if you watch a group of people hanging out together, you will notice that there is complete lack of face-to-face communication; each one is looking downwards at their phones, not at their company, some of them even chatting or commenting online with someone sitting right next to them!

Even our family ties are affected. Family members can be sitting together in the living room or around a table having dinner, and the children would have their Smartphones in hand communicating with their friends, playing games, or simply browsing. When Moms and Dads try to talk to them, all the answers they get are "Umm", "Yes", or "No"; they often do not listen to what their parents say.

Libraries and bookshops are also losing their visitors because of Smartphones, which have built-in dictionaries and instant access to the Internet to search for any meaning, in any language. Books and newspapers are also accessed and downloaded through these phones so there is no need to go to the library or to a bookstore to read a book. People are thus losing interest in anything made of paper, and are replacing it with Smartphones and tablets.

In addition to all this, Smartphones are affecting our health. Smartphone users are prone to complaining of pain in the arms, shoulders and neck, leading to stiff muscles, which are not always ready for this excessive type of work. Moreover, staring at your phone at a short distance for a long period of time may lead to eyestrain and headache.

Rather than being a sign of development, Smartphones are proving that we might not be ready yet for this kind of technology. Although they are designed to make our life easier, the way we handle these devices can potentially ruin our personal and social lives. Too much time is consumed doing nothing other than staring at the phone rather than doing something useful, or even having a normal conversation with friends and family.

Nevertheless, despite their somehow negative impact on our life, we cannot deny the fact that these devices bring the world to our fingertips; they are highly beneficial and time-saving, if they are used for the purposes they were intended to. Start with yourself: do not be addicted to it; use your Smartphone smartly.

Glossary

***International Consumer Electronics Show** is a show that began in New York in 1967, and is now put on every January in Las Vegas by the Consumer Electronics Association.

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Warning from WALL·E

By: Shahenda Ayman

I have not been a fan of animation movies simply because I am not really into science fiction, fairy tales, or mythical legends; it was my editor who advised me to watch "WALL-E", assuring me I would be inspired, betting me I would change my mind.

At the beginning of the 2008 computer-animated romantic science fiction movie, I had the feeling I would not like it at all because most of the first half of the movie is sort of a silent movie. After a while, however, I found myself engrossed in an unusual love story embedded with so many significant messages, bringing tears to my eyes.

A cautionary tale that takes place several hundred years in the future, "WALL-E" reflects how, if misused, technology can ruin our life instead of improving it. The movie features a robot, WALL-E—Waste Allocation Load Lifter-Earth—created by "Buy-N-Large Corporation", which has transferred all human beings from Earth to a spaceship called Axiom, leaving WALL-E alone to clean the waste and garbage humans left behind.

On the spaceship Axiom, a large army of robots serve the people who have turned into extremely fat, lazy, and useless creatures. All they do is sit on their hover-chairs, drinking their food through a straw as automation has cancelled their need to walk or even reach across a table for food.

Back on Earth, the lonely robot WALL-E spends his time collecting trash, compressing it into cubes and building towers using them. He collects things he finds interesting from the trash and keeps them in his home. One day, EVE—Extraterrestrial Vegetation Evaluator—a much more advanced robot arrives on Earth to detect any sign of life on Earth, which would signal the possibility for the Axiom passengers to return back.

Finding company at long last, WALL-E "falls in love" with EVE, who finds a seedling in WALL-E's home, at which point she completely pauses until she is brought back to Axiom. Lovesick and stricken, WALL-E follows her to the spaceship.

Although WALL-E's only aim on Axiom is to find his beloved EVE, in his quest to find her, he meets various robots, each with their own specific job, all related to cleaning up. It is apparent that human consumption is what has trashed Earth, and is now polluting outer space as well.

Despite being tiny and relegated to the dirtiest of the dirty jobs, WALL-E begins to show Axiom habitants how to regain what they have lost through sloth and over reliance on technology.

The movie reflects the downside of technology. From calculators to computers; and now laptops, tablets, and Smartphones, technology can be a motivator for laziness and isolation. People spend hours with high-tech equipment rather than with other people; they use machines rather than their bodies and brains to move from one place to another, to find information, and even to think.

Even children stay home and spend a lot of time playing video games rather than having a normal childhood, spending time playing in parks, coloring, or playing board games that stimulate their mental abilities and skills.

Nowadays, you can speak to your car and ask it to park by itself. There are smart televisions that interact with you and turn off when you fall asleep. All these technologies seem fabulous, but if you think for a while you will find that they make people dependent on them, becoming lazy even to do the smallest things like turning off the television.

There is no doubt that technology takes us to a new phase of life; however, relying too much on technology may cause drastic consequences to our life and our planet. Technology offers comfort to human beings, but that comfort is not always something good as they might someday become Axiom habitants!

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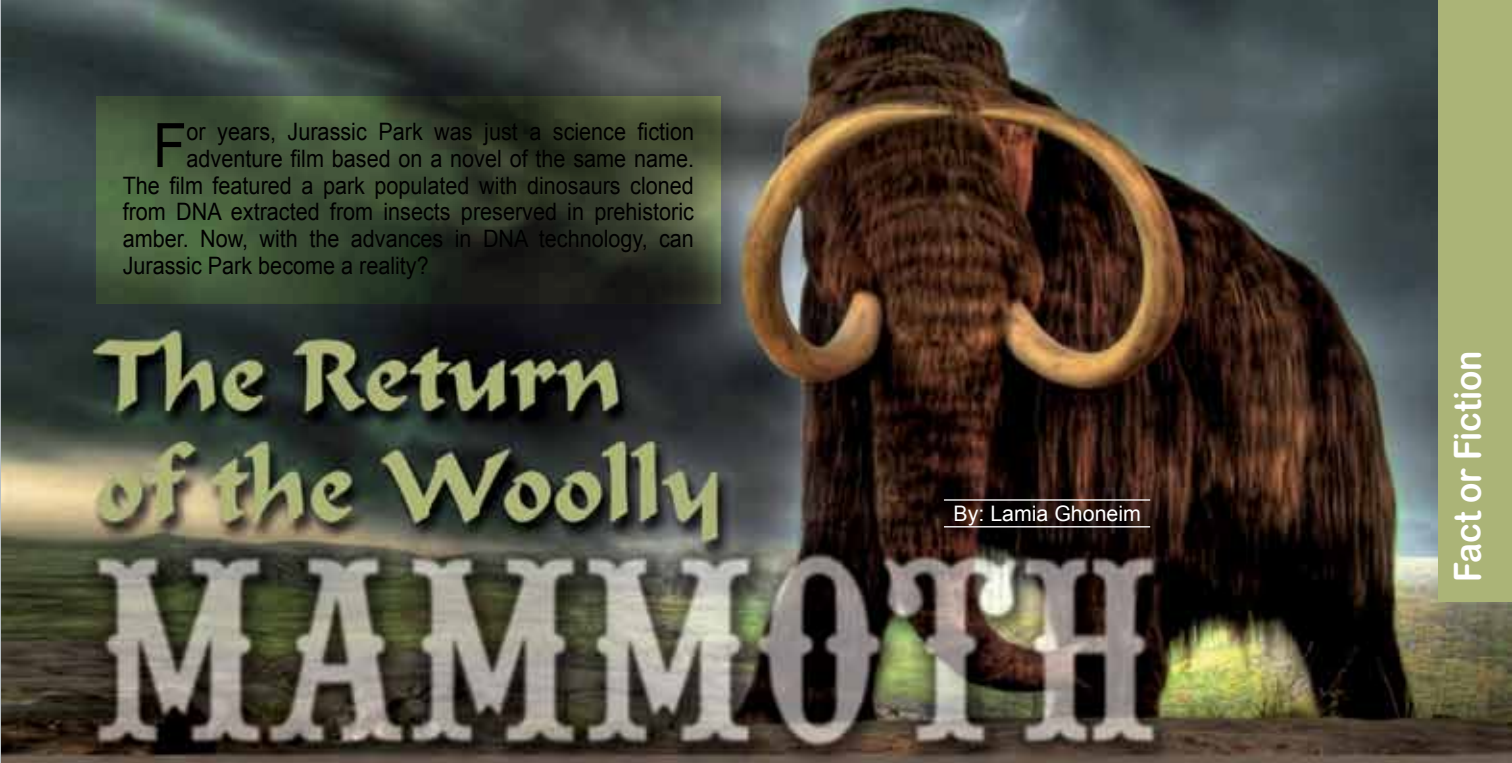

For years, Jurassic Park was just a science fiction adventure film based on a novel of the same name. The film featured a park populated with dinosaurs cloned from DNA extracted from insects preserved in prehistoric amber. Now, with the advances in DNA technology, can Jurassic Park become a reality?

The Return of the Woolly MAMMOTH

By: Lamia Ghoneim

Scientists claim that the dream of resurrecting extinct animals, the likes of the woolly mammoth, may very likely come true in a few years. Even though these giant beasts have been extinct for millennia, dozens of their carcasses, preserved in the frozen Arctic wilderness, have been found in an extremely good condition. Scientists have used these remains to discover much about how these animals lived and died; they also discovered the sequence of their genome. Can they also use these remains to bring the beast back to life? Will the woolly mammoth walk the Earth again?

Cloning a Frozen Mouse

According to the scientists, finding the right samples is the only hurdle, since the technology to extract and clone the nucleus of a cell from a frozen animal already exists, thanks to a Japanese mouse cloning experiment back in 2008.

Using cells from dead mice frozen for 16 years, a team of geneticists in Japan managed to successfully create healthy clones of the dead animals. Before then, scientists were not able to clone using cells from a frozen animal because there are no living cells available in frozen animals, as ice crystals puncture the dead cells and they are no longer intact.

Since previous cloning methods relied on fusion between a cell from the donor and the egg cell into which the genetic material was inserted, the cell membranes needed to be intact and the cells needed to be alive. The Japanese scientists, on the other hand, managed to devise a cloning method that does not require intact or live cells from the animal being cloned.

Instead of fusing two cells, they took nuclei out of the frozen cells from the mouse's brain and injected them directly into an enucleated egg—an egg with the nucleus removed. The researchers found that a frozen brain has more intact nuclei than other frozen tissues, since it contains large quantities of glucose known to decrease the damaging effects of freezing on the cells.

Injecting a nucleus from a recently frozen mouse into an enucleated mouse egg worked very well, but it failed for a mouse that had been frozen for 16 years. The researchers needed to adjust the protocol once more to be able to successfully clone mice frozen for extended periods of time.

Instead of transferring each embryo into a mouse's oviduct, the researchers extracted the inner cell mass from each embryo and generated lines of embryonic stem cells*. The researchers created 46 such lines, from which they were able to produce 13 mouse pups. Embryonic stem cells are pluripotent—capable of becoming many other types of cells. The scientists then transferred the nuclei from these cells into mouse eggs to produce the healthy mouse pups.

While cloning a mammoth from cells that have been frozen for thousands of years would definitely be more difficult than cells which have been frozen for just 16 years, this experiment has proven that it is achievable; we just have to wait for the right sample.

Cloning a Woolly Mammoth

Tens of thousands of years ago, back when the world was being overrun by glaciers during the last ice age known to mankind; woolly mammoths roamed the Earth freely, walking their way through the tundra's of Asia, Europe, and North America. With their huge elephant-like body, their thick coat of dark dense fur, and their long curved tusks, these ice age mammals must have been a daunting sight to humans who hunted them regularly for their meat and bones.

Armed with new reproductive biology and genome engineering technologies, a group of scientists from Japan, Russia, and South Korea announced their plans to clone a woolly mammoth from its frozen cells.

Unlike dinosaurs, which disappeared around 65 million years ago, and whose remains exist only as fossils, mammoth remains may still retain usable tissue samples. Nevertheless, finding well-preserved tissue with an undamaged gene has proven to be a real challenge, which is why attempts to clone the mammoth have frequently failed in the past.

However, it seems that this challenge could soon be overcome, as recent expeditions in Siberian permafrost have uncovered well-preserved remains of several woolly mammoths, including fur, and bone marrow, with high chances of containing the cells needed for the cloning procedure to be successful.

Since the elephant is the closest modern relative of the mammoth, the scientists plan to replace the nuclei of elephant egg cells with those of a mammoth, producing embryos with mammoth DNA. Those embryos will then be planted into the wombs of elephants, hoping that they will eventually give birth to baby mammoths.

Even as the scientists admit that the scale of the mammoth cloning project is elephantine and the risks yet unknown, they are convinced that soon, if all goes according to plan, a live mammoth will once again roam the Earth.

The fact that something is achievable does not always mean that we should attempt to achieve it since the risks of cloning a mammoth or any other extinct animal may outweigh its benefits. Aside from the controversy of performing a procedure that may be considered as tampering with Mother Nature, there is the question of the possibility of contamination of the frozen remains of such extinct species, which could expose us to infectious diseases not known.

On the other hand, it is only fair to point out that the production of a successful mammoth clone could open the door to recreating other extinct animals, and more importantly saving other endangered species from dying out, thus maintaining Earth's biodiversity and ecological balance.

Glossary

***Embryonic stem cells:** are stem cells derived from the undifferentiated inner mass cells of a human embryo. Embryonic stem cells are pluripotent, meaning they can develop into each of the more than 200 cell types of the adult body as long as they are specified to do so.

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By: Lamia Ghoneim

The Dawn of the ROBOTS

The Robots are coming. In fact, they are already here; mowing lawns, driving cars, vacuuming floors, and feeding hospital patients. Scientists say the next decade is expected to see a much more advanced creation, one that is much closer to the humanoid robot we have all been waiting for since "Robocop" and the "Bicentennial Man".

The creation of the "artificial human" has long been the ultimate dream shared by scientists and science fictionists alike; yet, the realization of this dream has always remained about 20 years in the future, and that future never seemed to arrive.

However, scientists are now promising that things are about to change, and that the technology we have pined for since the 1990s, is finally showing signs of making its way into our everyday lives.

The Inception of "Robota"

Ever since the Czech writer Karel Èapek first coined the term "robot" in his play "Rossum's Universal Robots" in 1921, there has been an expectation that robots would someday relieve us from the labor of hard work. The word, from the Czech "robota" meaning hard labor and servitude, described human-like machines made to replace workers, and used as slaves.

Over the decades though, the term robots extended to refer to many machines that perform tasks repeatedly and efficiently, machines that do not necessarily resemble humans except in their ability to do humans' work.

While we were still thinking of robots as something out of the movie "Transformers", and envisioning a future where they are living among us, they have already been slowly and steadily invading our lives, albeit in a bit different form than the humanoid form we were expecting.

Today, millions of household and industrial robots are operating worldwide; futurologists are predicting their sales to skyrocket within the next decade. While the majority of industrial robots are used for tasks that are simply too monotonous for humans as in automated production lines, some are used to perform vital tasks that require great levels of precision such as robotic surgeries, or to do jobs that are hazardous to people, such as exploring shipwrecks, helping out after disasters, studying other planets and defusing bombs or mines, and other military operations.

Yet, despite the usefulness and necessity of industrial robots, the real interest of the public—since we first laid eyes on "Rosie", the humanoid robotic maid from the 1960s animated television series the "Jetsons"—has always been the domestic robot.

The Invasion of "Roomba"

Despite the longevity of the robot concept, robotic butlers that roam our homes and relieve us from housework still seemed far from reality until very recently. Through a combination of increased computing power and advances made in the field of artificial intelligence, the newly-developed software is now smart enough to make robots considerably more useful around the house.

Readily available in stores now are robots that can vacuum your carpets, mop your floors, mow your lawn, clean your pools, wipe your windows, clean your gutters and even iron your clothes. iRobot's "Roomba" is one of the most popular domestic robots that has been around for more than a decade now, selling more than 6 million units worldwide.

A disk-shaped vehicle equipped with sensors to avoid it falling down stairs or bumping into obstacles, Roomba can clean your entire house completely unassisted, including under and around furniture, and along wall edges, all with one touch of a button. It can be programmed to start cleaning at a particular time every day and thus can go about its work even when the owners are not at home, cleaning all types of surfaces and even going back to its dock to recharge on its own.

Roomba is not alone; there are many other available versions of robotic vacuum cleaners and mops, in addition to robotic lawn mowers that are growing more popular as they are becoming increasingly more efficient. They are now capable of automatically maintaining and grooming up to 20,000 m^2 of lands, are self-docking and some even contain rain sensors if necessary, nearly eliminating all need for human interaction.

Although they are impressive, those smart little robots still do not measure up to the domestic robot servants of science fiction—think what Andrew from "Bicentennial Man" can do. Fear not; the closest version of the domestic robot we have all been waiting for is finally here in a fashion.

The Arrival of HERB

A recent addition to the domestic robots family is a state-of-the-art robotic butler aptly named HERB (Home Exploring Robot Butler). Developed by the Personal

Robotics Lab at Carnegie Mellon University, HERB was created using unbelievably sophisticated hardware and operating algorithms, rendering it a far cry from the home cleaning robot Roomba, or any of the domestic models previously mentioned.

For starters, "he" is a humanoid robot on wheels guaranteed to remind us of Disney's lovable waste cleaning robot, WALL-E, and can, in fact, do many things that WALL-E can do including navigation, command recognition, and performing basic household tasks.

Armed with spinning lasers that produce 40,000 points per second data stream, HERB has a clear three-dimensional view of the environment. In other words, he can "see" the world around him, allowing him to smoothly navigate across your home, or any other unpredictable environment, without bumping into things or crashing any objects.

HERB rolls around on a "Segway" base and can fit through standard doorways, and can also find his way around by building virtual maps stored in memory. Thus, the longer HERB exists in a certain environment, the better the map gets, which means that HERB gets better at understanding where he is in relation to everything else.

HERB can understand orders through speech recognition, which also gets better the more he gets acquainted. When first brought into a new house for example, orders have to be spelt out clearly so that he can do what you exactly want him to do.

For example, to fetch a soda from the fridge, explicit instructions must be laid out instructing HERB where the kitchen is, where the fridge is, how to open it, recognize a soda, grasp it and return. After just a few weeks living in a new home, HERB can fetch a soda by being asked to do so in one sentence.

Similarly, HERB can be taught to perform many basic tasks, and his knowledge base just keeps on growing. As an example, the researchers "taught" HERB how to operate a standard microwave oven recently, and now, HERB can heat lunch with just a couple of words in request, including oven settings.

HERB is not alone; another almost equally impressive domestic robot is the Personal Robot 2, or PR2 to its friends, sold by Willow Garage in Menlo Park, California. PR2 can do all sorts of useful stuff around the house; he can fold laundry, walk and pick up after dogs, even cook a complete breakfast.

So what is stopping us from getting our own personal domestic robotic servant that can fulfill our every whim?

Their price, for one thing is a major drawback, with PR2 priced at USD 400,000 and sold purely for research, and HERB not yet marketed but likely to be sold at a similar price. Moreover, although these robots are an amazing advancement, they are still research robots with many shortcomings. They require tightly controlled conditions and may produce uneven results; even simple tasks such as folding towels can prove to be challenging for them. That is besides the fact that they do not have "legs", and cannot walk but rather move as a vehicle, which makes actions such as climbing stairs impossible for them.

The Rise of ASIMO

Away from the robotic butler's arena, there are many stories of successful bipedal and humanoid walking robots that can certainly walk the walk and are much more advanced than the ones developed purely for domestic use.

Meet Honda's ASIMO, likely the world's most advanced humanoid robot to date. At 130 cm tall and 54 kg, ASIMO is certainly small but can do incredibly big things; his highly advanced capabilities seem straight out of a science fiction movie, and in fact, he already has his own live show in Disneyland!

ASIMO—an acronym for Advanced Step in Innovative Mobility—was designed to operate in real-world environments, with the ability to walk forward and backward,

or run on two feet at speeds up to 6 kilometers per hour, climb up and down the stairs, and even dance. He can also adjust the length of his steps, body position, speed, and the direction in which he is stepping. ASIMO has arms and hands that can do things like turn on light switches, open doors, carry objects, and push carts.

Honda engineers created ASIMO with 34 Degrees of Freedom—the ability to move right and left, or up and down—that help it walk and perform tasks much like a human. These Degrees of Freedom act much like human joints for optimum movement and flexibility. Lightweight materials, like a magnesium alloy structure, combined with powerful computers and 34 servo motors throughout its body help ASIMO move smoothly.

Advanced mobility is not its only merit; it can also understand gestures and spoken commands, as well as recognize voices and faces, which basically enable it to interact with humans. With a new technology developed by Honda for advanced intelligence, ASIMO can now simultaneously use visual, auditory, and tactile sensory input to assess its environment.

If multiple people are present in a room, ASIMO's voice recognition can parse their voices and identify each one. If a person is walking, it will predict where the person will be within the next few seconds, and if it needs to, quickly change its path to avoid a collision. Tactile sensors on ASIMO's fingers and a force center in its palm give the hand delicate feedback that is used to control the fingers independently. These sensors are combined with object recognition to pour the contents of the bottle into the cup, not the other way around.

Naturally, ASIMO can keep himself going all day and night with autonomous battery charging, seeking the closest electrical charging outlet. Moreover, if there is more than one ASIMO robot around, they will constantly share relevant data between each other; a survey of which robot is closest to the most pressing task, and what its battery life status is, allows them to "decide" which one is best suited to go in and do the job.

ASIMO is designed to operate in the real world, where people need to reach for things, pick things up, navigate along floors, sidewalks, and even climb stairs. ASIMO's ability to run, walk smoothly, climb stairs, communicate, and recognize people's voices and faces will enable him to easily function in our world and to truly assist us humans.

Unfortunately for us though, ASIMO currently retails for USD 1,000,000, which makes him unaffordable for most people, to say the least. However, judging from the popularity and the amount of research carried out on humanoid robots, along with the continuous advances in science and technology, the production cost is bound to drop in the near future, or so we are hoping.

The question remains: Have scientists finally created the humanoid robot we have all been waiting for? In other words, have scientists finally caught up with science fiction and created a robot that can measure up to our favorite Sci-fi-movie robots?

The answer is still up for debate. Until we can afford the robots, the question is likely to remain unanswered.

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THE NANO-TECH LIFESTYLE

By: Maissa Azab

Truth be said, nanotechnology is not really a science communicator's favorite subject given its seeming scientific complexity. I admit finding the challenge of trying to communicate how extremely important and valuable nanotechnology really is to our life and future quite daunting. However, it is definitely essential to tackle this challenge fearlessly and fiercely because nanotechnology is truly a "magical" science that can transform many, if not all, aspects of our life, dramatically and forever, altering its shape and quality.

Knowing that, nanotechnology has always popped up in our issues, starting with the very second installment of the PSC Newsletter published in January 2010. In that issue, my esteemed colleague, Ingy Hafez, discussed the then ongoing debate "Nanotechnology: Friend or Foe?" Evidently, it seems that not so many people still think nanotechnology a potential threat; not unintentionally anyway.

It is true what Dr. Mona Bakr, Associate Professor at the National Institute of Laser Enhanced Science (Cairo University), Adjunct Faculty at the Egyptian-Japan University for Science and Technology (E-JUST), and CEO of NanoTech Egypt for Photoelectronic (R&D Company-Bahgat Group), told my colleague at the time. A knife is an indispensable tool of everyday life; it can be applied for all sorts of highly useful purposes, making our lives so much easier in so many ways, yet, it can also be used as a weapon. Do we bar knives from our lives then? Or do we just use them carefully?

Every now and then, we have discussed one aspect or another of how nanotechnology is being studied in a widely diverse range of fields, to be applied in one groundbreaking way or another. So what is new with nanotechnology? How can it make our lives so much different; in a good way that is? Let us have a peak at how nanotechnology can potentially transform the quality of our life and wellbeing.

Investigating the Cloak

Nanoparticles have dimensions of less than 100 nanometres. They are of scientific interest because, at this scale, materials engage with cells and organisms in a completely new way, explains Professor Kenneth Dawson, Director of the Center for NanoBioInteractions at University College Dublin (UCD).

"You can cross biological barriers that you could not normally cross, and deliver nanoparticles into organs you could not usually access," Prof. Dawson elaborates. "But, for that very same reason, we also address the safety question because particles can accumulate in high concentrations in tissues where they would not normally go". This understanding will support the safe implementation of nanotechnology, as well as its effective application in drug delivery and therapeutics.

Prof. Dawson and his colleagues have made important insights into what happens when a "bare" nanoparticle gets into a new environment; whether it is a living organism or a milieu such as a river. They have shown that nanoparticles draw down molecules onto their surfaces to form a cloak known as a "corona"; it is this corona of proteins and fats that ultimately interacts with the body rather than the nanoparticle material itself.

"Nanoparticles cloak themselves in quite different ways than previous larger particles or drug molecules, meaning they can acquire almost the full range of biological activities that proteins can," says Professor Dawson. "[And] whatever is adsorbed onto the nanoparticle becomes its address label; that influences how the nanoparticle will function in the body."

Prof. Dawson and his team have been developing tools to analyze the patchwork of molecules that make up the corona under different experimental circumstances. "Now, we know where we are going. It is time to see if we can overcome some of the barriers to making practical advances".

Biosensing Breakthrough

In December 2012, having made it possible, for the first time, to detect the smallest virus particle, a research team at New York City College of Technology (City Tech) made a breakthrough with enormous potential significance for the treatment of serious diseases, since even one viral particle can represent a deadly threat.

Up until this discovery, no instrument or methodology had been successful in reliably and accurately detecting a single virus particle, which is in the size range of a nanoparticle; about 80,000 nanoparticles side by side would have the same width as a human hair.

The research will potentially have an immense impact, aiding disease detection at its earliest stage when fewer pathogens are present and medical intervention can be most effective. This new approach also has possible applications in the identification of numerous molecules, especially proteins, which are important for drug development research, both as targets and treatments.

While scientists have long used microscopes to view objects as small as bacteria, viruses are much smaller. Even the most sensitive electron microscopes, which are cumbersome, expensive and difficult to operate, cannot guarantee detection of these tiny particles.

The team's breakthrough involved adding a nano-antenna to the light-sensing device to enhance the signal. "The idea that light can 'sense' the presence of nanoparticles and respond to their arrival was groundbreaking," said Dr. Vasily Kolchenko, Associate Professor of Biological Sciences.

"Since all the deadliest viruses and most interesting biological molecules—proteins and DNA—belong to the nano world, our research proved truly innovative, and its promise is almost unlimited in terms of detecting pretty much everything of interest in life sciences," he added.

"One of the ultimate goals is to develop portable, inexpensive, easy to use and highly sensitive devices for healthcare and research settings," stated Dr. Kolchenko. "This research opens the door for highly sensitive detection and measurement of biological and other nanoparticles that are essential in

molecular biology, clinical medicine and diagnostics, epidemiology, ecology, nanotechnology and other fields".

Further research is planned, according to Dr. Kolchenko. "Since single protein molecules are much smaller than viral particles, their detection will be the ultimate test of the method," he says.

Catching Cancer Cells

Scientists from the RIKEN Advanced Science Institute in Japan and University of California Los Angeles report a new nanoscale Velcro-like device that captures and releases tumor cells that have broken away from primary tumors and are circulating in the bloodstream.

This new nanotechnology could be used for cancer diagnosis, and give insight into the mechanisms of how cancer spreads throughout the body. The device provides a convenient and non-invasive alternative to biopsy, the current method for diagnosis of metastatic cancer.

It could enable doctors to detect tumor cells that circulate in cancer patients' blood well before they subsequently colonize as tumors in other organs. The device also enables researchers to keep the tumor cells alive and subsequently study them.

Blood is passed through the device like a filter that contains a molecule capable of adhering to tumor cells like Velcro and separating them with efficiency ranging from 40% to 70%. The cancer cells are retained by tiny temperature-responsive polymer brushes inside the device, at 37°C, these polymer brushes stick to the tumor cells, but when cooled to 4°C, they release them, allowing scientists to examine the cells.

"Until now, most devices have demonstrated the ability to capture circulating tumor cells with high efficiency. However, it is equally important to release these captured cells, to preserve and study them in order to obtain insightful information about them. This is the big difference with our device," explains Hsiao-hua Yu, who led the team that developed the technique to coat the device with polymer brushes.

Maximizing Solar Power

Princeton researchers have found a simple and economic way to nearly triple the efficiency of organic solar cells; cheap and flexible plastic devices that many scientists believe could be the future of solar power.

The researchers, led by Electrical Engineer Stephen Chou, were able to increase the efficiency 175% by using a nanostructured "sandwich" of metal and plastic that collects and traps light. Chou said the technology also should increase the efficiency of conventional inorganic solar collectors, such as standard silicon solar panels.

Chou said the research team apploed nanotechnology to overcome two primary challenges that cause solar cells to lose energy: light reflecting from the cell, and the inability to fully capture light that enters the cell.

The sandwich, called a subwavelength plasmonic cavity, has an extraordinary ability to dampen reflection and trap light. The new technique allowed Chou's team to create a solar cell that only reflects about 4% of light and absorbs as much as 96%. It demonstrates 52% higher efficiency in converting light to electrical energy than a conventional solar cell.

That is for direct sunlight; the structure achieves even more efficiency for light that strikes the solar cell at large angles, which occurs on cloudy days or when the cell is not directly facing the Sun. By capturing these angled rays, the new structure boosts efficiency by an additional 81%, leading to the 175% total increase.

The physics behind the innovation is formidably complex; but the device structure, in concept, is fairly simple. The top layer, known as the window layer, of the new solar cell uses an incredibly fine metal mesh: the metal is 30 nanometers thick, and each hole is 175 nanometers in diameter and 25 nanometers apart.

The mesh window layer is placed very close to the bottom layer of the sandwich, the same metal film used in conventional solar cells. In between the two metal sheets is a thin strip of semiconducting material used in solar panels. It can be any type—silicon, plastic or gallium arsenide—although Chou's team used an 85-nanometer-thick plastic.

The solar cell's features—the spacing of the mesh, the thickness of the sandwich, the diameter of the holes—are all smaller than the wavelength of the light being collected. This is critical because light behaves in very unusual ways in sub-wavelength structures. Chou's team discovered that using these subwavelength structures allowed them to create a trap in which light enters, with almost no reflection, and does not exit. "It is like a black hole for light," Chou said, "it traps it".

The researchers said the solar cells can be manufactured cost-effectively in wallpaper-size sheets; Chou's lab used "nanoimprint", a low-cost nanofabrication technique Chou invented 16 years ago, which embosses nanostructures over a large area, like printing a newspaper.

Chou said that the development could have a number of applications depending on the type of solar collector. In this series of experiments, Chou worked with solar cells made from plastic, known as organic solar cells. Plastic is cheap and malleable and the technology has great promise, but it has been limited in commercial use because of organic solar cells' low efficiency.

In addition to a direct boost to the cells' efficiency, the new nanostructured metal film also replaces the current Indium-Tin-Oxide (ITO) electrode that is the most expensive part of most current organic solar cells.

Green Nano-Energy

Researchers at the University of Reading have patented a new method of producing electrode coatings with a thousand-fold increase in surface area compared with a flat electrode.

This larger surface means that conversion of fuel or sunlight into electricity can take place in a smaller, more compact cell, making the cells cheaper to produce. The chemical reaction to create the energy also takes place at room temperature allowing the cells to be fitted to cheap materials, such as plastic, for the first time.

Based on structures found in the natural world that occur within mitochondria and chloroplasts, nature's own "fuel cells" and "solar cells", the new nanostructure is formed of a network of tiny wires, millionths of a millimeter in size, and is created by growing the metal in a template made from a plant molecule.

Dr. Adam Squires Department of Chemistry at the University of Reading, said: "Making electrodes more efficient lies at the heart of making our energy production more sustainable. This novel electrode coating technique has applications for fuel cells in the newest generation of hybrid cars, photovoltaic cells, rechargeable batteries, or battery production for a wide range of green technologies".

The process works in water applying a technique known as electrochemical deposition, similar to silver-plating, and can be applied to any conducting electrode, creating a low cost, mass manufacture component. The unique 3D nanostructure enables much better conductivity and is the ideal shape for a high area electrode to create a more effective energy supply. The technique could potentially lead to energy storage devices with much greater capacity than traditional cells.

Browsing the Internet for nanotechnology applications, one is bombarded with an assortment of promising endeavors that could truly change the shape and quality of our life forever; the same way electricity—one of, if not the most life-changing breakthroughs of human history—did. We are thus going to keep a close eye on nanotechnology, which in my humble opinion is still in its embryonic stage, to witness its birth into our life.

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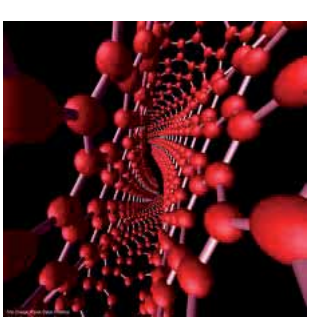

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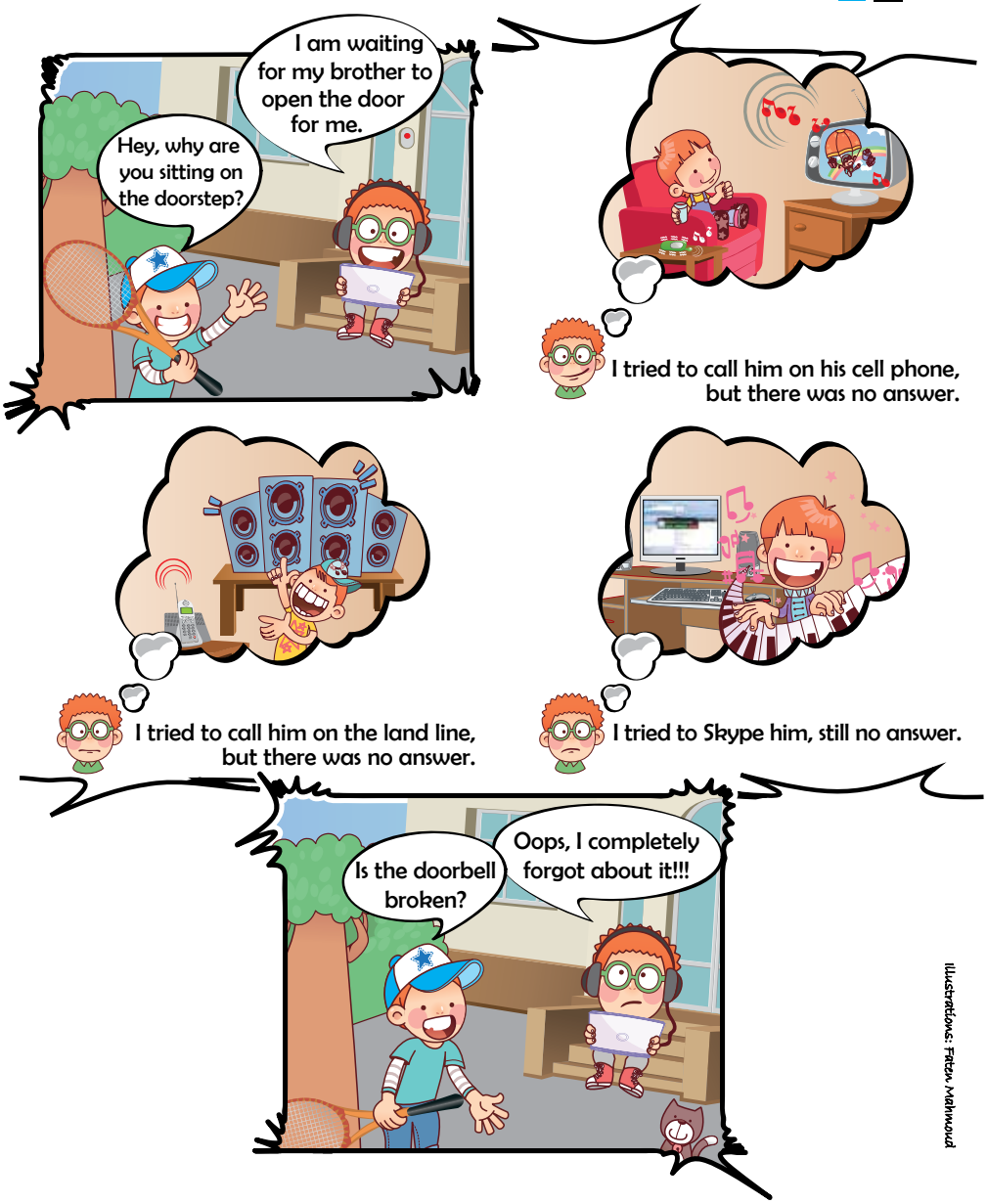

Illustrations: Fatma Mahmoud

Technology has become an essential part of our daily life.It makes our life easier, faster, and so much more accessible, facilitating many aspects of our life such as following up on our work using smartphones, tablets or laptops, communicating with our friends and family across the world, and numerous other critical aspects. Nevertheless, it also has its many negative effects; namely, technology addiction, whichis haunting people nowadays, making them completely reliant on it and causing them to forget the simple life before high-tech.
Do not be blinded by the magic of technology and remember that old is gold!

Planetarium Science Center
6th year | 3rd edition

SPRING 2013

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