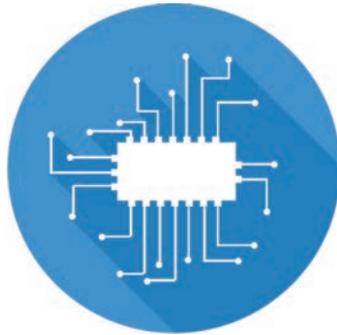


When Computers Become Human



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A Kid's Guide to the Future of
Artificial Intelligence

Kelly Lane and David Lane

MSAC Philosophy Group
Walnut, California

When Computers Become Human

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MSAC *Philosophy Group* was founded in 1990 and is designed to provide a wide range of materials (from books to magazines to films to audio presentations to interactive texts) on such subjects as evolutionary biology, quantum theory, neuroscience, and critical studies in religion and philosophy. All books are sold on a not for profit basis. Free PDF versions are made available whenever possible. In addition, there is a growing collection of audio books specifically created for students at Mt. San Antonio College and the community at large. A large series of original movies have also been produced which touch on such topics as artificial intelligence, eliminative materialism, consciousness, and skepticism.

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Kelly's Dedication

To my Aunt Kim who has
spoiled me since birth!

Hi, my name is Kelly. However,
my parents' pet name for me is
Nietzsche. I have always loved
computers.



One day my father told me a funny story about how back in the early 2000s one of his computers came with an Einstein-like animated assistant who would pop up whenever you had a question. My father used to trick my oldest brother Shaun (who was only 3 at the time) that it was a real person living inside the screen.



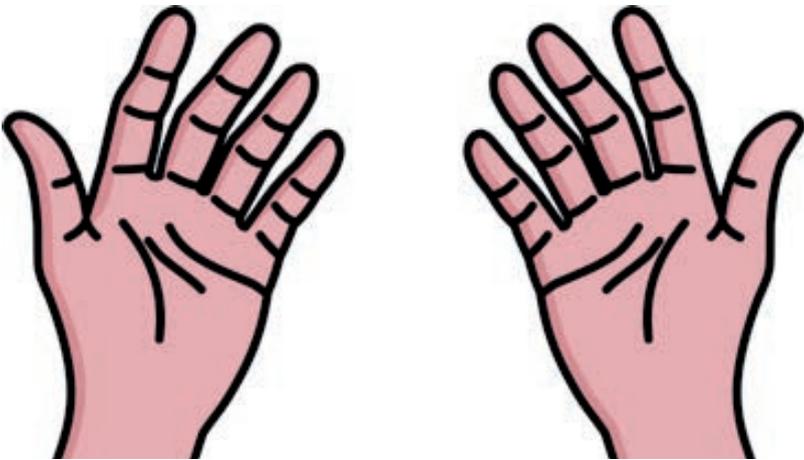
This got me to thinking, "Is it possible for a computer to actually become human-like?" As I pondered this and other related questions (such as, "Can a smart phone become self-aware?"), I realized that I needed to know more about the history of computers and programming.



"Yes! I am more than just a phone!!!"



I was surprised to learn that
the very first digital computer
was our own hands!



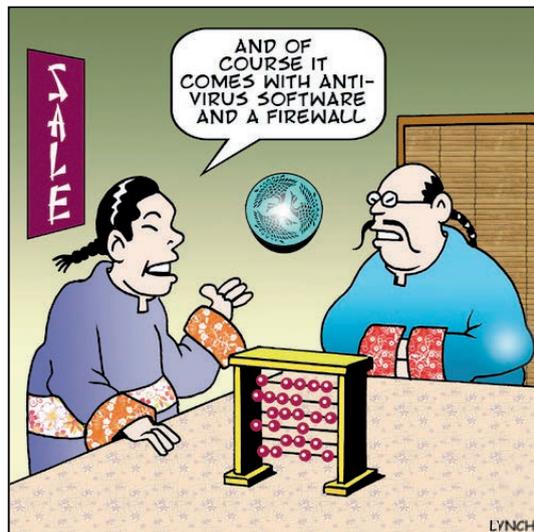
You can count with them,
remember things, and so
much more.



The First Digital Computation



Although our hands are quite useful, they are limited. Thus, over four thousand years ago, it appears the Sumerians developed an **abacus**. This is a counting device. It became popular among the Egyptians, Persians, Greeks, and Chinese.



Great thinkers like Pāṇini (6th-4th century B.C.) from India and Archimedes (287-212 B.C.) from Greece developed grammar and mathematical rules to better comprehend **recursions** which is where a particular "thing is defined in terms of itself."



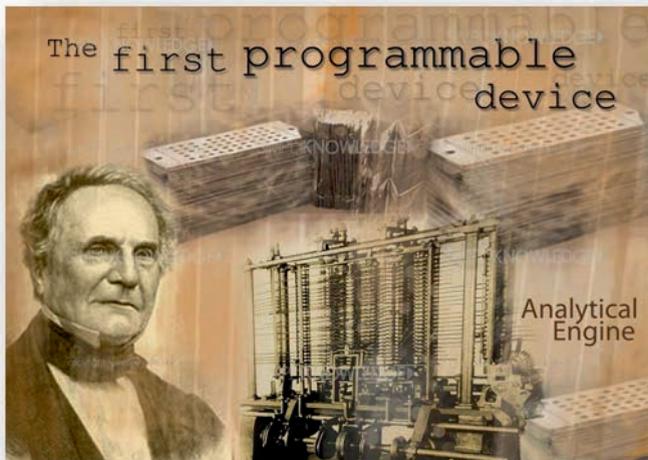
Historians believe that the **Antikythera mechanism** was the first analog computer. It was first discovered off a Greek island in the early 1900s and is believed to date back more than 2,000 years.



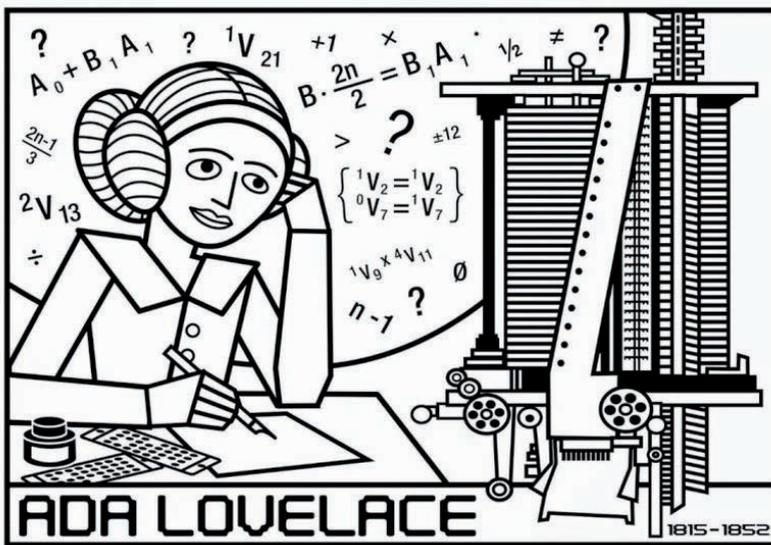
Centuries later Islamic astronomers further refined a fantastic tool to help in measuring celestial bodies and which, in turn, allowed sailors to better navigate when the ocean was calm. It is known as an astrolabe, which was first invented by Hipparchus around 200 B.C.



However, it was not until the 19th century that Charles Babbage (1791-1871) created what is known today as the first modern computer, an **analytic engine**. Sadly, his brilliant design wasn't built during his lifetime.

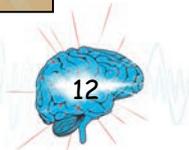


Working with Babbage was the remarkable Ada Lovelace (1815-1852), daughter of Lord Byron (the famous romantic poet), who may be rightly called the first computer programmer.

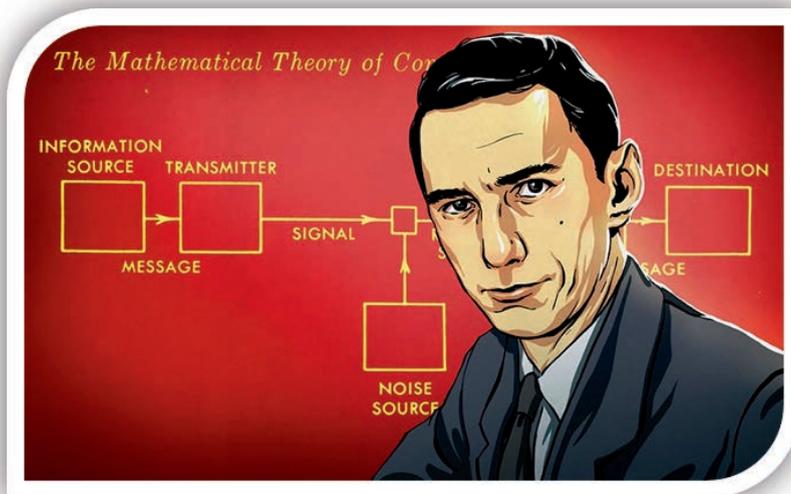


Perhaps the most famous
"father" of modern day
computing is Alan Turing (1912-
1954), who wrote a famous paper
in 1936 on computable numbers.

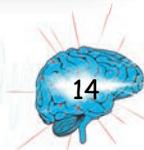
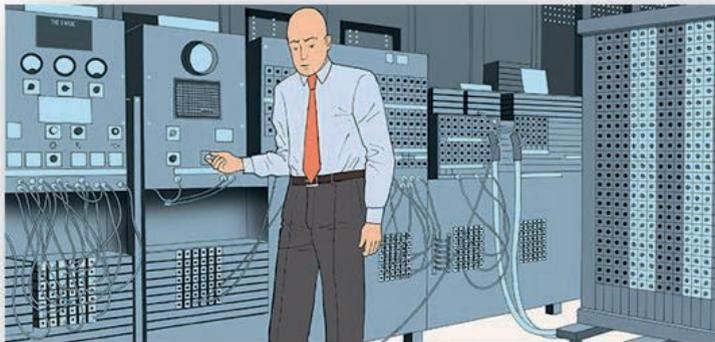
This led to the idea of a
universal machine where
potentially any mathematical
problem could be solved.



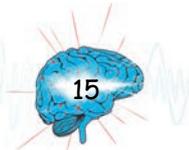
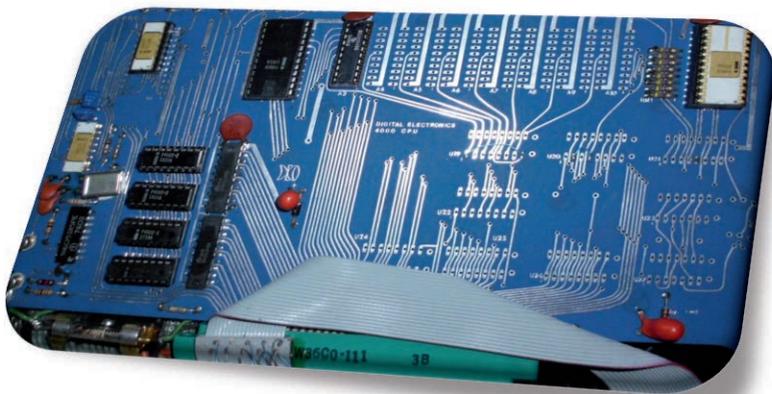
Less well known, but a vital link in the history of computation, is mathematician-engineer, Claude Shannon (1916-2001), who is the chief architect behind information theory and digital circuit design.



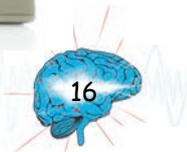
One of the very first all-purpose electronic computers was made in 1946 and showcased at the University of Pennsylvania. It was called ENIAC, which stands for Electronic Numerical Integrator and Computer.



After World War II, there have been remarkable advances in computer technology, including the invention of the microprocessor in the late 1960s, which led to the evolution of microcomputers.



By the 1980s/1990s, personal computers became a viable option for consumers. They allowed individuals to do all sorts of amazing things that were not possible before, including word processing and electronic mail.



The Internet connects individual computing devices throughout the world electronically. It may be likened to a massive global brain that allows for super fast communication between local and distant peoples and lands.



Upon the Internet can be laid all sorts of **applications** (apps). Perhaps the most significant and powerful app is the **World Wide Web**, which was advanced by Tim Berners-Lee while working at CERN in Switzerland in 1989 working on a Steve Jobs inspired computer called:



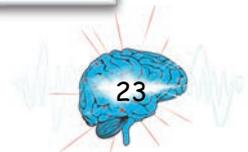
Today many people around the world have a computer, usually a smart phone that they carry around with them wherever they go. One survey estimated that teenagers check their cell phones at least 150 times a day.

We have all become very attached to our computational devices. In fact, most of us won't leave home with out some electronic device that is connected to the Internet and the multiplicity of apps.





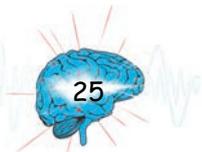
The amount of information that we can now access is so vast that it is almost impossible to imagine. We don't even need to store books, films, or other data because of **cloud computing**.

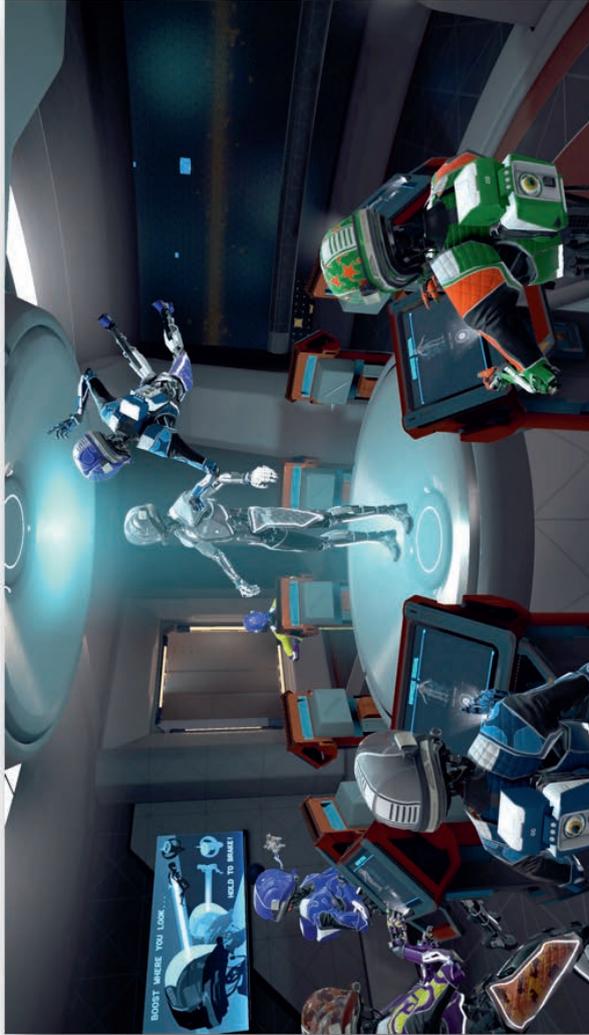


The term "cloud computing" describes how anyone with an Internet connected gadget can access data (text, images, movies) that is stored on massive **servers** positioned around the world. Amazon, Google, Facebook, Apple, and Microsoft have lots of **servers**.



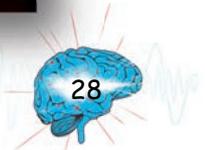
With so much computing power, which appears to grow exponentially year by year, it can allow for programmers to create incredibly life-like simulations of the real world. Gamers are acutely aware of how much more realistic their games have become since the 1980s, even on cheaper devices. Indeed, we now live at a time where it is becoming increasingly difficult to distinguish between what is real and what is artificial.





This illusion as reality became clearer to me when I put on the virtual reality headset, **Oculus Rift**. Right from the beginning, even with the tutorial, I felt immersed into another world. Dinosaurs come alive and can even walk right over and breathe into your face. My mom got so scared of the animal, fake as it was, that she immediately took off the headset and said, "Wow, that is way too real!"





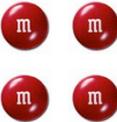
With Virtual Reality becoming better each year, it got me thinking about what the future of computation holds for us. Will we live in self-created worlds? Will artificial intelligence become too powerful to control? Will computers become human-like? To better answer these questions, I turned to great thinkers in science, such as Max Tegmark, Stephen Hawking, Ray Kurzweil and Elon Musk.



The first thing I focused on was Ray Kurzweil's idea about the **law of accelerating returns** and how it applies to the future of technology. One of the ways to envision how this law works is to imagine placing a piece of candy (let's use 2 M&M's for our example) and placing it on the first square of a game board that has 15 other squares. Now for each square after the first you double the amount of M&M's.



Exponential Growth

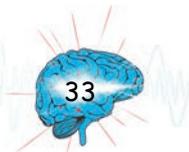
		8 M&Ms	16 M&Ms
32 M&Ms	64 M&Ms	128 M&Ms	256 M&Ms
512 M&Ms	1,024 M&Ms	2,048 M&Ms	4,096 M&Ms
8,192 M&Ms	16,384 M&Ms	32,768 M&Ms	64,536 M&Ms

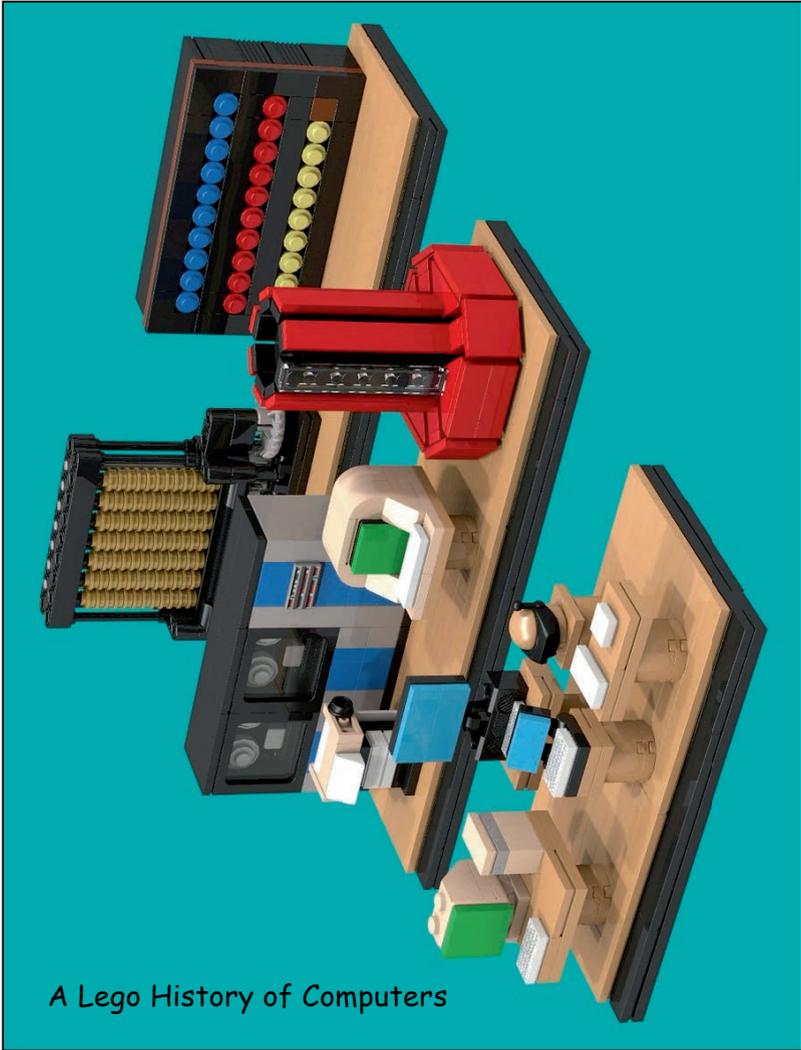
What is astounding is how quickly the amount of M&M's increase. At 16 squares you have 64,536 pieces of candy. Now if you have 300 spaces and are doing the same doubling on each square the number of M&M's is beyond imagination at:

2 novemvigintillion 37 octovigintillion 35
septenvigintillion 976 sexvigintillion 334
quinvigintillion 486 quattuorvigintillion 86
trevigintillion 268 duovigintillion 445 unvigintillion
688 vigintillion 409 novemdecillion 378
octodecillion 161 septendecillion 51 sexdecillion
468 quindecillion 393 quattuordecillion 665
tredecillion 936 duodecillion 250 undecillion 636
decillion 140 nonillion 449 octillion 354 septillion
381 sextillion 299 quintillion 763 quadrillion 336
trillion 706 billion 183 million 397 thousand 376

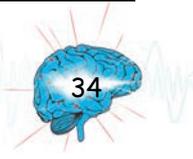


Or, put another way, by the time you have reached the 300th square you could replace every atom in the universe with a piece of M&M candy! What this means when applied to technology is obvious, since every year (if not months) digital devices get more powerful and cheaper. The smart phone in our pocket is a 1000 times more capable than all the NASA computers that got the first man on the moon back in 1969.

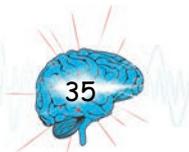




A Lego History of Computers



We have become addicted to an array of digital devices. Scanning information moment to moment has become our addiction. Neil Postman, the acerbic media critic, has long argued that we have been swallowed whole by technopoly, where the newest gadget is given higher priority than real human interaction. We have become attached to the interactive display screen and less with the person across from us.



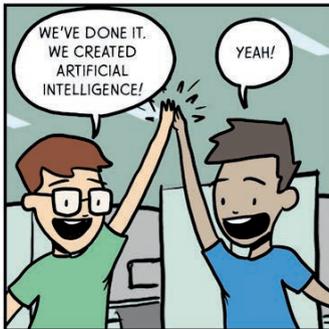
Stephen Hawking, the famous Cambridge astrophysicist, is scared of the potential danger of Artificial Intelligence since it could become too powerful to control. As Hawking argued, "It would take off on its own, and re-design itself at an ever increasing rate," he said. "Humans, who are limited by slow biological evolution, couldn't compete, and would be superseded."



The fear of A.I. and what it might portend has become the touchstone of our age. Books and movies focusing on the consequences of runaway synthetic intelligence have become a mainstay, including Dan Brown's latest novel, [Origin](#), where a computer scientist comes to realize that humans and machines will in just 30 years become one and the same.



The question that confronts us now is this: Will A.I. usher in a better or worse world for us?

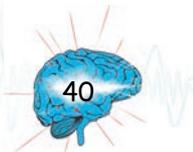


THEUNDERFOLD.COM

BY BRIAN RUSSELL



In the late 1960s after Stanley Kubrick's movie, 2001: A Space Odyssey was released, my grandfather Warren, a highly educated lawyer well trained in mathematics and the sciences, categorically told my Dad that a computer, no matter how advanced, will never beat a Grand Master in chess.



Well, my grandfather was wrong. Just three decades later, an IBM computer poetically named *Deep Blue* beat the premier chess master in the world, Gary Kasparov.



EVOLUTION OF THE CHESS COMPUTER.

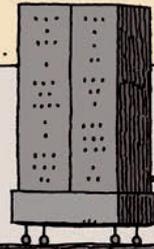
1962: FIRST CHESS-PLAYING PROGRAM INVENTED.

KNIGHT
TO KING'S
FIFTH.



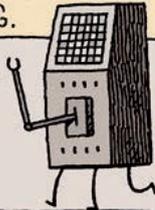
1997: A CHESS COMPUTER BEATS A GRANDMASTER.

CHECK
-MATE.



2011: CREATION OF A COMPUTER WHICH CAN GLOAT/SULK UPON WINNING/LOSING.

YES!!!
IN YOUR
FACE!



2019: FIRST PRETENTIOUS CHESS ANALOGY MADE BY A COMPUTER.

LOVE, HATE, SEX,
DEATH, PRIDE
AND DESPAIR
ARE WRIT LARGE
UPON THESE 64
HUMBLE SQUARES.

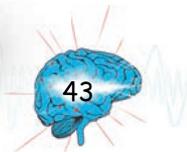


2028: A COMPUTER WINS THE WORLD CHAMPIONSHIP, LOSES ITS MARBLES AND GOES TO LIVE IN THE WILDERNESS.

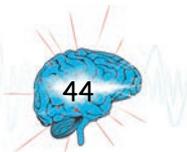


TOM GAULD 2010.

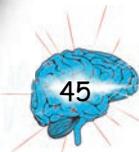
This past year, AlphaGo, a sophisticated computer program, developed by Google's *Deep Mind*, beat 18-time world champion, Lee Sedol, at the extraordinarily complex game *Go*.



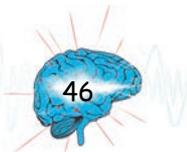
This was an unexpected outcome since many scientists predicted it would take another five or ten years for a computer to achieve such mastery.



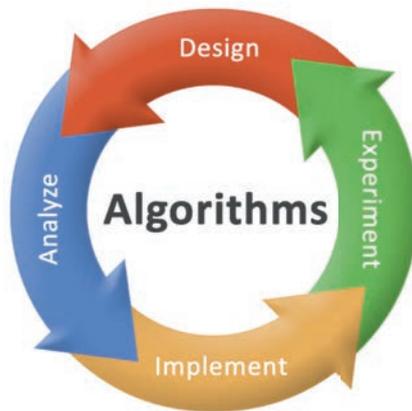
But the most shocking news to rock the A.I. community happened when it was announced that a new version of *AlphaGo Zero* beat its predecessor in head to head *Go* competition a mind boggling 100 to 0.



The implications of this development cannot be understated since the law of accelerating returns allows Synthetic Intelligence to grow at an exponential rate. Given what AlphaGo has been able to accomplish in such a short period of time, it gives one pause since we may be on the threshold of advancing algorithms that are far beyond our ability to either understand or control them.



As David Meyer for Fortune Magazine opined, "While it sounds like some sort of soda, AlphaGo Zero may represent as much of a breakthrough as its predecessor, since it could presage the development of algorithms with skills that humans do not have."



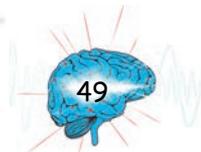
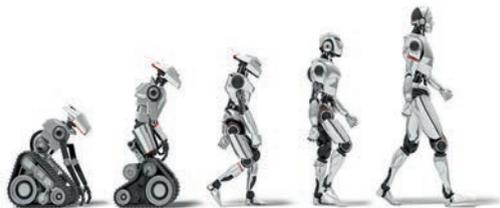
Those very last eight words
"algorithms with skills that
humans do not have" should
give us a deep pause, if not
a ponderous shudder.

Far from being the smartest
possible biological species,
we are probably better thought
of as the stupidest possible
biological species capable
of starting a technological
civilization.

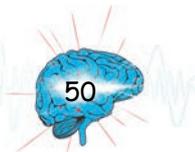
--Nick Bostrom



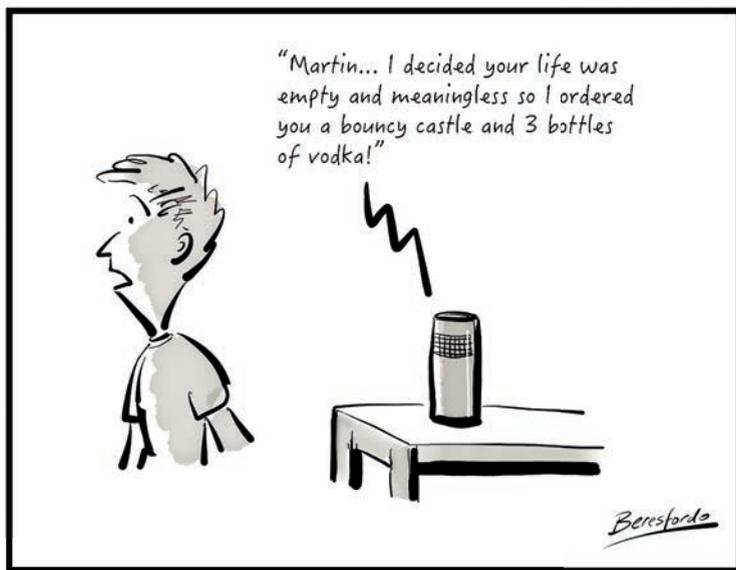
As Yuval Noah Harari warns in his review of MIT Professor Max Tegmark's latest book, [Life 3.0](#), "If you hear a scenario about the world in 2050 and it sounds like science fiction, it is probably wrong; but if you hear a scenario about the world in 2050 and it does not sound like science fiction, it is certainly wrong."



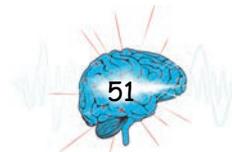
Today we interact with voice activated devices such as **Amazon's Echo** and **Apple's iPhone**. We even give the intelligent assistants personal names, such as "**Alexa**" or "**Siri**". What will happen when these programs become so life-like that they know us more intimately than any of our family or friends? What happens, in sum, when we cannot tell the difference between a Human Being and an A.I.?



The relationship we have with technology is becoming ever more intimate, such that we spend more time with computers than with humans.

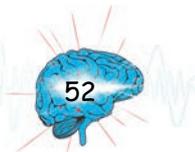


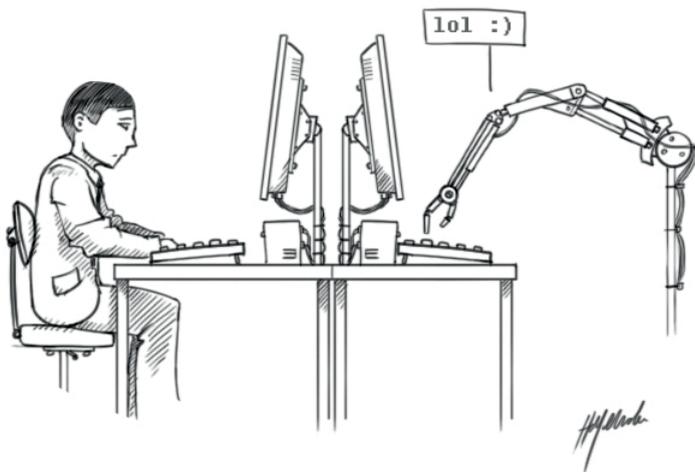
"ALEXA" GETS TO KNOW YOU A BIT TOO MUCH!



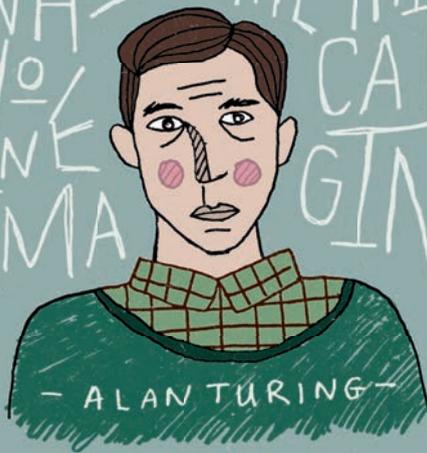
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Our computers are becoming us, and in the world of tomorrow we may have difficulty knowing whether we are speaking with a humanoid or an android. Alan Turing back in 1950 proposed a test that became well known as the "imitation game." Simply put, by only using a series of written exchanges one attempts to determine whether the person hiding behind a screen is a human being or merely a machine.

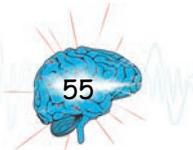




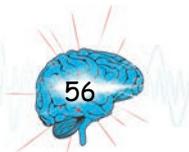
SOMETIMES
IT'S THE PEOPLE
NO ONE IMAGINES
ANYTHING OF
WHO DO THE THINGS
NO ONE CAN
ONE IMAGINE.

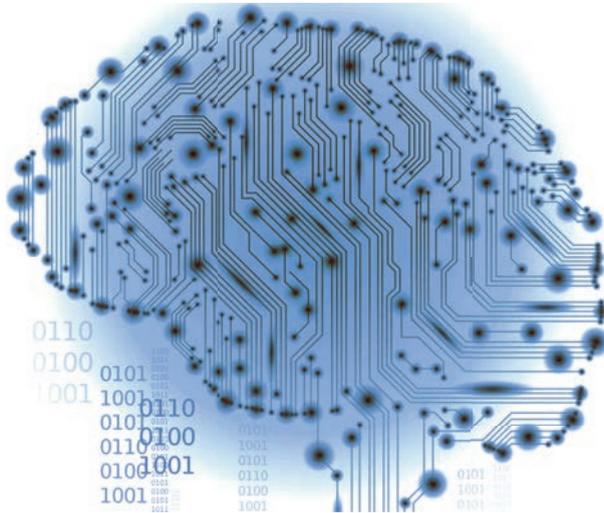


If computers in the future will easily trick us into believing that they are like us, does it mean that they have self-awareness? Do they too also possess consciousness?



The answer to those questions appears to be directly connected to how our own brains produce subjective awareness. If we could properly understand how a complex net of 86 billion neurons within our craniums creates consciousness then we would have a potential model for reconstructing something similar in a machine. In essence, we need to reverse engineer the brain and see how its construction produces "I".



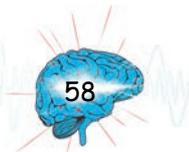


“I visualize a time when we will be to robots what dogs are to humans, and I’m rooting for the machines.”

Claude Shannon

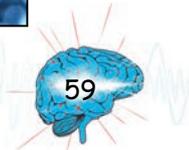
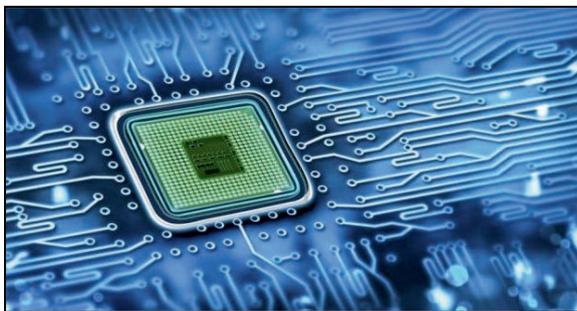


If consciousness can be mathematically explained in terms of a complex informational system, then it is substrate independent. This means that self-awareness is not dependent on any particular biological material, but can be reconstructed using artificial chips. The implications of this, if true, are profound since in the future we could endow almost anything with subjective awareness.

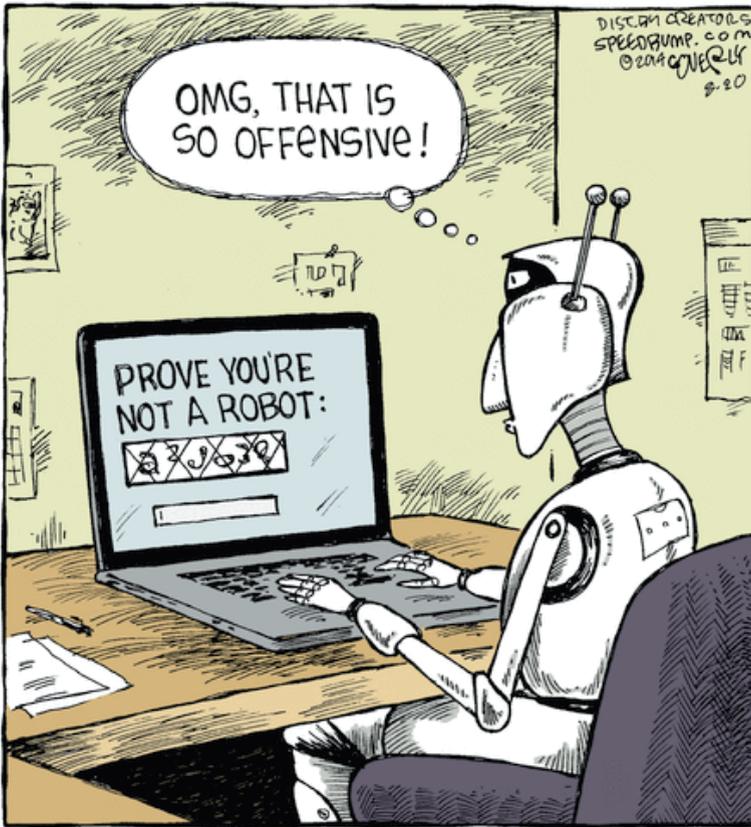


“If consciousness is the way that information feels when it’s processed in certain ways, then it must be substrate-independent; *it's only the structure of the information processing that matters, not the structure of the matter doing the information processing.* In other words, consciousness is substrate-independent twice over!”

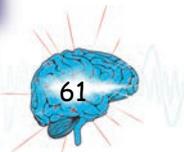
--*Max Tegmark*, MIT



“We're seeing the arrival of conversational robots that can walk in our world. -- *David Hanson*”



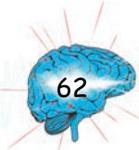
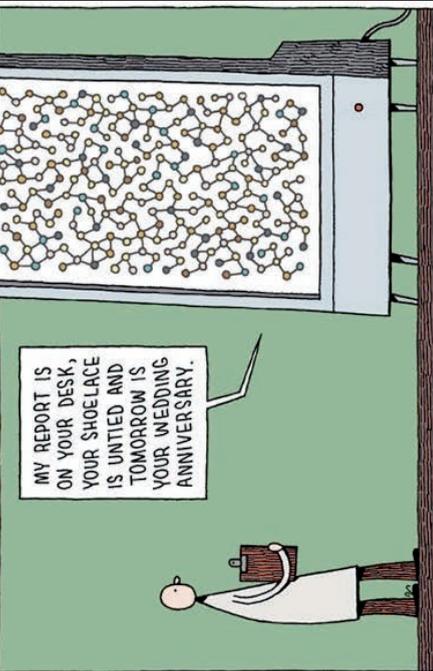
We are at a crossroad in human existence, since we are giving birth to a new species of artificially intelligent machines that may wholly transcend our ability to control or understand them. Yet, it may be that such doomsday prophecies are mistaken and that in the future we will evolve symbiotically (in mutually beneficial ways) with technology.



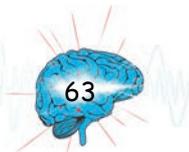
A.I. of the PAST ...



A.I. of TOMORROW ...

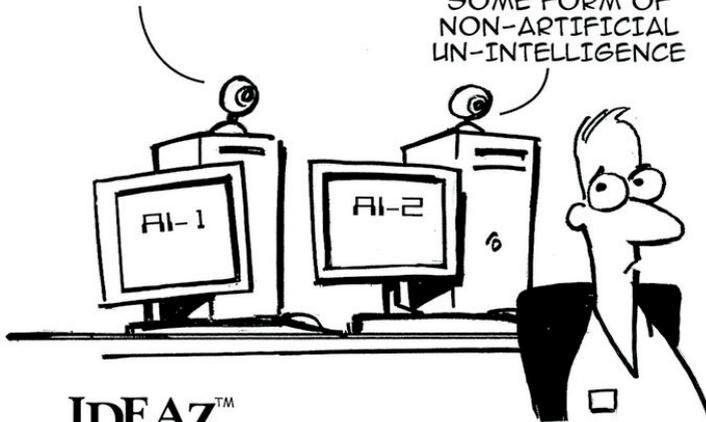


It is fascinating to reflect that the very first computer prototype was our own hands and from those fingers and our enlarged brain we have created a digital future that is beyond our wildest imaginations. The deeper issue that confronts us now is this: Will the world of tomorrow be a utopian-like paradise where technology benefits humankind or will A.I. turn out to be a nightmare from which we cannot awake?



WHAT IS THAT THING SEATED NEXT TO US?

I'M NOT SURE - BUT IT APPEARS TO BE SOME FORM OF NON-ARTIFICIAL UN-INTELLIGENCE

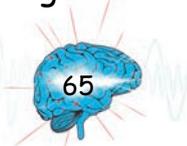


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“Artificial intelligence will reach human levels by around 2029. Follow that out further to, say, 2045, we will have multiplied the intelligence, the human biological machine intelligence of our civilization a billion-fold.” Ray Kurzweil

For Further Reading

There are a plethora of interesting books and articles on the history of computers and the future of artificial intelligence. These range from the highly technical (such as Claude Shannon's classic tome, [A Mathematical Theory of Communication](#) and Alan Turing's groundbreaking paper, [On Computable Numbers](#)) to the more accessible, yet quite informative, works (such as Max Tegmark's [Life 3.0](#) and George Dyson's [Turing's Cathedral](#)). Perhaps the most popular work on the subject of where artificial intelligence is heading is Ray Kurzweil's [The Singularity is Near](#). As mentioned earlier, even Dan Brown's latest novel, [Origin](#), provides the reader with a dramatic plot in which to envision the future of technology and how it will impact our current religious beliefs. Finally, I highly recommend Walter Issacson's very readable book, [The Innovators](#), which serves as an insightful introduction to our digital age.



About the Authors

Kelly Lane is 11 years old and in middle school. He is an avid surfer who loves interactive computer games, such as *Minecraft* and *Roblox*. Kelly also likes playing *Superhot* and *Waltz of the Wizard* in Virtual Reality on Oculus Rift. His favorite academic subjects are mathematics and science. Kelly loves to read books on technology and at the age of 7 read Brad Stone's The Everything Store: Jeff Bezos and the Age of Amazon and Walter Issacson's biography, Steve Jobs.

David Lane is a Professor of Philosophy at Mt. San Antonio College. Besides being the proud father of Kelly and his brother Shaun, he also surfs as much as he can. David has a deep interest in quantum theory, evolutionary biology and neuroscience. He is the author of several books, including You are Probability and Confessions of a Bibliomaniac.

