There is no doubt that we are in the midst of an ever-quickening digital revolution and if companies want to succeed, data skills and know how have to be at the heart of that mission. But this doesn't mean firing all your employees and installing hardcore robotics everywhere. Here we take a look at the cutting-edge technologies for data analysis:

- o AI
- o Deep Learning: Neural Networks
- o IoT

SME leaders need to set the example by embracing data, analytics and digital. By doing that, they will enable new ways for their employees to access, collaborate and work which break down silos and drive analytics adoption across their businesses.

They need to have the right tools in place–from easy-to-consume dashboards and self-service solutions to advanced Artificial Intelligence–that deliver intelligence at the point where decisions are being made. That ability starts new conversations and inspires actions across teams.

Artificial Intelligence

Be honest – this is what you think of when you hear the words AI: The Terminator, Skynet, Ex Machina etc…the scary conclusion of teaching machines to think.
Don't Panic! We are still pretty far from a true thinking machine such as those in the media (and nightmares)
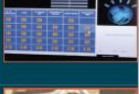
This is the best on the market: Pepper the Robot

Pepper the Robot is programmed to recognise human emotions through facial expressions. It is used in shops and offices to take messages, 'chat' with people and sound notifications. [1]

Timeline of AI Development so far

TIMELINE

1942: Isaac Asimov publishes his three laws of robotics.

1950: Alan Turing creates the Turing test to determine if a machine is intelligent or not.

1956: The term "artificial intelligence" is coined at a Dartmouth College summer conference.

1958: John McCarthy invents LISP to program early AIs.

1966: Joseph Weizenbaum introduces ELIZA, an early natural language processing program.

1968: The movie 2001: A Space Odyssey is released.

1973: "AI winter" begins, a time when interest in, and funding for, research on artificial intelligence is low.

1977: The AI characters C-3PO and R2-D2 appear in Star Wars.

1981: The first commercial expert system is introduced at Digital Equipment Corp. AI winter ends.

1997: Deep Blue beats world chess champion Garry Kasparov.

2002: The Roomba robotic vacuum cleaner is introduced.

2004: The DARPA Grand Challenge, a contest for autonomous vehicles, takes place for the first time.

2011: An AI named Watson wins the game Jeopardy!.

2011: The development of Siri is announced.

2012: The first DARPA Robotics Challenge takes place.

2014: Alexa is introduced.

2014: Chatbot Eugene Goostman claims to have passed the Turing test, but, in reality, does not.

2016: AlphaGo beats world Go champion Lee Sedol.

2017: The Space Robotics Challenge takes place.

2018: A self-driving car hits and kills a person for the first time, causing people to question whether autonomous cars are a wise idea.

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[1] https://www.softbankrobotics.com/emea/index.php/en/pepper

- Some of the biggest players in the AI game are the present giant technology companies: Google, Facebook, Microsoft, Baidu, Alibaba, Amazon, Apple, Tesla, IBM and Deep Mind. But what is AI exactly?
- A recent global consumer survey revealed that only 33 percent of consumers think they use an AI-enabled device or service, while 77 percent actually use AI technology. [2]

What is AI?
Based in Questions:
- Can Computers think?
- Can they learn?
- Will computers ever match the creative and cognitive abilities of the human mind?

Artificial: something designed, created, programmed, made by humans
Intelligence: this is trickier to define.

AI covers a large area of computer science research, which has grown so large that it encompasses many disciplines making it difficult to limit exactly what it is or isn't. For example, Cognitive Computing was once considered part of AI as the goals were so intertwined, but CC has since forked to become its own science.

Simple definition of Merriam-Webster, which defines AI as "the capability of a machine to imitate intelligent human behaviour."[3]

It's a way to program machines or computers to carry out tasks or respond to queries with human intelligence. By taking thousands of data points and setting rules (an algorithm) for the problem-solving process modelled on human neural networks, AI can provide human-like responses.

- When IBM's Deep Blue beat Grandmaster Garry Kasparov in 1997: do you think that this victory meant that Deep Blue was intelligent? Deep Blue had been programmed (by a human) to calculate 200 million possible chess moves a second and had the memory and processing power and speed to calculate billions of move permutations.[4]

- But it only had this one task- in that respect it was an instance of what we now call weak (or narrow) AI. Weak AI is one of the key definitions in data driven learning and analysis. Others are:

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[2] https://articles.bplans.com/how-artificial-intelligence-can-help-small-businesses/
[3] https://www.merriam-webster.com/dictionary/artificial%20intelligence
[4] https://www.scientificamerican.com/article/20-years-after-deep-blue-how-ai-has-advanced-since-conquering-chess/

- Weak AI: Weak AI tends to be machine learning focused on doing one kind of task. Weak AI might also simply be an intelligent algorithm, which is a set of rules a computer follows to solve a problem.

- Strong AI: machine intelligence that follows the same patterns as human learning: end result being the possession of well-rounded human intelligence

- Machine Learning/ Deep Learning: a type of AI where a computer can automatically learn and improve from experience without being programmed. Machine learning is really a series of algorithms that give the computer the ability to learn. An algorithm looks at the data and then makes predictions and decisions based on that information[5]

- Algorithm: a set of steps that are followed to solve a mathematical problem or to complete a computer process.

- Speech Recognition: the ability of a computer to identify human speech and respond to it.

- Natural Language Processing: the ability of a computer to understand human spoken and written language.

- Internet of Things (IoT): the interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data.

The AI Effect:

- occurs when something that is AI becomes such a standard part of our experience that we no longer think of it as AI. For example, speech recognition was once considered an essential part of AI. Today, it seems rather normal.

EVOLUTION THROUGH GAMING

- 1997: IBM's Deep Blue v Garry Kasparov: super computing
- 2011: IBM's WATSON wins Jeopardy
- 2015: AlphaGo beat Fan Hui (1981–), the European Go champion. AlphaGo is an AI designed by DeepMind, a company that is now part of Google. Go is an ancient strategy game invented in China more than 2,500 years ago! The rules are simple. Two players take turns laying down black and white stones on a board. If the stone of one colour is

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[5] https://expertsystem.com/machine-learning-definition/

surrounded by the other colour, the stone is taken prisoner. The player who captures the most prisoners and territory on the board wins. Though it sounds simple, Go is much more complicated than chess. In chess, there are 20 possible opening moves. On a Go board, the first player has 361 possible moves!

- 2017: The newest version of the Go-playing AI, called AlphaGo Zero, learned to play the game just by playing against itself! **Machine Learning**
- Now: IBM's WATSON uses machine learning in the health service to read x-rays **Image Processing**

How does AI differ from Machine Learning?

- AI despite all the rhetoric really boils down to be a computer program or set of algorithms that does something seemingly clever. It can be a simple knowledge based agent with a set of rules: a pile of if-then statements in a procedural program or a complex Bayesian network. [6]

- The consensus and general belief is that Machine learning is a subset of AI. Furthermore, the science builds algorithms that allow machines to learn to perform tasks from data that they process or obtain themselves instead of being explicitly programmed.
- However that definition is somewhat ambiguous as the notion of possession of data begs the question as to its origin for example if we populate the knowledge base in an AI agent with sentences that provide a representation of the world model then that isn't learning or intelligence its simply programming.

- Hence the goals of machine learning is to reduce the amount of predetermined knowledge that is imparted to an agent and to let the agent learn about its environment itself through the continual assessment of the data, the precepts, it receives through its own sensors.

- In the last decade, machine learning has produced a deluge of applied AI applications an extremely limited scope of intelligence – such as software robots, which manifest themselves as chat bots, web bots, interactive voice recognition (IVR) systems, and automated software that perform the high-volume repeat tasks like payroll, accounting, finance, order management, and HR in business and loan, claims and mortgage approvals in commerce.

- Many of us also of us have Siri, Alexa, Google Assistant or similar on our phones or in our homes. These devices store the data we provide them with, analyse it through algorithm-based processes and apply machine learning and simple pattern matching to predict our behaviour: movies, music, we might like etc.

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[6] https://www.scribd.com/book/353907395/Machine-Learning-Adaptive-Behaviour-Through-Experience-Thinking-Machines

- These devices interact with other 'smart' devices through **IOT** sensors: lights, household appliances, watches, cars etc.

- All of the examples in the last paragraph are applied AI or weak AI that uses different techniques for machine learning. Apple's, Siri for example, uses a huge body of speech segments contained in a database, of words it thinks it understands as this was the product of machine learning. Then Siri tries to figure out what you said. It doesn't understand English (or any other natural human language), but it can compare your words against a large set of templates that lead to specific actions. Now that might seem very smart.

- However, Siri is not capable of "learning" how to do new things. It can be extended and expanded, but it will never do something that it wasn't programmed to be able to do. All it can do is figure out which of the things it can do best matches with what it understands you spoke to it. Typically, Siri, Alexa and the other personal assistants tend to use a combination of Natural language processing - the ability to understand human language and converse in it and some Machine learning, which uses an ML algorithm for tasks such as interactive voice recognition (IVR).

Examples – Enterprise using Machine Learning

SonarHome, Poland   https://www.facebook.com/sonarhomepl/
SonarHome is a start-up that works in the iBuying model (instant buying), which allows for quick and convenient sale of apartments. This business is based on the platform, which, thanks to machine learning and Sonar Home analytics, enables quick property valuation. Data about localization, size and legal status are confronted with data from popular Polish real estate services lie OLX or Otodom. After getting the value, the SonaHome representative checks the property and negotiates the final price. Then SonarHome buys the property and prepares it for sale. It charges 6 to 10 percent commission for the service of accelerating the sales process.
Source: Sonar Home. Technologiczny klucz do mieszkań, Forbes , Listopad 2019

Voice Lab AI, POLAND
https://www.voicelab.ai/
Voice Lab AI is a Polish company dealing with the processing and understanding of speech. The company conducts research and development, creating new algorithms based on artificial intelligence.

One of the main investorS in Voice Lab AI underlines the crucial meaning of collecting data in form of conversation. To develop AI which will be able to effectively process and recognize, huge amount of data is needed. The voice recorded from the radio is not enough. To teach the AI to recognize the voice, many hours of conversations are required, which differ in transcription, voice and background noise. To understand the scale of the data, it is worth to mention that Google uses 20 thousand recordings to develop its own system.
Source: Czarno na białym. Rozmowa z Jackiem Kawalcem, Forbes. 01/2020

DEEP LEARNING

- Deep learning is a specific machine learning algorithm which automatically learns features, employing a neural network to do so. It is the application of deep artificial neural networks that contain many layers.
- A **neural network** is called such because at some point in history, computer scientists were trying to model the brain in computer code. The eventual goal is to create an "artificial general intelligence", a program that can learn anything you or I can learn.
- Currently neural networks are very good at performing singular tasks, like classifying images and speech. Unlike the brain, these artificial neural networks have a very strict predefined structure.
- The brain is made up of neurons that talk to each other via electrical and chemical signals (hence the term, neural network). We do not differentiate between these 2 types of signals in artificial neural networks, so from now on we will just say "a" signal is being passed from one neuron to another.
- Signals are passed from one neuron to another via what is called an "action potential". It is a spike in electricity along the cell membrane of a neuron. The interesting thing about action potentials is that either they happen, or they don't. There is no "in between". This is called the "all or nothing" principle.
- Thus, we can think of a neuron being "on" or "off". (i.e. it has an action potential, or it doesn't)
- What does this remind you of? If you said "digital computers", then you would be right!
- Binary classification is perfect for the machine learning algorithm of deep learning.

"Encoded in the large, highly evolve sensory and motor portions of the human brain is a billion years of experience about the nature of the world and how to survive in it.… Abstract thought, though, is a new trick, perhaps less than 100 thousand years old. We have not yet mastered it.

It is not all that intrinsically difficult; it just seems so when we do it." - Hans Moravec, Mind Children (1988)

IoT: Internet of Things – IIOT- Industrial Internet of Things & Big Data

IoT has emerged in as a new trend in the past few years where mobile devices, smart transportation, public facilities and home appliances can all be used as data acquisition equipment in IoT: Devices 'talk' to one another and relay data – geographical, environmental, logistical.

IoT offers a platform for sensors and devices to seamlessly communicate within a smart network enabled environment, enabling information sharing across platforms: a large number of communication devices are embedded into sensor devices in the real world- and these devices sense and transmit data using embedded communication devices: Bluetooth, Wi-Fi, GSM, RFID.
Over 50 Billion devices expected to be connected in 2030 with the big market drivers being: Internet oriented (cloud), sensors, and data management systems (knowledge). [7]

IoT Big data is different from normal big data collected in terms of characteristics because of the various sensors and objects involved during data collection and complications of hardware automation and embedded systems: subject to the physics of the landscape – need for hardware engineering and material science.

However, implementing IoT could have huge benefits for communication and collaboration, particularly in concepts such as Smart Cities, Smart Retail, Smart Ageing or even the Super Connected home.

What is needed is the next generation of big data technologies that can extract the value from the massive volume of data, in various formats, by enabling high-velocity capture, discovery and analysis. In simplified terms this means that the business opportunities lie in: data sources, data analytics, especially real time analytics and presentation of the results – the Management systems and reporting tools for data.

These big data analytics require all sorts of technologies and tools that can transform a large amount of structured, unstructured and semi-structured data into more understandable data and metadata formats for analysis: algorithms are needed to analyse patterns, trends, correlations etc over a variety of time horizons.

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[7] https://news.strategyanalytics.com/press-release/iot-ecosystem/strategy-analytics-internet-things-now-numbers-22-billion-devices-where

Big Data

Analytics
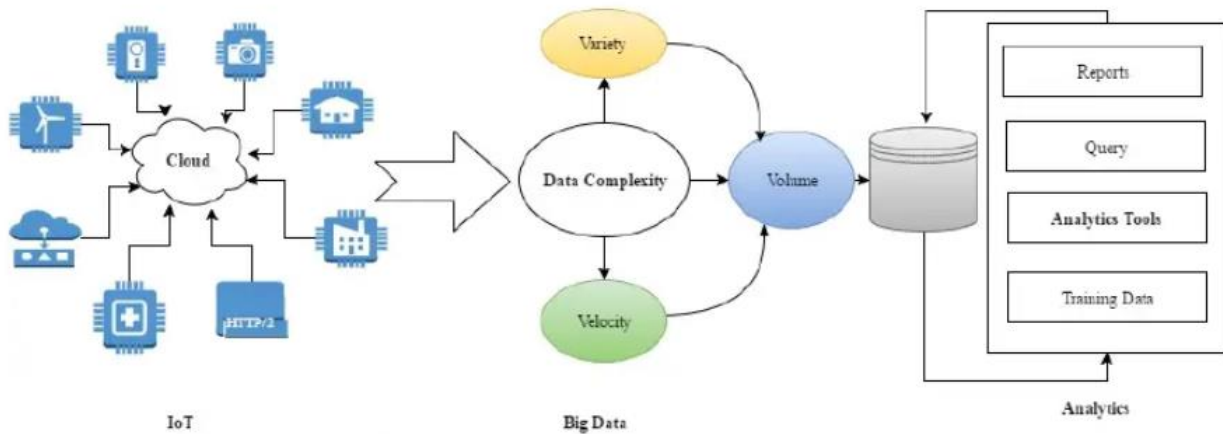
BLOCKCHAIN

What is BlockChain: the buzzword

Blockchain is a technology that can allow individuals and companies to make instantaneous transactions on a network without any middlemen (if they are decentralized). Transactions made on blockchain are completely secure, and, by function of blockchain technology, are kept as a record of what happened. Cryptographic encryption algorithms ensure that no record of a transaction on blockchain can be altered after the fact

Put simply it is a chain of blocks that contain information:
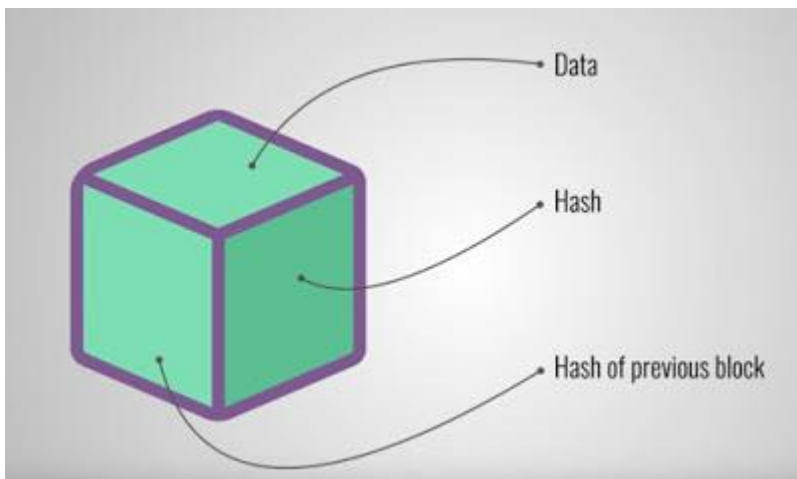
Single Block Structure

A block contains data, its hash, and the hash of the previous block. Now let us get a little deeper in the explanation:

Data: The data stored depends on the type of block. For example with a cryptocurrency it might contain information on the sender, receiver, and the amount of the transaction.

Its hash: Once a block is created the hash is calculated. The hash is unique, basically it is the fingerprint for the block. It identifies both the block and its contents.

Hash: Hash of the previous block.

Chain goes something like this: first block is called a Genesis Block

BLOCK 1	BLOCK 2	BLOCK 3

Hash: 6U9P2
Previous hash:
00000

Hash: 8Y5C9
Previous hash:
6U9P2

Hash: 9L4Z1
Previous hash:
8Y5C9
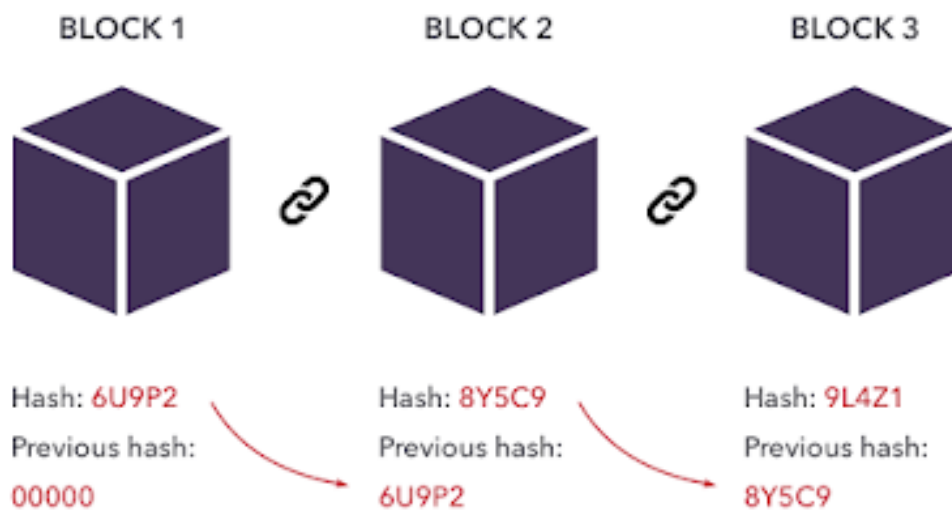
Example of Use:

- Let's say that the lemonade stands in a town are all using blockchain technology to process transactions.
- Say John buys a lemonade from Sandy's lemonade stand. On John's copy of the blockchain, he marks that transaction down: "John bought Lemonade from Sandy, €2." His copy gets spread around town to all the lemonade stands and lemonade buyers, who add this transaction to their own copies. By the time John has finished drinking that

lemonade, everyone's blockchain ledger shows that he bought his lemonade from Sandy for €2.
- **<u>Verification:</u>** In reality, everybody else wasn't just adding his new block of data…. They were verifying it. If his transaction had said, "John bought Lemonade from Rishi, €500," then somebody else would have (automatically!) flagged that transaction. Maybe Rishi isn't an accredited lemonade salesperson in town, or everybody knows that that price is way too high for a single lemonade. Either way, John's copy of the blockchain ledger isn't accepted by everyone, because it doesn't sync up with the rules of their blockchain network.

Key Benefits

Instantaneous: Blockchains built for speed can process and verify transactions more quickly than the alternative systems. This might seem counterintuitive, because the lemonade example makes it sound like everyone has to copy everything that happens to the chain. But in actuality, these transactions can get processed by computers in milliseconds [8]

Transparency: Since everyone in a blockchain network has access to the ledger and the rulebook, nobody involved gets left behind. You can see who owned or paid or gave or did what, at various points in time, whenever you want or need. It's a totally transparent system

Peer-2-Peer (P2P) Security : Communication occurs directly between peers without a central authority or middle man. Since everyone has a copy of the ledger that they use to validate the newest version, it's a democratically secured system, too. There's no single company or agency with extra power. Everyone is in charge

Programmable: The transactions can be programmed. Users can set up algorithms and rules that automatically trigger transactions between nodes.

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[8] https://www.fundera.com/blog/blockchain-explained

How it works:

Someone requests a transaction.

The requested transaction is broadcast to a P2P network consisting of computers, known as nodes.

Validation

The network of nodes Validates the transaction and the user's status using known algorithms.

A verified transaction can involve cryptocurrency, contracts, records, or other information.

Once verified, the transaction is combined with other transactions to create a new block of data for the ledger.

The new block is then added to the existing blockchain, in a way that is permanent and unalterable.

The transaction is complete.

A Basic Blockhain Network

> "Picture a spreadsheet that is duplicated thousands of times across a network of computers. Then imagine that this network is designed to regularly update this spreadsheet and you have a basic understanding of the blockchain."
> BlockGeeks

The information is constantly reconciled into the database, which is stored in multiple locations and updated instantly. That means the records are public and verifiable. Since there's no central location, it harder to hack since the info exists simultaneously in millions of places.

In essence, the blockchain is the particular organisation of hashchains inside another hashchain- the purpose of the external hashchain is to replace the central access point that could be controlled and potentially abused by human interaction.

Real World use

Maersk: Has blockchain based projects for maritime logistics to explore potential cost savings. This is due to the expense of verifying freight documents which is sometimes more costly than the shipping. This expensive process involves over 200 persons that includes agents, government officials, and agencies

DeBeers: Uses the technology to track the import and sale of diamonds.

Farm to Fork traceability: with blockchain technology if something is contaminated you can now destroy specific batches and not everything, which has been the normal practice

How simple AI has been used in Business so far: applications

- Customer Service / Sales
    - Answering basic questions
    - Correct redirecting
    - Automated marketing
    - Upselling
    - Specialised Issue solving is faster
    - Reduce time on phone
    - Autoresponders and contacts
    - Logistics – warehouse management

- Detecting Fraud
    - Area Code Detection
    - Out of Habit detection
    - Falsifying Credentials
    - Facial Recognition
    - Security Threat analysis
    -

- User Data Abstraction
    - Automate meetings
    - Product Failure Predictions
    - Website Lead success
    - Potential Product suggestion

- Predicting Area Failures
    - Machinery repair cycles
    - Nonoptimal production
    - Customer Patterns

- Mass Monitoring
    - Production Output
    - Worker Health
    - Customer Service Speed
    - Acquisition Rates

- Finance Risks
    - ROI Analysis

- Audience Analysis
- Future Working Capital Analysis

- Regulation
  - Built in law books
  - Auto law updates
  - Monitoring made easy
  - Audit Compliance

Future Trends:
- Energy
  - Smart Metering
  - Smart Grid

- Smart Supply Chains
  - Diagnostics – factory equipment
  - JIT Ordering
  - In-transit visibility
  - Customer data
  - Automating price plans

- Smart Transport
  - E-plates
  - Weather monitoring
  - Congestion / smart lights
  - Engine health
  - Driver health

- Smart Agriculture
  - Climate conditions
  - Soil health
  - Plant health
  - Animal Welfare

Benefits of AI for small business

Can demonstrate expansion areas
Customer understanding
Customer Service automation

Rapid improvement
Cheap – only needs data
Data can be sold – addendum (GDPR)
Ai RESULT DATA CAN BE SOLD

Challenges for future tech
- Efficient Teaching + Efficient Learning
- Humans can learn from very few examples
- Machines (in most cases) need thousands/millions of examples
- High accuracy in complex pattern matching tasks is difficult
- Specialised domain expertise needed
- Privacy & Security
- Heterogeneity: different sensors, datasets etc, how do they relate to each other

The next big thing: AR / VR: Augmented Reality & Virtual Reality

Difference between AR and VR

- Augmented reality takes our current reality and adds something to it. It does not move us elsewhere. It simply "augments" our current state of presence, often with clear visors- snapchat filters, Pokemon Go, Google glasses

- Virtual reality is able to transpose the user. In other words, bring us someplace else. Through closed visors or goggles, VR blocks out the room and puts our presence elsewhere – we're talking about those boxy, closed headsets with high resolution displays, lenses and head-tracking sensors. They are designed to visually immerse the wearer in 360-degree videos and computer-generated animation with 3D audio and vibrating or rumbling accessories and controllers to enhance the effect.[9]

[9] https://medium.com/@kavithakavy/what-is-the-difference-between-augmented-reality-ar-and-virtual-reality-vr-23071bc8ff9d

For the things we have to learn before we can do them," wrote Aristotle, "we learn by doing them."

Since 350BC, and probably long before, humankind has recognised the value – and potential contradiction – in "learning by doing". More recently, though, the concept described in Aristotle's Nicomachean Ethics has been bolstered by further scientific evidence.

Last year, a University of Chicago study found that students who physically experience scientific concepts, such as the angular momentum acting on a bicycle wheel spinning on an axel that they're holding, understand them more deeply and also achieve significantly improved scores in tests.[10]

Some organisations and businesses have acknowledged the same underlying principle for a long time. In the aviation industry, for example, flight simulators have been used to train pilots to fly more complicated aircraft for decades. The benefits in terms of safety, cost and learning are obvious, but the characteristics of aviation gave it an advantage that many other industries and many other types of learning haven't been able to enjoy- until now.
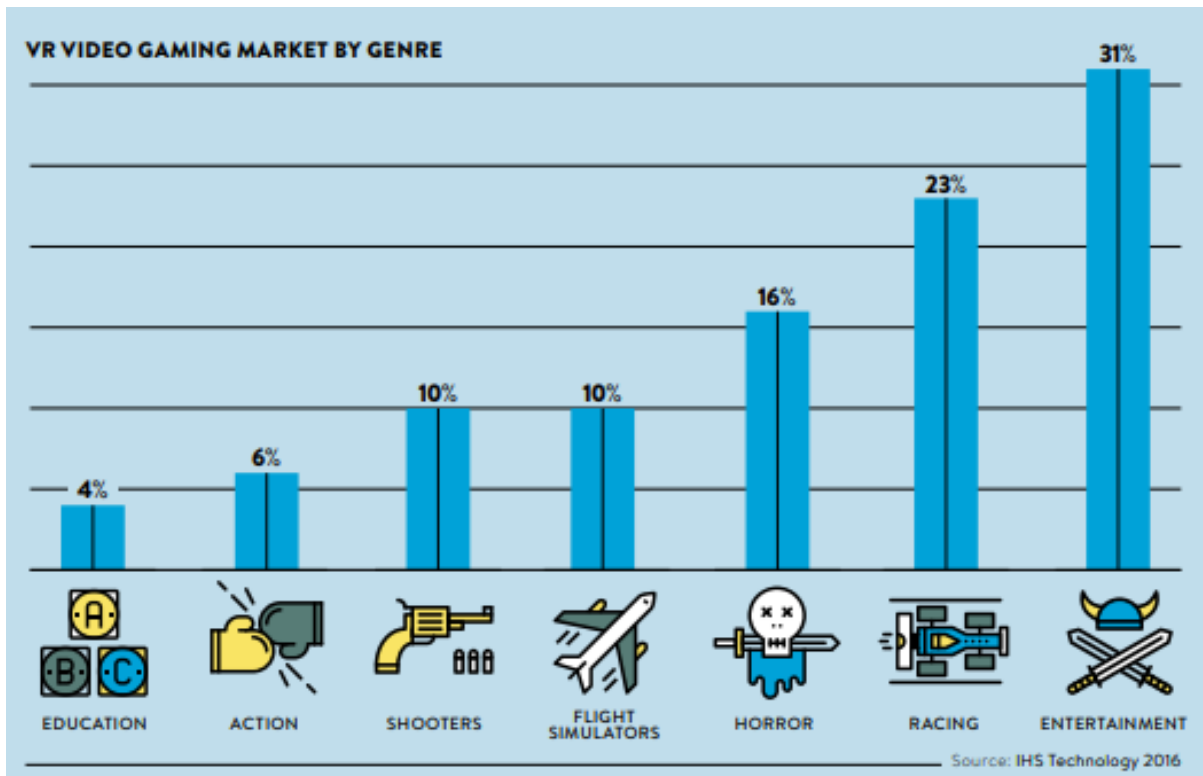
Heralded as the most significant technological innovation since the smartphone, virtual reality is poised to transform our very notions of life and humanity. Though this tech is still in its infancy, to those on the inside, it is the future. VR will change how we work, how we experience entertainment, how we feel pleasure and other emotions, how we see ourselves, and most importantly, how we relate to each other in the real world.

But VR isn't simply a new form of media; it sweeps away the barriers of all previous forms. Reading something on paper, hearing a voicemail, and even watching a YouTube video are all enjoyable, yet they're all limited. Each is a representation of the real thing, but it doesn't actually feel like the real thing at all

VR has grown from that chunky black box into the biggest technological revolution since the smart-
Phone. So far, VR has been dominated by PC accessories – the HTC Vive and Facebook-owned Oculus Rift – which have been in tens of thousands of gamers' houses for six months and Samsung's £80 Gear VR headsets which are powered by Galaxy phones.

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[10] https://news.uchicago.edu/story/learning-doing-helps-students-perform-better-science

VR VIDEO GAMING MARKET BY GENRE

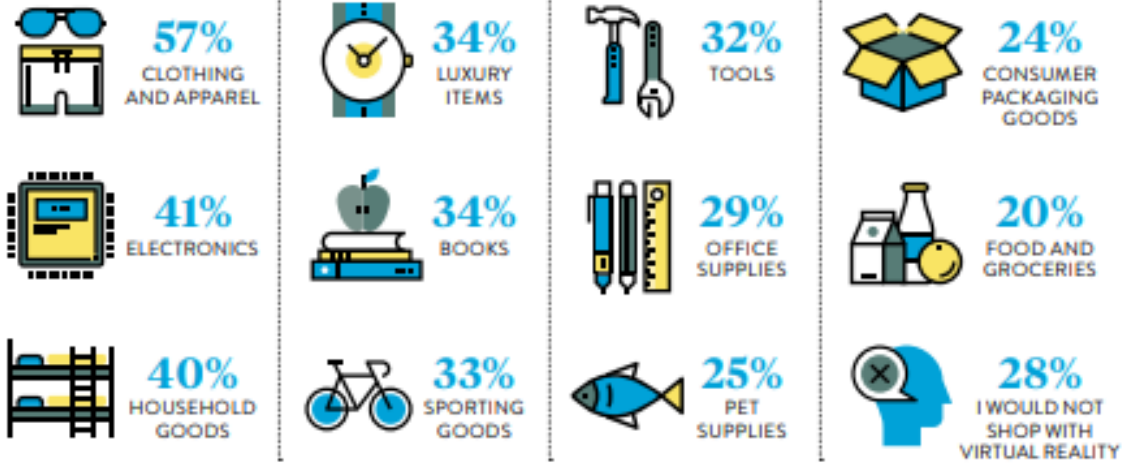| Genre	Percentage
EDUCATION	4%
ACTION	6%
SHOOTERS	10%
FLIGHT SIMULATORS	10%
HORROR	16%
RACING	23%
ENTERTAINMENT	31%

Source: IHS Technology 2016

Being immersed in another environment or viewing digital content over your field of view isn't just disrupting entertainment. Developers and startups continue to explore AR and VR's uses in industry, retail, education, healthcare, therapy and journalism.[11]

While both augmented reality and virtual reality are gaining speed, and are more relevant in our current marketplace than ever before as millions of users hunt Pokemon and Oculus Rift becomes a consumer ready device, they are still more than anything a toy for a small minority of marketers and tech enthusiasts

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[11] https://www.raconteur.net/technology/virtual-and-augmented-reality-are-shaking-up-sectors

PRODUCTS CONSUMERS WOULD CONSIDER SHOPPING FOR VIA VIRTUAL REALITY

57% CLOTHING AND APPAREL

34% LUXURY ITEMS

32% TOOLS

24% CONSUMER PACKAGING GOODS

41% ELECTRONICS

34% BOOKS

29% OFFICE SUPPLIES

20% FOOD AND GROCERIES

40% HOUSEHOLD GOODS

33% SPORTING GOODS

25% PET SUPPLIES

28% I WOULD NOT SHOP WITH VIRTUAL REALITY

Source: Walker Sands 2016

Uses for AR – NOW:
Remote assistance
On the job training
Remote collaborations
Computer assisted tasks
Product maintenance
Knowledge sharing – recording historical task for training
Sales – design

Uses for VR now:
Virtual tours
Point of view training
Gaming

Mini Case Study: VTS Software

VTS is a software company in New York City area that has an innovative platform designed to service the financial sector. The platform serves as a marketplace for banks to display and sell their properties directly to homebuyers and developers. Properties are digitally sold, all initiated by smart contracts and recorded onto a private blockchain.

The platform showcases preset documents and contracts for e-signature, that minimise the back-and-forth follow-up, and simplifies the signing process for banks and home buyers. All documents are recorded and tracked on the blockchain. Users are able to browse profiles and connect with real estate brokers, agents, lawyers, inspectors, and other professionals directly.

Similar to some famous payment systems like PayPal the platform processes on- line payments and transactions. The payments for real estate services and property purchases are powered by smart contracts, then recorded and tracked on their blockchain.

The users are also able to view up-to-date floor plans, property photos, 3D walk- throughs, digital videos and drone shots of the properties. They also receive a secure online wallet. They can store, receive or send digital payments to other users on the platform and all payments are recorded and tracked on their private blockchain. [12]

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[12] Blockchain: Real-World Applications - Wayne Walker