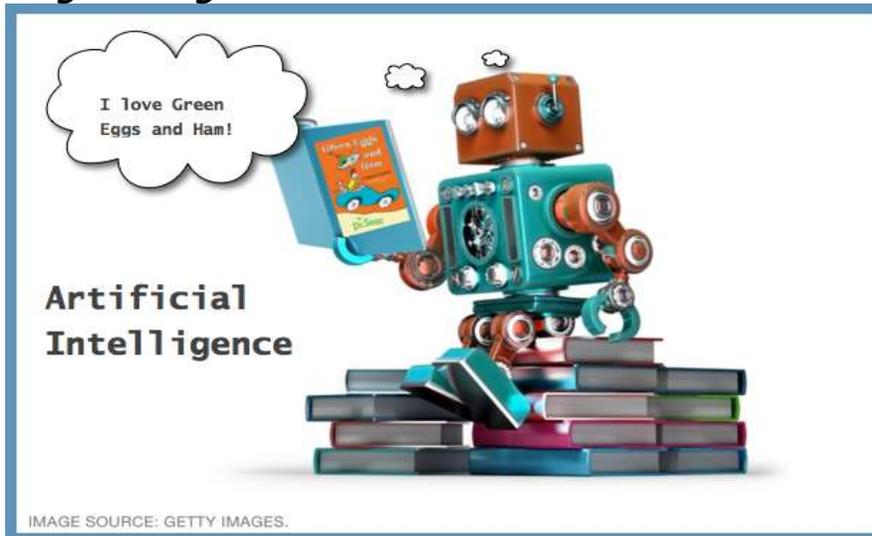


E.Q Trendwatch™

Evolving intelligence



“Our intuition about the future is linear. But the reality of information technology is exponential and that makes a profound difference. If I take 30 steps linearly, I get to 30. If I take 30 steps exponentially, I get to a billion.”
—Ray Kurzweil, futurist

“We spend a great deal of time studying history, which, let’s face it, is mostly the history of stupidity. So, it’s a welcome change that people are studying instead the future of intelligence. We are aware of potential dangers, but perhaps with the tools of this new technological revolution we will even be able to undo some of the damage done to the natural world by industrialization.”

—Stephen Hawking, *Brief Answers to the Big Questions* (2018), p. 184-190

In his final book, *Brief Answers to the Big Questions* (2018), Stephen Hawking notes that if computers continue to follow Moore’s Law in doubling their speed and memory capacity every eighteen months, they will overtake human intelligence within the next hundred years. Further, once ‘artificial intelligence or AI’ becomes better than humans at AI design “we may face an intelligence explosion that ultimately results in machines whose intelligence exceeds ours by more than ours exceeds that of snails.”

Hawking, a self-proclaimed optimist about the future, acknowledged that the potential benefits from AI are well beyond our imagination: “we cannot predict what we might achieve when intelligence is magnified by the tools AI may provide. The eradication of disease and poverty is possible.”

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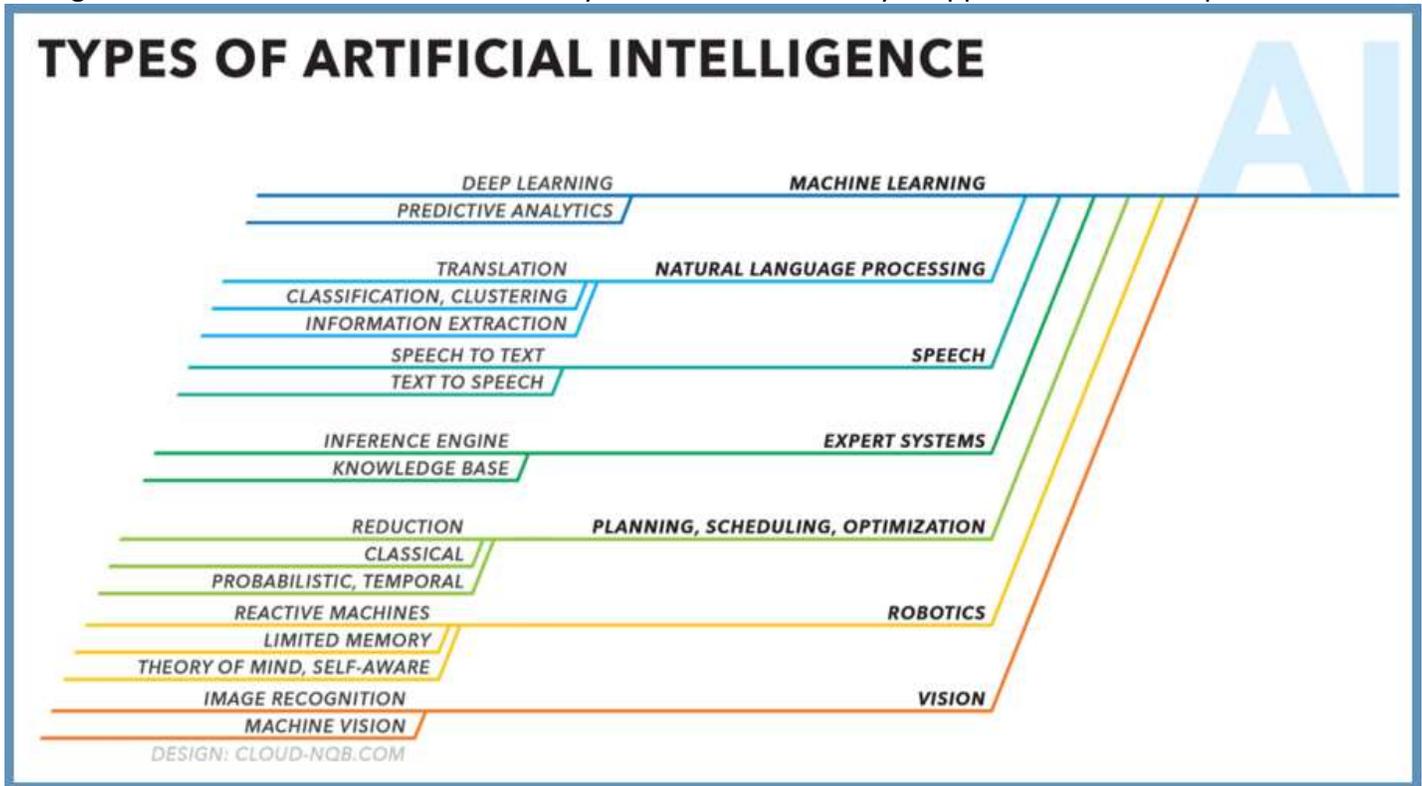
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In general, Artificial Intelligence (AI) refers to the science of making machines perform as if they had human intelligence. The chart below shows the many subsets of AI currently in application or development.



A pioneer of machine learning, Arthur Samuel noted in 1959 that instead of humans teaching computers everything we know, it would be more efficient for computers to teach themselves. Samuel used the new IBM 701 computer after hours to develop a “learning program” based on the game of checkers, and his work is foundational for many of today’s AI programs.

Current forms of AI in operation are “narrow” or “weak” meaning programmed by humans to perform a single task such as checking the weather, playing chess, or analyzing raw data to write reports. Narrow AI is not conscious, sentient, driven by emotion, or able to think for itself. It pulls information from a specific dataset and doesn’t perform outside of the task for which it was designed. At present, it is used across a multitude of recognition, classification, translation, processing, locomotion, and question-answering systems in a wide range of sectors, relieving humans from many mundane tasks and freeing up time for other activities. *Of course, what individuals choose to do with their freed-up time will decide the extent to which it is a benefit or not!* Google Translate and Apple assistant Siri are narrow AI examples widely used today.

When strung together, different narrow AI programs can simulate broader intelligence. For example, the weather app, “Umbrella Taker” downloaded to a smartphone can link to Amazon’s Alexa device and prompt Alexa to recommend that the homeowner take an umbrella where there’s a 70% chance of rain. Hence, narrow AI systems are the building blocks for more advanced “General” or “Strong” AI systems that will

replicate the human ability to learn and solve problems. General AI (AGI) has long been prophesized in science-fiction movies like “I, Robot,” “Her”, and others.

Already, narrow AI systems are able to process data faster than humans. But for AGI to replicate human-like intelligence, it needs self-awareness, the ability to make judgements amid uncertainty, plan, learn from experience and be innovative, imaginative and creative.

When AGI is finally achieved, a next level Artificial Super Intelligence (ASI) is anticipated where machines will surpass human intelligence in all aspects. Unless AI development is carefully controlled and aligned in support of human life, it could be our collective undoing. Hawking was cautiously optimistic:

“our future is a race between the growing power of technology and the wisdom with which we use it...Intelligence is characterised as the ability to adapt to change. Human intelligence is the result of generations of natural selection of those with the ability to adapt to changed circumstances. We must not fear change. We need to make it work to our advantage.”

Fear itself

Readers and movie viewers have been conditioned to fear artificial intelligence since the early 50’s, with killer robots, sentient software programs run-a-muck or robots using humans as batteries. Four broad-reaching examples were “The Day the Earth Stood Still” (1951), Arthur C. Clarke’s “A Space Odyssey” (1968) with “Hal” the creepy sentient computer, the apocalyptic “Terminator” of the nineties, and the “Matrix” trilogy (our personal favorite!) with its self-replicating software program “Mr. Smith.”



Each of these movies would have had little, if any, lasting impact on our fear response if the technologies dreamt-up had simply stayed in the realm of science fiction, but science fiction has a recurring habit of prophesizing science fact. Consider the following short list of technologies born of the movies that exist today: Star Trek’s PADD, is now the iPad; Iron Man’s suit is today’s T.A.L.O.S; Minority Report’s Face scanner is today’s security system on many smart-phones; Star Trek’s replicator is today’s 3D printer; Demolition Man’s virtual reality headset is today’s Oculus headset; Dick Tracy’s watch is today’s smartwatch; Star Trek’s visual display goggles are today’s Google glass; and last but not least, the Jetson’s robot vacuum is now the Roomba.

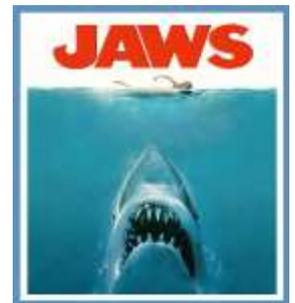
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Our survival as a species has been in large part due to strong biases, helping us determine what is harmful, dangerous or helpful based on experience. However, some biases are not the result of experience, but rather born of fiction and reinforced by provocations designed to elicit emotional responses, especially fear.

A recent experiment by Dr. Vyacheslav Polonski at Oxford University studied collective behavior and found that after watching both utopian and dystopian AI related movies, viewers were polarised:

“Surprisingly, it didn’t matter whether the movies like Terminator, Her or Ex-Machina depicted a Utopian or Dystopian future. We found that, regardless of whether the film they watched depicted AI in a positive or negative light, simply watching a cinematic vision of our technological future polarised the participants’ attitudes. Optimists became more extreme in their enthusiasm for A.I. Conversely, skeptics became even more guarded in their attitudes toward A.I. They doubted the potential benefits and were more willing to actively resist A.I tools used by their friends and families.” —Dr. Vyacheslav Polonski

Joanne Cantor, Professor of Communication Sciences at the University of Wisconsin-Madison, has studied the ‘Jaws-effect’—the impact frightening movies have on memory. Twenty-five years after the release of Stephen Spielberg’s movie “Jaws”, 43% of respondents report “enduring problems” with swimming in open water, even though empirical evidence shows an average of just eight shark-bite fatalities per year among billions of ocean swimmers worldwide. Cantor explains:



“Fear, as an emotion, was intended to keep us alive. Fear tells us we are in danger and you better protect yourself or you’re going to be eaten by a predator. So fear, has to act quickly- if you see that sabre-tooth tiger coming at you-you better run- and when our brains saw Jaws for the first time, our fear response kicks in and it kicks in before our conscious brain can start telling us that, ‘It is only a movie, it is only a movie’.”

Still, given that many labour-intensive manufacturing jobs have been lost to automation over the last two decades, job loss to AI is a legitimate fear. A survey by the *Center for the Governance of A.I* found that prevailing attitudes tend to split along socio-economic and educational lines. Correctly or not, those with higher incomes perceive they are less susceptible to automation as a result of work-place specialisation.

Of workers making less than 30k annually, just 15% were optimistic about the prospects of AI compared with 55% of those earning 100K+. Eight percent of those with a high school diploma or less were optimistic about AI, while 53% of respondents having a university degree, and 65% of those with a computer science or engineering degree were optimistic (keeping in mind AI could be a source of their employment). Those aged 18 to 37 (raised in the age of technology) were 40% optimistic, while just 3% of the leading edge of the boomer generation (age 70+) reported optimism about AI.

Apart from employment, respondents cited other legitimate concerns like a failure to design systems that align with humanity’s goals, the efficacy of safety features, governance issues, privacy, fairness, loss of control and autonomous weapons wielded by nefarious groups.

According to a 2018 report from the Brookings Institution, 25% of North American jobs are deemed "high-risk" of being replaced by AI; particularly those in office administration, production, transportation and food preparation, where physical labor, information collection and routine processing activities make up 70% of daily tasks.

Jobs the researchers deem "more secure" are those based on non-routine, "abstract" activities, requiring social and emotional intelligence like those in arts and entertainment. Less than 30% of tasks in this field are judged likely to be automated, with athletes, music directors and composers deemed least vulnerable. (Although we note that computer-generated prose and music is already in circulation). The report found that smaller, more rural areas "seem significantly more exposed" to automation than larger cities.

As it kills some jobs, however, AI is also enabling new employment opportunities (often with above-average incomes), while making much of human life more efficient, safe and sustainable. As with most new technologies, first-hand experience with AI tends to increase human trust and comfort with it.

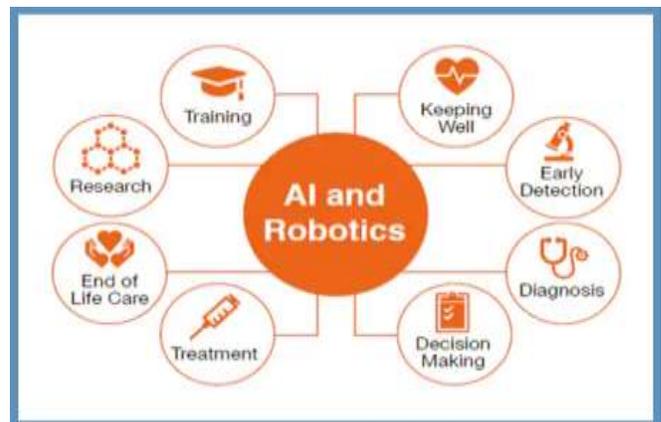
Healthcare

When Canada's federal government passed the *Medical Care Act* in 1966, the oldest baby boomers were 20 years old and life expectancy was 72. Today it is 82 and boomers, now aged 55 to 73, are just entering their most expensive medical care years. AI is arriving at a critical time for public health systems.

Already healthcare providers track and monitor sensors worn by patients. Data collected can be sent in real-time to machine learning services that flag anomalies and alert medical professionals to improve and quicken diagnosis and treatment.

Eventually, intelligent machines similar to IBM's Watson or Google's DeepMind will allow practitioners to compare patient symptoms, diagnosis and treatment progression with every practitioner, hospital, medical journal, case study and trial data within minutes. Pattern recognition software can sift through millions of MRIs, CT scans and x-rays, saving precious time while reducing errors and false positives.

In 2016, a group of Harvard pathologists developed an algorithm to identify breast cancer cells. While human specialists accurately spotted aberrant cells 96% of the time, the algorithm on its own had just a 92% detection rate. But when humans and the algorithm were combined, 99.5% of the cancerous cells were caught, improving prognosis for thousands of patients per year.



Other AI applications in development are working to edit DNA and eliminate the propensity for certain diseases and disorders. Others use silicon chip implants and wireless electronic interfaces between the brain and the body, to allow better control over movements and thoughts.

Construction

Heavily used in construction today, cement production generates about 8% of global carbon emissions, mostly during the production of clinker, a key component in the manufacturing process. Designers recently wrote parameters and constraints into a computer-automated software which devised a 3D printed pan prototype that was 25% lighter, with much less waste and lower carbon emissions. Remarkably, the computer's solution

was counter-intuitive to human thinking. While we have a natural tendency to strap smart machines on to traditional designs and processes, when allowed the latitude, AI solutions often break from status quo thinking and practices completely.



A new generation of AI-empowered architects and engineers are turning the construction industry on its head, with revolutionary designs, systems and materials that are healthier and cheaper to maintain, better for users and the environment. As recently observed by Dale Sinclair, technical director of Aecon engineering:

"We shouldn't be inventing a robot to lay a brick, which

is 2000-year-old technology developed for the human hand. Don't reinvent brick-laying, redefine the brick."

Clean-up

Cleaning up nuclear waste has been another driver of AI development. Since the Three Mile Island nuclear disaster in 1979, automated machines have been designed to conduct tests, inspect and clean-up in areas too dangerous for humans. Last year, the South West Nuclear Hub at the University of Bristol, UK began developing a powered exoskeleton robotic suit for humans, taking inspiration from the comic book hero Iron Man. Combining robots with human workers is considered optimal for decontamination operations.

Transportation

The AI based Advanced Driving Assist System or "ADAS" is now in many newer automobiles. The system enables a suite of driver aids, including adaptive cruise control, traffic sign recognition, lane-departure warning, park assist, frontal collision avoidance and automatic electric braking. A 2018 J.D Power study showed more than 50% of car owners with advanced cruise control systems reported having avoided accidents.



"Driver assistance and safety systems will continue for the foreseeable future to be among the most important contributors to reducing crashes."—Bryan Reimer, Ph.D. Research Scientist - MIT

Finance

A world of flat interest rate spreads, slowing trade and shrinking loan demand, has already led two-thirds of systemically important global financial institutions to announce cuts to their workforce while ramping up AI

investment in areas like trading, lending, money laundering surveillance and targeted marketing programs.

The largest US bank, JP Morgan, recently reported that AI-generated-ad-copy attracted more prospects than ads written by people. In one example: an AI generated ad reading *“REGARDING YOUR CARD: 5% Cash Back is Waiting For You”* generated 5 x more unique clicks than the human made version which read *“HURRY, IT ENDS DECEMBER 31 Earn 5% Cash Back At Department Stores, Wholesale Clubs.”* The results led the bank’s chief marketing officer to declare that *“Machine learning is the path to more humanity in marketing.” (Ironic?)*

Over the last decade, so called ‘robo’ investment advisors tell people what products to buy with their retirement savings and when to reweight holdings back to a target asset allocation. Because of the minimal involvement of humans, fees charged are typically .40 to .89% of account assets per year (depending on the size), and often cheaper than traditional broker/dealer/mutual fund/management services. Some have no account minimum which makes them accessible to people with less savings.

The platforms use a short survey of investment-related questions and plug answers into an algorithm that then ‘advises’ asset allocations which are typically 60 to 100% in stocks, regardless of valuation level, stage of the market cycle, or the extent to which a person ‘needs’ to take on capital risk in the first place. Robo-advisors have all the bias and hubris of the product-pumping people who create them. They devise investment strategies and portfolios based on Modern Portfolio Theory and the Efficient Market Hypothesis, both of which have been widely debunked and shown to be harmful in real life financial management. Robo-advisors don’t consider overall financial plans. They don’t, for example, recommend that one first pay off debt before buying securities. They don’t warn people off of unreasonable expectations, buying high, selling low, greed, fear, panic and other self-destructive thinking. Robo-advisors have attracted assets during the market recovery since 2009. Their value-add and staying power have not yet been tested by a 12 to 24-month bear market typical at the end of each cycle.

A recent report by Thomson Reuters found that algorithmic trading systems are now responsible for 75% of global trading volume and most of these are trend-following programs that have not yet been tested by a recession or global bear market.

This cycle’s unprecedented co-dependence between big tech, price-indiscriminate ‘passive’ mutual funds and ETFs and algorithmic-driven fund flows are a recipe for financial pain as ‘mindless’ buying switches to mindless selling in the coming downturn. While enticing people into more debt and risky financial products is good for lenders and product sellers, it’s generally the opposite for borrowers and buyers, and underlines the vulnerability consumers face in an age of AI-enhanced marketing.

Big data

Big data is a term for information whose volume, velocity and/or variety is beyond the ability of traditional human systems to manage and process effectively. Google and Facebook use AI to collect mountains of big data from the pictures, texts, emails and social media of their users so they can sell access to those looking to target them. While this can be helpful to consumers, it also risks privacy, fraud and abuse of trust.

A troubling area brought to light in the 2016 US election and UK Brexit votes were AI systems used to shape public opinion and sway votes. If you have not yet seen the documentary *The Great Hack* available on Netflix, we recommend it! Vote manipulation is happening all over the world and undermining democratic principles.

These developments led The Economist magazine to declare in May 2017 that data had overtaken oil as the world's most valuable resource (cover below). Beyond strict regulatory frameworks around how AI is developed and deployed, public education around its benefits, risks and costs are critical.



What's next?

There's little doubt that a combination of humans and machines will be the normal workforce of the future. It's impossible to know when the first sentient machine will arrive, but there is consensus that it will. While narrow AI continues to develop and compound functionality, the move to General AI is still likely to be several years away. Once General AI is achieved and computers are thinking for themselves however, the leap to Artificial Super Intelligence (ASI) that surpasses that of humans is expected to be short.

By 2045, futurist Ray Kurzweil predicts that humans will be able to multiply our intelligence by linking wirelessly from our neocortex to that of other people as well as a synthetic neocortex containing all human knowledge, virtually stored in the cloud. Obviously, this could dramatically improve access to information and enhance society as a whole. But humans being humans, it's unlikely to solve all our problems and conflicts. Power struggles are likely to continue.

As families, businesses and governments dig out from two decades of debt abuse and destructive financial management, tools and innovations that help us to waste less and benefit more will be critical and AI has arrived just in time. The transitions needed are capital intensive though, and likely to suppress both corporate profits and employment over the next few years as old business models die or evolve, some traditional jobs are lost, and large parts of the work force retrain. Already, many in their 30's through 50's are seeking to reskill with low-paying "minternships" or middle-career internships in new fields. Government support programs are likely to be increasingly strained on all fronts as tax receipts decline and benefit claims rise.

Coming off a decade of record profit growth, credit gorging and financial engineering, generating corporate earnings growth in the next phase is likely to be harder than in the last, when cheap financing, tax loopholes and share buybacks were short-term magic maneuvers. Over the next couple of years, it's likely that corporate tax and borrowing rates will rise along with anti-trust prosecutions against big conglomerates. At the same time, share-buybacks are likely to be curtailed by incoming legislation, already proposed, to restore pre-1980 bans on it as illegal market manipulation. In capitalism, neither workers nor owners get it all their way indefinitely, and a pendulum shift back towards a focus on worker rights and compensation is now due.

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As we've explained in the past, since the 1990's public companies have moved down an increasingly destructive road by endorsing narrower and narrower principles of "shareholder primacy" – the idea that corporations exist principally to serve shareholders above all other stake holders. This has played a significant role in our present social and financial disorder as well as waste, malinvestment, harm and asset bubbles.

This month, one hundred and eighty American CEO's known as the Business Roundtable signed onto a new Statement on the Purpose of a Corporation, committing to lead their companies for not just near-term benefits to shareholders (rising stock prices and dividends), but for all stakeholders – customers, employees, suppliers, communities, lenders and shareholders. (See it here: [Business Roundtable Redefines the purpose of a corporation to promote 'an economy that serves all Americans'](#)).

The new Statement outlines a modern standard for corporate responsibility and a potential sea change for American capitalism. Pushing back on unreasonably self-absorbed, 'activist' shareholders, will not be accomplished easily, but this stated goal shift marks an important turning point and opens the door for a new era of more responsible, constructive business management, policies and attitudes.

There is much hope for wiser decisions ahead. But these developments also underline compelling reasons to shun over-valued corporate debt, equity and realty investments amid record debt, falling income and earnings, while heading into a period of massive business disruption that requires large capital-investment for necessary transitions. The promise of valuable opportunity lies in waiting for this repricing cycle to complete.

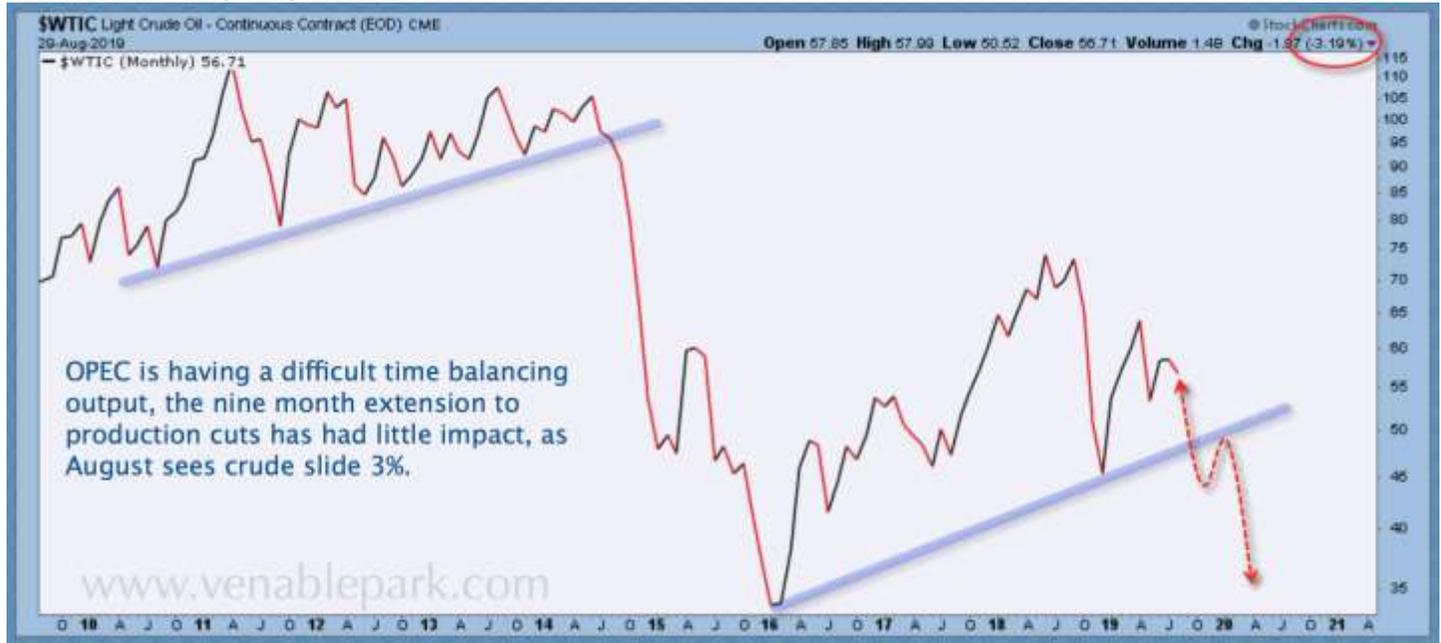
Artificial intelligence is here to stay. But emotional intelligence—the self-discipline to break from the herd and stick to our own individually focused, risk-management plans—will continue to be rare and valuable.

The US\$, here since 2009, strengthened in August. During periods of economic disappointment, the US\$ typically strengthens against the C\$ and emerging market currencies. The loonie bottomed with equity markets in 2002 and 2009 and we expect a similar pattern is likely to transpire in the months ahead, generating further capital gains in our accounts.



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Oil (WTIC), here since 2009, fell in August. The downward price trend remains intact. Crude bottomed with the economy/market cycle in 2002 and 2009 and could potentially test the \$25 area this cycle, with West Canadian Select (WCS) back in the low teens.



Energy company shares (XEG in red), here since 2009, fell another 5% in August, now back to 2016 levels. This reflects a world where oil supplies are swamping demand and the global economy is continuing to slow. Both crude and energy companies are likely to weaken further into the onset of recession.



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As shown below since 2005, the number of S&P 500 companies trading above their 200-day moving average fell 25% in August. Price weakness spread despite ongoing share buybacks by many constituent companies.



The S&P 500 (below since 2013) has been exhibiting a classic technical formation known as a 'broadening top' since 2018. This sideways period of high volatility and recoveries to marginal new highs before renewed weakness is a hallmark of market tops (see inset box).



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Shown below since 2013, Canada's TSX index is showing the same topping pattern. The coming recession and 3rd bear market since 2000 are likely to take Canadian stocks back to price levels seen in the late 1990's and bring a secular opportunity for value-focused cash at the ready, with dividend yields 3 and 4x higher than they have been over the last decade.

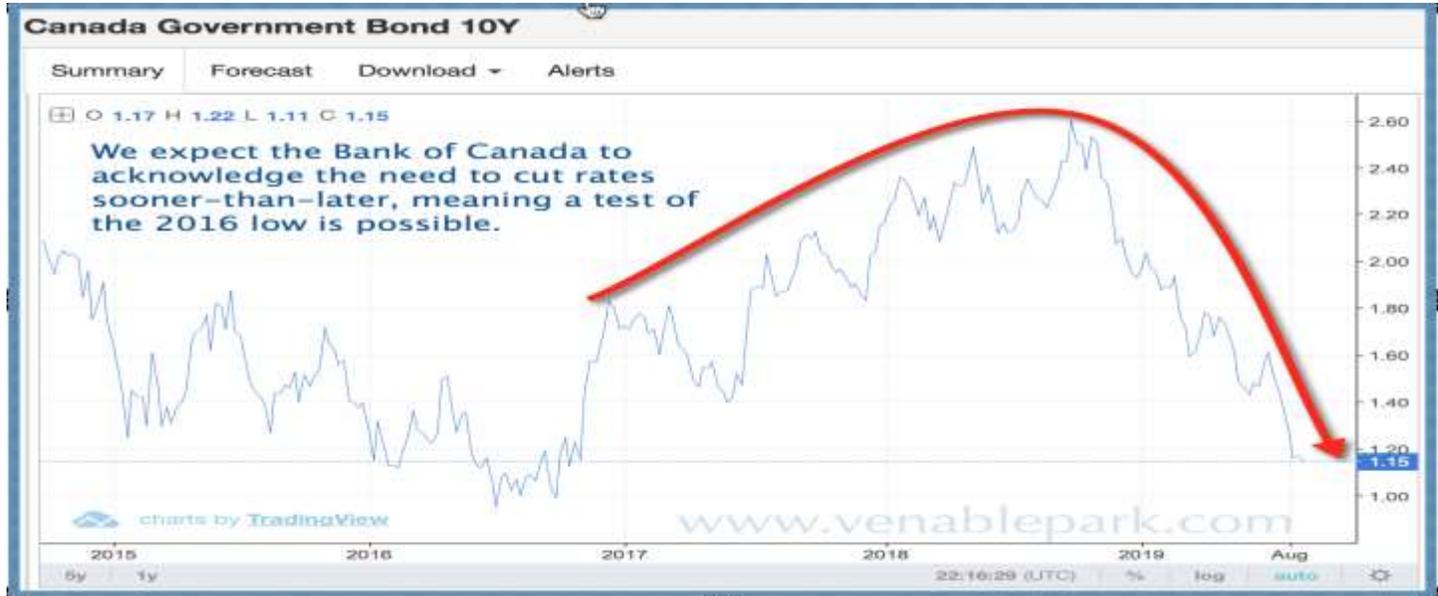


The lowest quality corporate 'junk' bonds have lost ground to the highest-grade issues since the fall of 2018 (ratio below since 2009). Capital continued to move out of junk debt into higher quality credits in August.



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Canada's 10-Year Treasury yield, here since 2014, continued to fall in August as our government bond holdings rose in value. Yielding just 1.14 today, a retest of the .96 low of July 2016 is probable as existing bond prices rise further. The Bank of Canada (BOC) will be forced to follow the US Fed in cutting its policy rate back near the zero bound as the economy slows. They are 'pushing on a string', trying to stimulate further borrowing and spending by households and businesses that are highly indebted and low on cash.



As shown below, Canadian treasury yields are now less than the Bank of Canada rate at every point out to 30 years and the yield curve is the most inverted since the 2008 recession. The bond-market believes the BOC's 1.2% growth forecast for 2019 is too optimistic and recession risks are high.



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US Treasury 10-year versus 3-month yield curve (here since 1990) inverted in August to a level which marked the onset of the last two recessions in 2001 and 2007 (red arrows).



Happy September! Back to school or not, may we all keep learning!

Quotes of the month:

“No computer has ever been designed that is ever aware of what it’s doing; but most of the time we aren’t either.” – Marvin Minsky (1927-2016), cognitive scientist focused on artificial intelligence

“According to estimates released by J.P. Morgan in late June, passive strategies now control 60% of U.S. equity assets while quant funds control 20% — a staggering 80% combined. Passive titans Blackrock and Vanguard now oversee \$12 trillion, up from less than \$8 trillion just five years ago. And based on a recent report by Thomson Reuters, algorithmic trading systems are now responsible for 75% of global trading volume.

This development has never been tested by a recession. And evidence continues to mount suggesting the algorithmic and passive transformation of markets will only accelerate and deepen pain.

...Low-volatility stocks [dividend paying] are trading at almost three standard deviations above the mean. That means low-vol is more expensive than it has been nearly 99% of the time, relative to the mean, since 1990,” according to the Leuthold Group.”

— The passive and algorithmic transformation of equity markets could lead to a crisis, April 2018

Don’t forget to visit our blog www.jugglingdynamite.com for daily charts and commentary.