THE FUTURE OF EXPONENTIAL DISRUPTION

UNLIMITED THINKING . EXPONENTIAL POTENTIAL

BY MATTHEW GRIFFIN

ABOUT THE AUTHOR

Matthew Griffin, an award winning futurist and author of the Codex of the Future series, is described as "The Adviser behind the Advisers" and a "Young Kurzweil." Matthew is the Founder of the 311 Institute, a global Futures and Deep Futures advisory, as well as the World Futures Forum and XPotential University, two philanthropic organisations whose mission it is to solve global inequality and the world's greatest challenges.

Regularly featured in the global media, including AP, BBC, CNBC, Discovery, Forbes, Netflix, RT, ViacomCBS, and WIRED, Matthew's ability to identify, track, and explain the impacts of hundreds of exponential emerging technologies and trends on global business, culture, and society, is unparalleled.

Recognised for the past six years as one of the world's foremost futurists, innovation, and strategy experts Matthew is an international advisor and speaker who helps many of the world's most respected brands, governments, investors, and institutions, explore, envision, build, and shape the future of global business, culture, and society.

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A LETTER FROM OUR FOUNDER
MATTHEW GRIFFIN

WE LIVE in extraordinary times, in a world where individuals, organisations, and technology can impact the lives of billions of people and change the world at a speed and scale that would have been unimaginable just twenty years ago.

We also live in a world full of challenges, and a world where all too often negative news gets amplified at the expense of good news, and where tales of hope, inspiration, and positivity get drowned out and lost in the noise. It's no wonder therefore that today more people are more anxious about the future than ever before. And, arguably, a society which believes it's marching towards the darkness, rather than the light, has a poorer future than one that doesn't. Hope, however, is all around us and it's our purpose to light the way so all of us, people and planet, can prosper.

TESTIMONIALS

THANK YOU EVERYONE!

#FUTURENOW

"EXTRAORDINARY!
Peter K., EMEA Managing Director
Accenture

"AMAZING!
Abdessamad K., Head of Derivatives
Bloomberg

"SIMPLY GREAT!
Isaac H., Country Manager
Google

"BLOWN AWAY!
Nicola P., Global Procurement Director
Lego

"EXCEPTIONAL!
Robert D., Global Strategy Director
Qualcomm

"VISIONARY!
Catherine C., Managing Director
WIRED

"ASTOUNDING!
Peter B., COO
Aon

"INSPIRING!
Jay C., CHRO
Dentons

"ESSENTIAL!
Christina L., Director
Her Majesty's Government, UK

"WORLD CLASS!
Ana C., CMO
LinkedIn

"BLOWN AWAY!
Mark R., Director
Willis Towers Watson

OUR
MISSION.

FOR PEOPLE & PLANET: BUILDING A BETTER FUTURE

OUR MISSION is to be a driving force to help solve the world's greatest challenges, help organisations build sustainable and lasting legacies, and democratise access to the future so everyone everywhere, irrespective of their ability or background, can benefit from it.

We do this by surfacing essential future-focused insights and open sourcing our content, by amplifying inspiring stories and voices, and by bringing people together.

OUR
BRANDS.

OUR BRANDS compliment one another and align with our core mission, they include:

311 INSTITUTE

Our **globally renown** Futures and Deep Futures advisory working with the world's most respected brands, governments, and investors to explore, co-create, and shape the future of global business, culture, and society.

WORLD FUTURES FORUM

Our **philanthropic organisation** working with the United Nations and other world leading institutions to find solutions to the world's greatest challenges including all 17 UN SDG.

XPOTENTIAL UNIVERSITY

Our **philanthropic university** working with academia, governments, and regulators to create and deliver accessible future focused curricula and educational content for business executives and students from around the world.

"DISRUPTION HURTS, ESPECIALLY IF YOU'RE NOT THE ONE DOING THE DISRUPTING."

- Matthew Griffin, Founder

311 Institute
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Explore how we prepare our children and society for a future where Science Fiction becomes Science Fact.

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Explore the forces accelerating global disruption and how close we are to disrupting industries in just a day.

THE FUTURE OF INNOVATION AND CREATIVITY.

Explore what happens when creative machines and not humans are the dominant creative force in the world.

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EXPLORE MORE

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Explore the future of gaming and what happens when the simulations become people's new reality.

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Explore the future of smartphones and smartphone formats, and discover what's around the corner.

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Explore the technologies and trends shaping the future of sport and sports performance.

THE FUTURE OF SYNTHETIC CONTENT.

Explore the technologies and trends revolutionisning how content is made and consumed.

CONTENTS

Discover what happens when AI powered Creative Machines innovate in real time.

Learn how to build your own disruptive Exponential Enterprise.

INTRODUCTION

ASK ANYONE from any background from anywhere in the world whether they think the rate of disruption is faster now than it was a decade ago and you'll be very hard pressed to find anyone who doesn't think that today the rate of disruption is faster than ever before.

Furthermore, ask them whether or not they think the rate of disruption will be even faster in another decade's time and again you'll be very hard pressed to find anyone who thinks the rate will be the same or slower than it is today. In short, as fast as the rate of disruption is today, it's still only going to get faster from here on in.

Despite this accelerating rate though what many people don't realise is that as the world becomes increasingly digitised and connected, and as machines become increasingly creative and intelligent, the rate is not just going to accelerate it's going to accelerate exponentially - so much so that we can see a point of time where it will be possible to disrupt entire global industries, from the aerospace industry to the transportation industry, in just a single day.

As improbable and as sci-fi like as that sounds in this codex, along with the other codices in the Codex of the Future Series,

I'll show you not just the exponential technologies we're leveraging and using to achieve this rapid rate of disruption, but also what you can do to prepare yourselves and your companies for what lies ahead. So sit back, grab a pot of molecular coffee, and read on.

Explore more,

MATTHEW GRIFFIN
Founder

TRYING TO decode the future often feels like trying to decrypt some confounding puzzle. There are billions of different possible combinations and outcomes, and trying to use brute force is just a hiding to nothing. However, with access to the right breadth and depth of insights putting the big picture together and forecasting what the future could look like and, perhaps more importantly, when and how it's going to arrive - the What, How, and When of futures forecasting - although difficult certainly isn't impossible.

After all, as they say: The future is often hidden in plain sight. You just have to know where to look.

In order to forecast the future as accurately as is practically possible I do my best to work with what I call full network insights. That is to say I work with the academics, entrepreneurs, governments, inventors, investors, multi-nationals, and regulators who are all in one way or another adopting, building, combining, developing, scaling, testing, or regulating tomorrow's exponential technologies, products, and services, or concepts as I'll call them from here on in.

It's this rich tapestry of contacts, that cuts across every geography and industry, combined with a deep understanding of how hundreds of exponential technologies can be combined together to solve challenging yet valuable problems that, in part at least, helps me to piece together our puzzle with a high level of accuracy and detail. But, as mentioned previously, and to re-iterate the point - it's no easy feat.

In order to decode the future you must look at many different things and connect many different "dots," so it's important to remember that while all the technologies in this codex play a vital role in helping shape the future, and it's important you know and understand them, they're only part of our puzzle.

Inevitably - as I discuss in more detail in the chapter Building Exponential Enterprises - accurately decoding the exponential future relies on your ability to discover valuable problems worth solving, identifying the technology combinations that could be used to innovate solutions to them, and then tracking a host of market forces and metrics that, if they align, could push those concepts mainstream.

Fail to track all of these and forecast out their future and not only will your forecasts be inaccurate but you could miss by miles, and your concepts - if you're building any - could quickly turn

into expensive failures whose potential is never realised.

BACK TO TECHNOLOGY

Switching back to technology, since that's what we're focusing on in this particular codex, with so many different emerging technologies it's inevitable that some of them will compliment each other and that some won't. It'll also be inevitable that some will be more impactful and world changing than others.

Furthermore, when these new technologies do finally emerge from the R&D labs then it's down to you and I, and increasingly our capable synthetic counterparts, the Creative Machines - which I also discuss later - to combine them to create tomorrow's must have concepts.

One of the greatest challenges for analysts, foresight teams, futurists, industry watchers, and investors alike however is the fact that all our dots can be combined in billions of new, unique, and exciting ways to create a limitless number of new concepts, and that seeing through the fog to pinpoint the most likely winners - the ones to bet on and watch closely - can be challenging. Furthermore, as the number of new

technologies and dots increase over time this task only gets more complicated.

Personally, and it's more through experience than by design, I've found that if we are using a tech-first approach then the best way to cut through this fog is to divide the universe in twain. On the one hand we have the promising, individual emerging technologies, and on the other we have the problems they could be used to solve, the new concepts they could be used to create, and the markets.

Evaluating the technologies comes first because unless a specific technology can be bought to market affordably and in the timeline we care about then it follows that it won't get the opportunity to be used to create a concept. In which case we can rule it in or out of our foresight exercise.

Then, once we've filtered them it's a fairly straight forward process of ideating all of the different ways in which they can be combined together to create new concepts which can then be evaluated on their own merits and used to inform our future views.

As you'll see from this codex I've tried to make it easy for you, as easy as it can be under the circumstances, to quickly

Notes:

evaluate the maturity, merits, and status of the hundreds of the exponential technologies I track, after which you should then be able to categorise the ones that you feel are the most relevant to your industry or market, explore them in more detail, and develop a base you can work from as you progress through your forecasting program.

As the pace of change continues to accelerate, as the borders between industries continues to erode, and as science fiction increasingly becomes science fact, the future will belong to those individuals and organisations that have the foresight to see change coming, and who are agile and strong enough to adapt to it, shape it, and lead it.

DECODING EXPONENTIAL DISRUPTION

IF YOU step back a decade or so ago the word on everyone's lips was innovation and, frankly, if you didn't have it thrust into your face at least thirty times a day by every executive or ad man or woman you met then it's likely because you were in a coma. Or dead. Or both.

Fast forward to today and now they have a new buzz word - Disruption. But is disruption today as commonplace and accelerating as quickly as people will have us believe, or is it just hype and a word that executives and eager Silicon Valley startups throw around with impunity in the vain hope of convincing people that they're innovating at the bleeding edge and pushing boundaries?

Well my friend, let's take a journey together. Let's cut through the marketing fog, summit the hype cycle, and crack open an genetically modified beer while we raise cynical eyebrows and take a deeper look at the world that's unfurling around us.

PRIMARY DISRUPTIVE FORCES

DIGITISATION

DECENTRALISATION

DEMONETISATION

DEMOCRATISATION
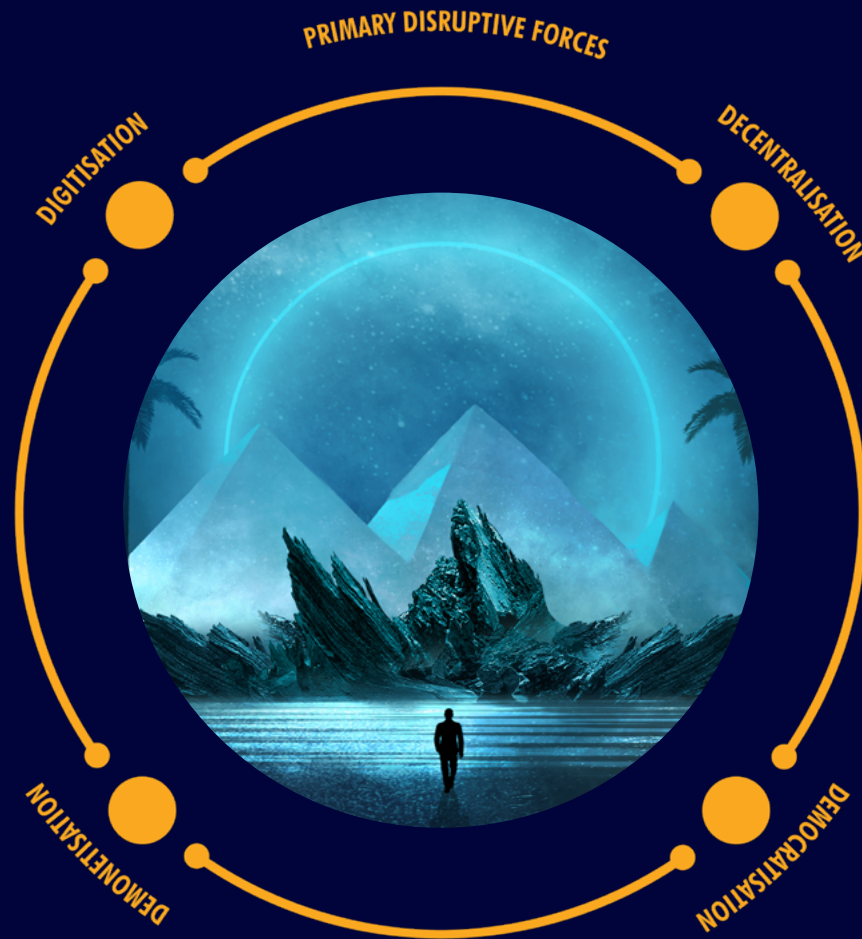
YOU ARE THE MOST POWERFUL YOU HAVE EVER BEEN

The emergence of increasingly powerful exponential technologies that are increasingly decentralised, democratised and demonetised, now means that individuals have more power than ever before to create exponential products that change the world at an increasingly furious rate.

YOUR POWER AND POTENTIAL. MAGNIFIED.

DISRUPTIVE TECHNOLOGIES are nothing new. After all, the wheel was disruptive, and even the humble screwdriver was disruptive in its own right, let alone the myriad of other technologies we could spend a lifetime discussing. But when it comes to discussing the speed and impact that new digital and physical products can have on the world at large today it's very different from the times of old.

Today, for example, it is easier than ever before for a single individual to find problems to solve and innovate, produce, and distribute their products at global scale at a speed that would have been unimaginable even just a decade ago, and in doing so have an out sized impact on the future. However, this is all just the beginning, especially when you then consider that the products themselves are infinitely more capable and powerful than ever as well.

As a consequence of all these factors as all these powerful innovations and technologies become increasingly democratised, decentralised, digitised, and demonetised, in short become cheaper and simpler to access and use, we are also seeing the power that individuals have to transform the world become magnified as well.

The result of all this is that today, and then even more so tomorrow, that not only will the rate of change continue to accelerate, in old fashioned cyclical terms, but that the impact of those individual changes will continue to be magnified as well. The combination of these two factors, especially as they continue to be further amplified and magnified over time, will then have titanic consequences on our society, for better and worse - consequences that, arguably, we're not prepared for.

A POWERFULLY HEALTHY EXAMPLE

In order to demonstrate this point, that individuals can increasingly change industries at global scale for increasingly paltry sums of money, let's run through an example, just one of possible millions.

Traditionally if you'd wanted to give the billions of people on the planet who don't have access to primary or secondary healthcare access to potentially life saving services you would have had to have built out expensive infrastructure and hired professional staff at the cost of many billions of dollars.

Today, however, suitably skilled students can access one of the world's most powerful AI platforms for free, develop an algorithmic model in just a few weeks, integrate it with the camera and sensors on an internet connected smartphone, and now, all of a sudden, you have a smart device that can diagnose everything from ADHD, cancers, and disease, as well as the onset of dementia, diabetes, heart disease, and PTSD for free with above a 90 percent accuracy.

That's revolutionary, and now just think of the impact of that - access to free healthcare, albeit in particular niches for now, anywhere on Earth on tap. And that is just one of the millions examples of how today individuals, not just corporations, are changing the world we live in for the better by using increasingly powerful technologies and tools.

Average United States Industry Disruption Cycle (Years)
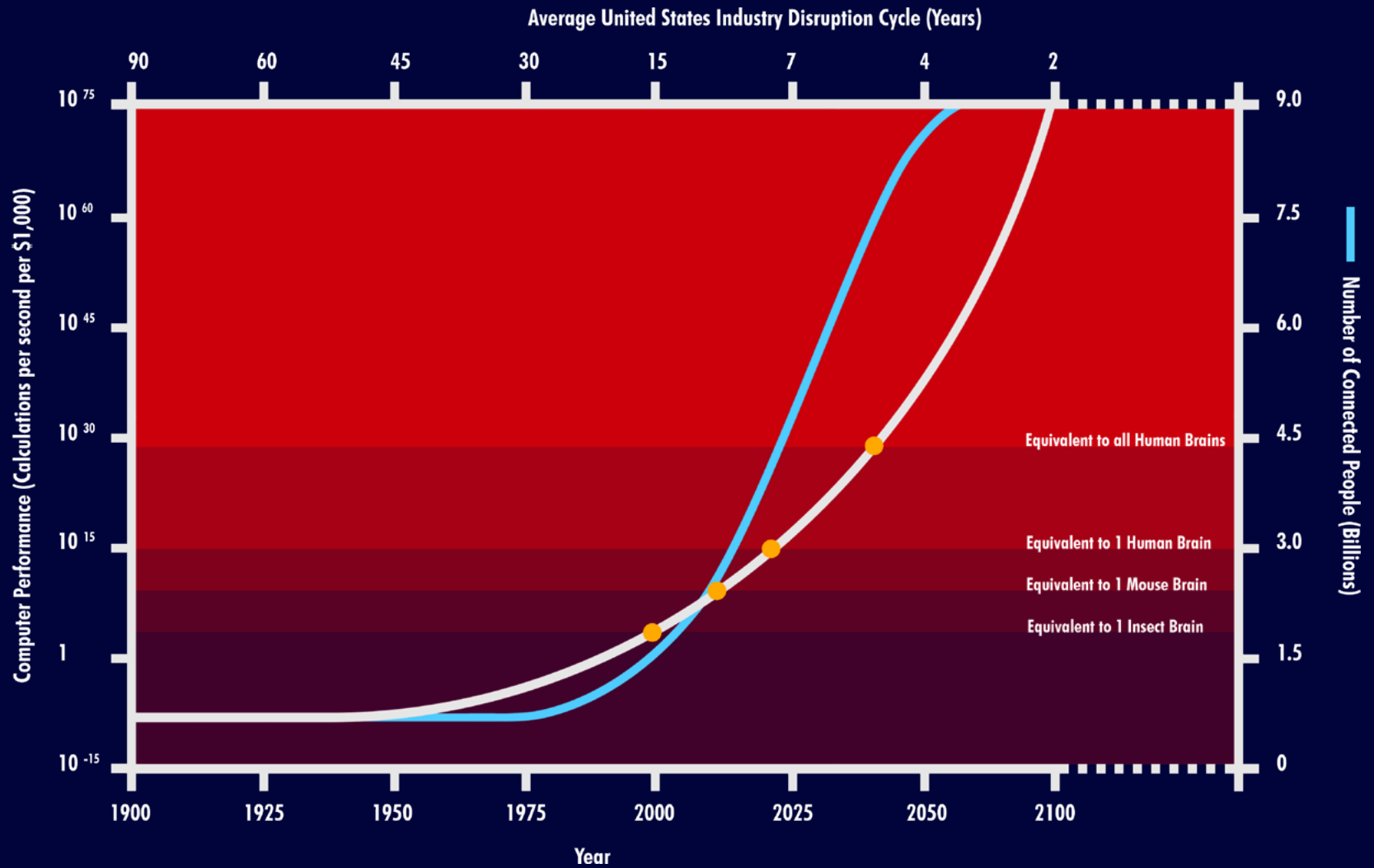
TECHNOLOGY FUELLED DISRUPTION IS ACCELERATING

As increasingly powerful exponential technologies emerge and are democratised, with computing power being just one example, and as the world becomes increasingly digital and connected industry disruption times plummet.

THE ACCELERATING RATE OF DISRUPTION.

THE CORRELATION is obvious, but it's worth discussing nevertheless. If you want to disrupt the status quo, or an individual organisation or industry, it's not just good enough to have the technologies, tools, and resources that you need to bring your idea to life, but you also need to be able to get it into the hands of as many consumers as possible as fast as possible.

Historically when products were predominantly physical, not digital, and the only markets that entrepreneurs had easy access to were local ones, trying to disrupt anything at speed and scale, let alone a global industry, was not only an immense challenge but it also took an inordinately long time and cost a staggering amount of money to achieve. The consequence of this was that ultimately the rate of disruption was quite slow.

Today, however, increasingly digitised products and an increasingly connected society now means it's easier than ever before for entrepreneurs and organisations alike to take their idea global - in the blink of a digital eye.

Just like their forbears though today's entrepreneurs still have to be skilled enough to discover customer frictions and valuable problems worth solving, but unlike their forbears they now have access to technologies, tools, resources and finally markets that are a match for their lofty ambitions.

As a consequence it is now easier than ever before for one individual to disrupt the status quo faster than ever before, and as more of the world's population goes online, and as technologies and tools become even more powerful, this is a trend that is only going to accelerate which is why, over the past century the average time that it takes to disrupt a global industry has fallen from 90 years to just a few years.

However, as we'll see in the next section, soon disrupting a global industry within just a few years will seem slow …

CODEX

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THE FUTURE OF
INNOVATION
AND CREATIVITY

CREATE . BUILD . LAUNCH

TELEPHONES	75 YEARS
CARS	62 YEARS
ELECTRICITY	46 YEARS
CREDIT CARDS	28 YEARS
TELEVISION	22 YEARS
ATMs	18 YEARS
COMPUTERS	14 YEARS
MOBILE PHONES	12 YEARS
INTERNET	7 YEARS
FACEBOOK	4 YEARS
WECHAT	1 YEAR
POKEMON GO	19 DAYS
?	MINUTES . HOURS . DAYS ...

MONTHS: 1 6 12
YEARS: 10 20 30 40 50 60 70 80
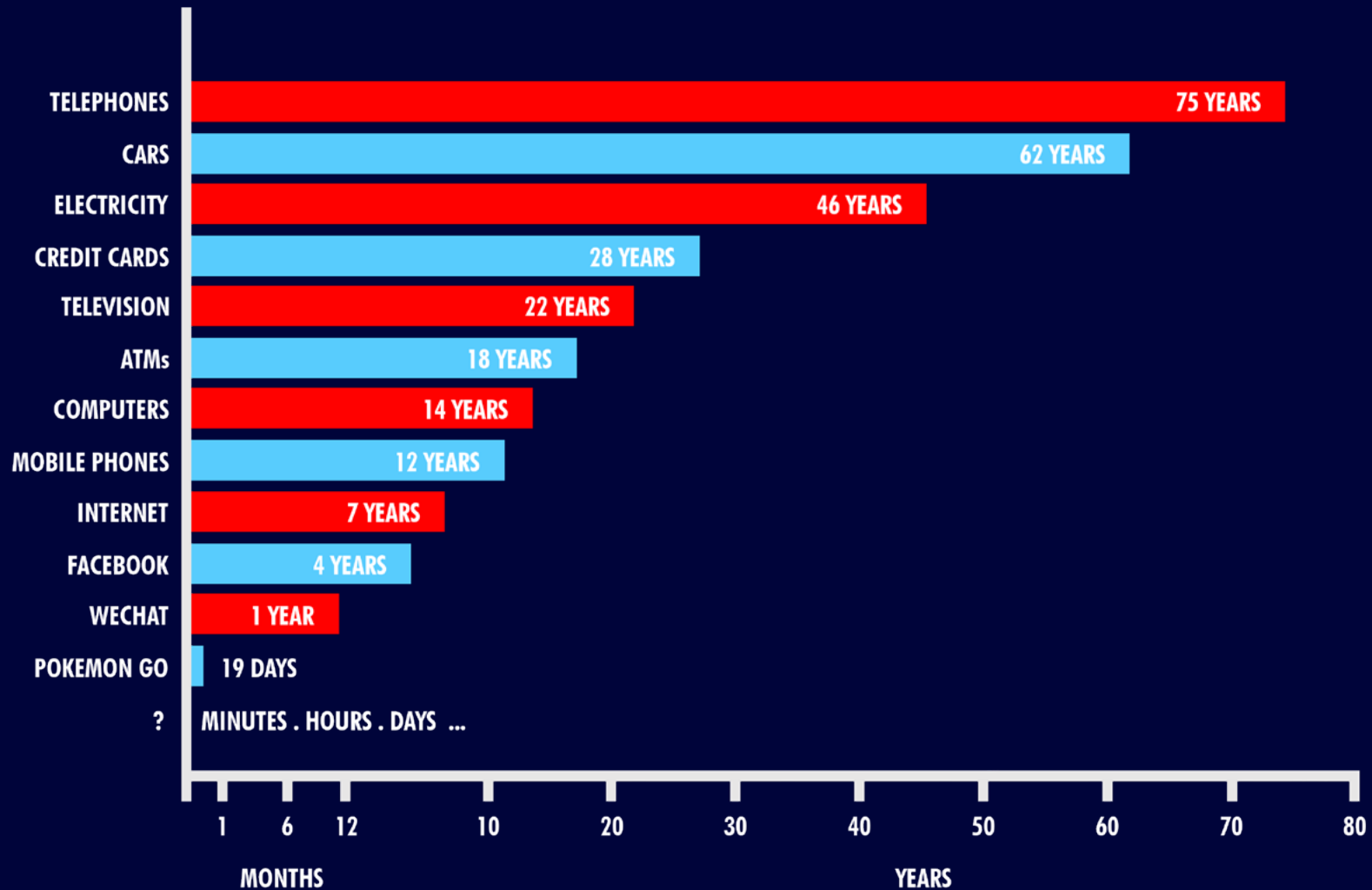
THE TIME TO REACH 50 MILLION USERS DROPS TO HOURS

As industries become increasingly digitised and as the world becomes increasingly connected it's only a matter of time before we see an industry disrupted in a day and a multi-billion dollar enterprise built and launched in hours or minutes - a trend that is further accelerated by the emergence of Creative Machines.

GLOBAL DISRUPTION IN A DAY. EVERY DAY.

TODAY OUR increasingly connected and digital society makes it possible for entrepreneurs and organisations to market, distribute, and sell new products to a global audience at just a fraction of the cost and time that it used to take.

The upshot of this is that new products and services can be adopted and taken up by millions, tens of millions, hundreds of millions, or even billions of people in or near real time which consequently means we have already reached the point in time when global business, culture, and society can be disrupted and transformed in just a single day.

To highlight this point it took 75 years for 50 million people to adopt the telephone. It then took just 19 days for Pokemon Go to hit the same milestone and just 6 days for 100 million people to adopt Call of Duty.

Then, to crown it all and to really drive the point home, when Facebook launched its cryptocurrency Libra in June 2019 had the regulators approved it then in the words of the chairmen of the Bank of England, European Central Bank, People's Bank of China, and the US Federal Reserve, it would have "changed the state's control of money and the global financial system overnight."

Languishing on those statements for a moment, and to put this new disruptive world reality into perspective, Facebook could have launched Libra in the morning and could have had hundreds of millions, and possibly billions of people, using it - their new product - come the evening.

In fact, the only reason why this didn't happen was because the central banks, governments, and regulators didn't trust Facebook. But, as they said at the time, while the organisation behind it was "flawed" the technology and the concept itself was sound.

Accelerating the rate of global disruption in this way is one thing, however, new technologies - Creative Machines - are emerging that let us extend this paradigm to hardware as well and cut the time it takes organisations to go "from concept to shelf," as they say, by up to 99% or more.

THE RISE OF CREATIVE MACHINES

Creative Machines - Artificial Intelligence "machines" that can design and innovate new products in virtual simulation, and then via 3D printing manufacture them in real time on demand - have arrived. And they are already accelerating the rate of hardware innovation by up to 99% or more.

Capable of designing, innovating and producing new digital and physical products, from content and software, to batteries, cars, clothing, computer chips, and pharmaceutical drugs, and much more, in real time Creative Machines are truly game changing.

AUTONOMOUS ORGANISATIONS

But it doesn't end there. Now add in the emergence of fully autonomous organisations and all of a sudden you have an ever accelerating virtuous cycle of disruption - all operating at exponential speed.
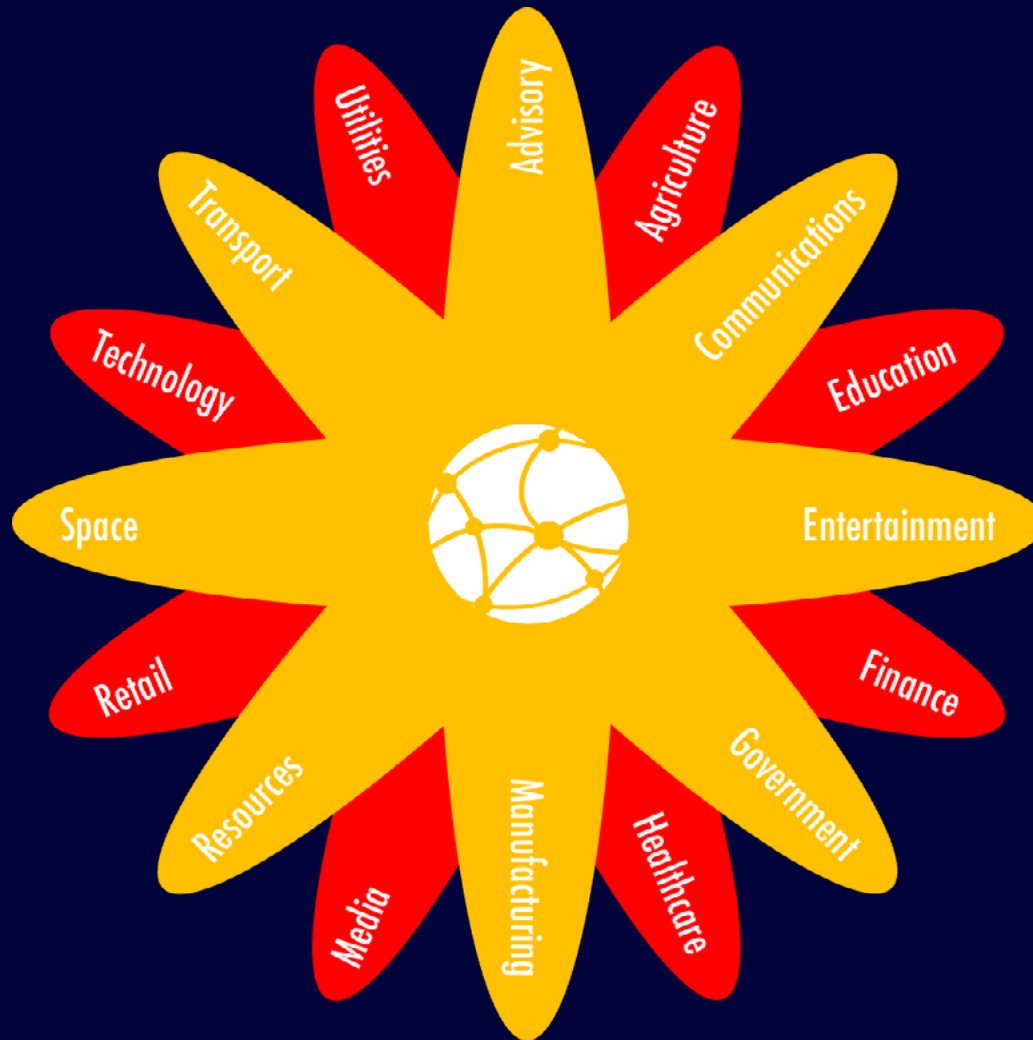
INDUSTRIES WITHOUT BORDERS

All industries are connected with one another and as digitisation erodes the borders that kept them all distinctly separate not only do changes in one affect the others faster but it's also now easier than ever before for organisations in one industry to enter and disrupt other industries, thereby accelerating the overall rate of disruption.

NO MORE INDUSTRY BORDERS.

AS THE global rate of disruption accelerates towards real time, as I've discussed, we have yet another force at play which, in its own way, also helps accelerate the overall rate of disruption.

While it has always been the case that changes in one industry would eventually ripple out and affect other industries, when it comes to accelerating the rate of global and industry disruption digitisation simply adds rocket fuel to the already white hot fire.

As organisations and industries accelerate their own rates of digitisation one of the most significant impacts of digitisation is the erosion of the individual borders and boundaries that previously kept all of these industries separate and distinct from one another.

Today we see this effect manifesting itself time and time again, where companies who've traditionally only operated in one industry sector are now able to branch out easier and faster than ever before to capitalise on market opportunities in other sectors.

The best and most obvious examples of this trend today are in the technology sector where companies in the so called FATBAG collective, or Facebook, Alibaba, Tencent, Baidu, Amazon, and Google, now seem to be able to develop new products and services that cross previously unassailable industry boundaries with impunity.

Amazon, for example, was primarily a E-Tailer, but now the company has interests in everything from finance and healthcare to entertainment. Google meanwhile was originally just an advertising and search engine organisation, but now has interests in everything from communications and energy, to finance, healthcare, and transportation. And so the story goes on for all of the other companies in this collective.

Born in the digital era these so called Digital Natives were unencumbered by the need to produce and sell physical products so their companies were afforded a level of adaptability, agility, and flexibility that their legacy peers, encumbered by physical assets and products, and the associated long development cycles and capital restrictions thereof, simply couldn't match.

Now though those legacy players are spending hundreds of billions of dollars digitising their own organisations and trying to catch them up, and once their transformation programs are complete then they too will be able to move into and disrupt adjacent industries with increasing impunity, and as a result the pace of disruption will accelerate even further.

MEGATRENDS AND STARBURSTS

EVERY YEAR I publish a new Griffin Exponential Technology Starburst and update this codex and the complimentary the 311 Institute Trends Codex that you can download and explore on the following pages - all of which are designed to help you envision, shape, and lead the future.

Today, it's plain for everyone to see that every aspect of global business, culture, and society are being disrupted and transformed faster than ever before thanks to the relentless, and some would say furious, rate of change that's made possible by giant advances in technology and the megatrends it helps create and drive.

As this rate of change accelerates exponentially in time we will see the technologies we think of as powerful today being complimented and superseded by even more powerful and capable exponential technologies - many of which we can see today, circling above us like the stars in the Heavens, just biding their time, waiting to fall to Earth where their impact will be total and irreversible.

While this might not be a surprise though, what might be a surprise is the number of new exponential technologies that are appearing - over 600 by my latest count,

with on average of more than 60 being added every year.

In the right hands every single one of these so called "Blank Slate" technologies, so named because until someone innovates on top of them they are just that - blank slates - has the potential to transform either just a part of our global business, culture, and society or all of it.

As powerful as all these individual technologies are though it's when they're combined - to form what I call "Exponential Combinations" - that the real magic happens and their power to transform everything is magnified many times over.

That future is what I invite you to dive into and explore which is why I've made all this content available to you - so you can join the dots, harness and combine together interesting megatrends and exponential technologies, and use them to envision and shape your own fantastic future.
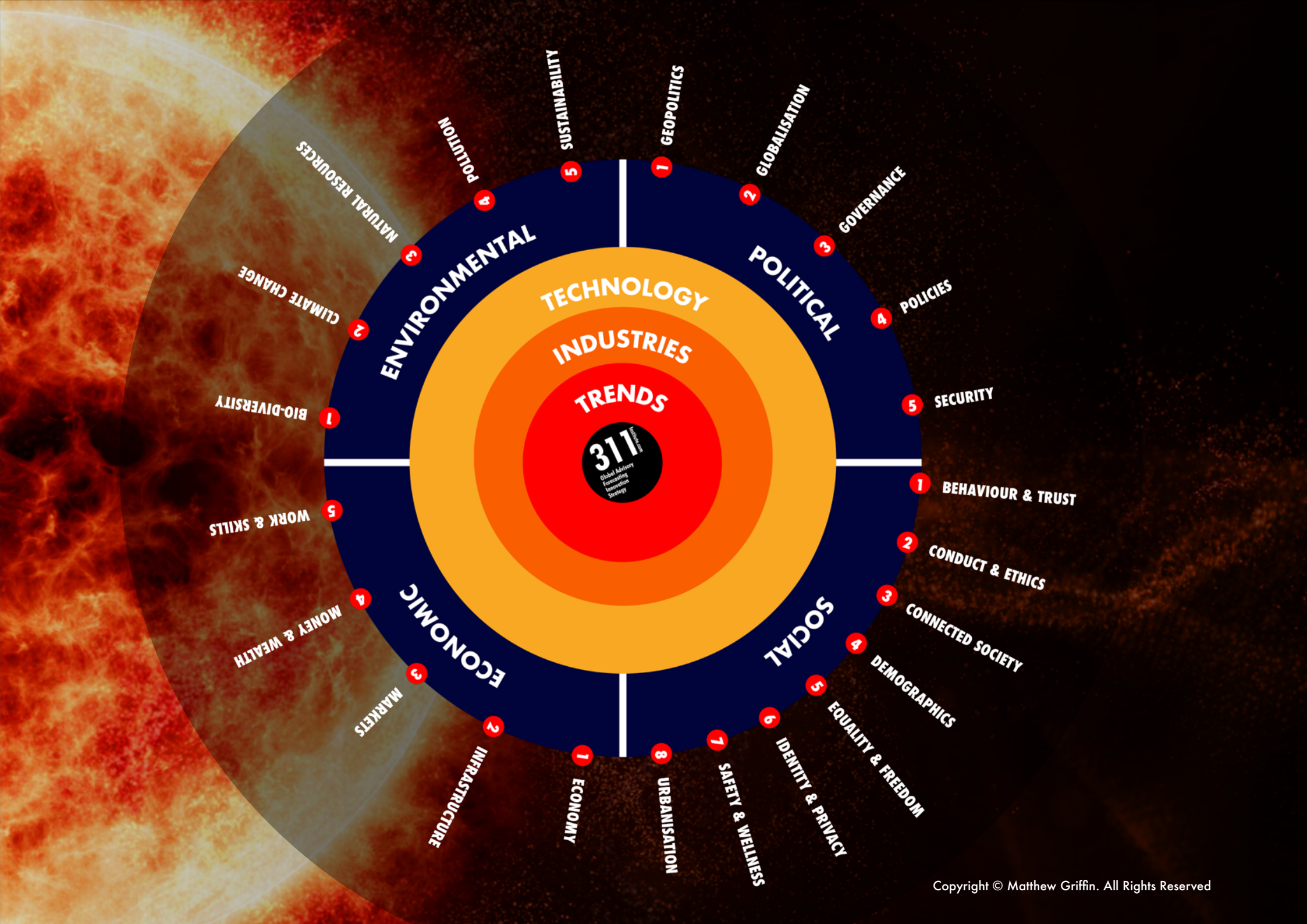
ENVIRONMENTAL
5 SUSTAINABILITY
4 POLLUTION
3 NATURAL RESOURCES
2 CLIMATE CHANGE
1 BIO-DIVERSITY

POLITICAL
1 GEOPOLITICS
2 GLOBALISATION
3 GOVERNANCE
4 POLICIES
5 SECURITY

SOCIAL
1 BEHAVIOUR & TRUST
2 CONDUCT & ETHICS
3 CONNECTED SOCIETY
4 DEMOGRAPHICS
5 EQUALITY & FREEDOM
6 IDENTITY & PRIVACY
7 SAFETY & WELLNESS
8 URBANISATION

ECONOMIC
1 ECONOMY
2 INFRASTRUCTURE
3 MARKETS
4 MONEY & WEALTH
5 WORK & SKILLS

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MEGATRENDS STARCHART AND CODEX

MEGATRENDS ARE powerful, transformative forces, backed by observable and verifiable data, that have the power to shape the future of global business, culture, and society, and they have been shaping the way we live for centuries - just think about the automobile, electricity, or the internet. And they will continue shaping our society until the end of time or human existence - whichever comes sooner.

Examining megatrends and their impacts plays an integral role in helping corporate foresight teams contemplate and envision different versions of the future. They also indicate a general direction of change, and can themselves be comprised of several different trends, with their evolution often being influenced to a degree by their past - although not entirely.

Megatrends are also not surprising - they're often familiar things, changes that are already happening now and that are highly likely to continue happening into the future.

To use an analogy you can think of

megatrends much like you think about the ocean – a large unstoppable force that seems to have a mind of its own and that only seems to travel in one direction despite some of your best efforts to disrupt or divert it. The sea is the megatrend, and if you get caught in it try as best you can to fight against it it's going to sweep you in one direction.

Within this ocean though there are other smaller forces, or microtrends, at work – currents, eddies, and vortexes. And, as the megatrend sweeps you in one overall direction it's often these microtrends that snare you and determine your final eventual destination – your future state.

Trends are just as important as the technologies that help create and drive them, and as part of my mission to democratise access to the future and help you envision, shape, and lead it I created the 311 Trends Codex to compliment the Exponential Technology Codex you're reading right now. And it's yours to download and explore for free ...
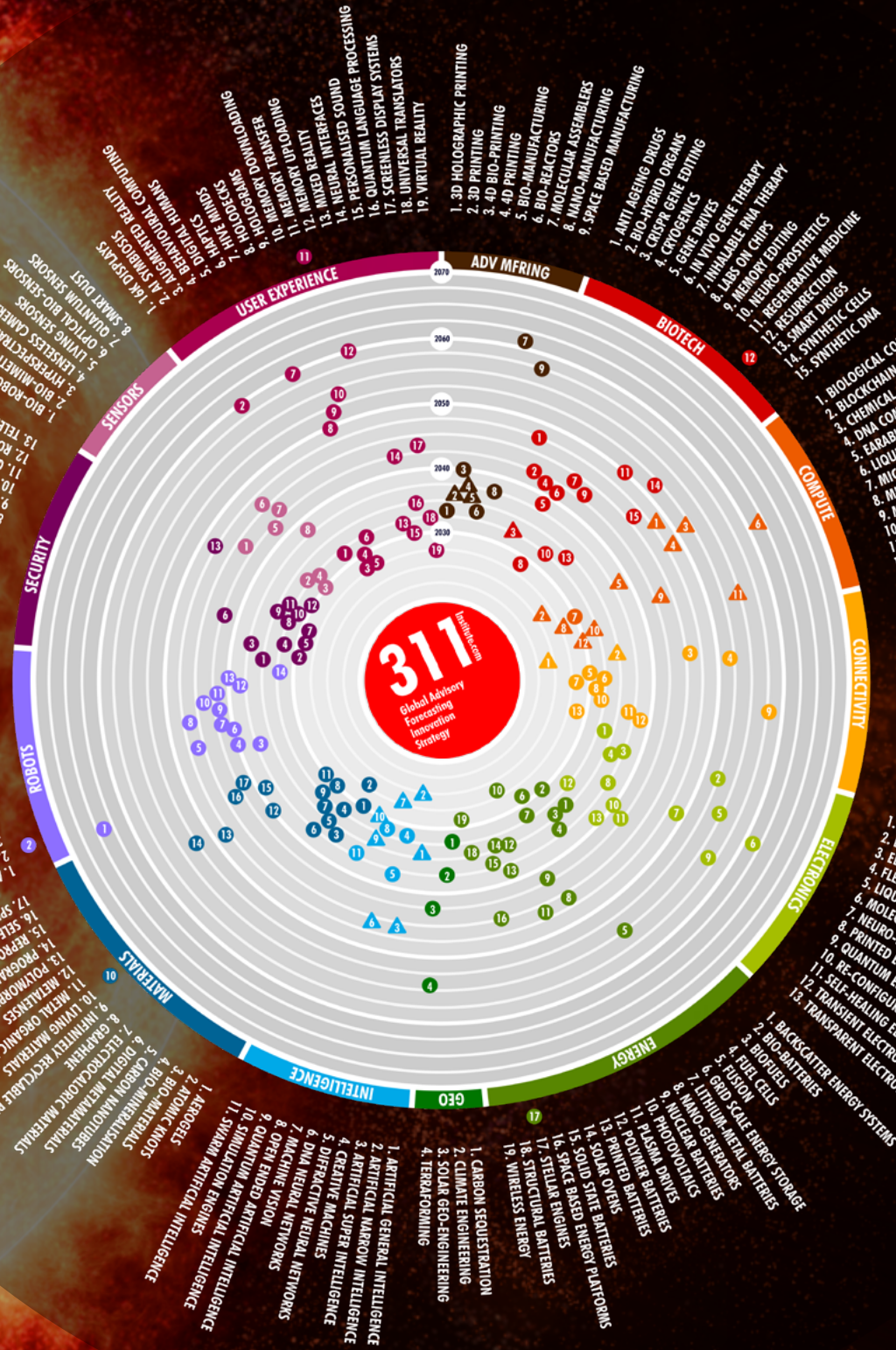
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3. CRISPR GENE EDITING
4. CRYOGENICS
5. GENE DRIVES
6. IN VIVO GENE THERAPY
7. INHALABLE RNA THERAPY
8. LABS ON CHIPS
9. MEMORY EDITING
10. NEURO-PROSTHETICS
11. REGENERATIVE MEDICINE
12. RESURRECTION
13. SMART DRUGS
14. SYNTHETIC CELLS
15. SYNTHETIC DNA

COMPUTE
1. BIOLOGICAL COMPUTING
2. BLOCKCHAIN
3. CHEMICAL COMPUTING
4. DNA COMPUTING
5. EARABLE COMPUTING
6. LIQUID COMPUTING
7. MICROMOTES
8. MINERLESS BLOCKCHAINS
9. MOLECULAR COMPUTING
10. NEUROMORPHIC COMPUTING
11. ORGANIC COMPUTING
12. QUANTUM COMPUTING

CONNECTIVITY
1. 5G
2. 6G
3. BACTERIAL NANO-NETWORKS
4. BODY AREA NETWORKS
5. COGNITIVE RADIO
6. DELAY TOLERANT NETWORKS
7. LOW EARTH ORBIT PLATFORMS
8. LOW POWER WIDE AREA NETWORKS
9. NIL COMMUNICATION
10. PSEUDO SATELLITES
11. QUANTUM COMMUNICATIONS
12. UVF ULTRA LOW FREQUENCY COMMUNICATIONS
13. WIGIG

ELECTRONICS
1. BIO-COMPATIBLE ELECTRONICS
2. BIOLOGICAL ELECTRONICS
3. EDIBLE ELECTRONICS
4. FLEXIBLE ELECTRONICS
5. LIQUID ELECTRONICS
6. MOLECULAR ELECTRONICS
7. NEURO-ELECTRONICS
8. PRINTED ELECTRONICS
9. QUANTUM ELECTRONICS
10. RE-CONFIGURABLE ELECTRONICS
11. SELF-HEALING ELECTRONICS
12. TRANSIENT ELECTRONICS
13. TRANSPARENT ELECTRONICS

ENERGY
1. BACKSCATTER ENERGY SYSTEMS
2. BIO-BATTERIES
3. BIOFUELS
4. FUEL CELLS
5. FUSION
6. GRID SCALE ENERGY STORAGE
7. NANO-GENERATORS
8. NUCLEAR BATTERIES
9. PHOTOVOLTAICS
10. PLASMA DRIVES
11. POLYMER BATTERIES
12. PRINTED BATTERIES
13. SOLAR OVENS
14. SOLID STATE ENERGY PLATFORMS
15. SPACE BASED ENERGY PLATFORMS
16. SOLID STATE BATTERIES
17. STELLAR ENGINES
18. STRUCTURAL BATTERIES
19. WIRELESS ENERGY

GEO
1. CARBON SEQUESTRATION
2. CLIMATE ENGINEERING
3. SOLAR GEO-ENGINEERING
4. TERRAFORMING

INTELLIGENCE
1. ARTIFICIAL INTELLIGENCE
2. ARTIFICIAL GENERAL INTELLIGENCE
3. ARTIFICIAL NARROW INTELLIGENCE
4. ARTIFICIAL SUPER INTELLIGENCE
5. CREATIVE MACHINES
6. DIFFRACTIVE NEURAL NETWORKS
7. DNA NEURAL NETWORKS
8. MACHINE VISION
9. OPEN ENDED
10. QUANTUM ARTIFICIAL INTELLIGENCE
11. SWARM ARTIFICIAL INTELLIGENCE

MATERIALS
1. AEROGELS
2. ATOMIC KNOTS
3. BIO-MINERALISATION
4. CARBON NANOTUBES
5. DIGITAL METAMATERIALS
6. GRAPHENE
7. INTELLIGENT MATERIALS
8. LIVING MATERIALS
9. INFINITELY RECYCLABLE PLASTICS
10. METAL ORGANIC FRAMEWORKS
11. METALENSES
12. POLYMORPHIC LIQUID METALS
13. POLYMORPHIC INKS
14. PROGRAMMABLE MATTER
15. REPROGRAMMABLE MATERIALS
16. SELF-HEALING MATERIALS
17. SPRAY ON MATERIALS

ROBOTS
1. ANDROIDS
2. CYBORGS
3. BIO-HYBRID ROBOTS
4. DNA ROBOTS
5. EVOLUTIONARY ROBOTICS
6. EXO SUITS
7. GENERAL PURPOSE ROBOTS
8. LIVING ROBOTS
9. MOLECULAR ROBOTS
10. NANO-MACHINES
11. NEUROBIOTICS
12. SHAPE SHIFTING ROBOTS
13. SOFT ROBOTS
14. SWARM ROBOTICS

SECURITY
1. ANTI-CRISPR TECHNOLOGY
2. ARTIFICIAL IMMUNE SYSTEMS
3. CYBER-BIOSECURITY
4. HACKPROOF CODE
5. HOMOMORPHIC ENCRYPTION
6. MORPHEUS COMPUTING PLATFORM
7. NEURAL NETWORK WATERMARKING
8. ONE TIME PROGRAMS
9. POST QUANTUM CRYPTOGRAPHY
10. QUANTUM CRYPTOGRAPHY
11. QUANTUM SAFE BLOCKCHAINS
12. ROBO-HACKERS
13. TELEPATHIC CYBER DEFENCE

SENSORS
1. BIO-ROBOTIC SENSORS
2. BIO-MIMETIC SENSORS
3. HYPERSPECTRAL SENSORS
4. LENSLESS CAMERAS
5. LIVING SENSORS
6. OPTICAL BIO-SENSORS
7. QUANTUM SENSORS
8. SMART DUST

USER EXPERIENCE
1. 16K DISPLAYS
2. AI SYMBIOSIS
3. AUGMENTED REALITY
4. BEHAVIOURAL COMPUTING
5. DIGITAL HUMANS
6. HAPTICS
7. HOLODECKS
8. HOLOGRAM DOWNLOADING
9. HOLOGRAMS
10. MEMORY TRANSFER
11. MEMORY UPLOADING
12. NANO LITHER-GENE
13. NEURAL INTERFACES
14. PERSONALISED SOUND
15. QUANTUM LANGUAGE PROCESSING
16. SCREENLESS DISPLAY SYSTEMS
17. UNIVERSAL TRANSLATORS
18. VIRTUAL REALITY

Legend:
- ● Estimated Wide Spread Use
- ▲ General Purpose Technology

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GRIFFIN EXPONENTIAL TECHNOLOGY STARBURST

THIS YEARS Griffin Exponential Technology Starburst timeline spans the next fifty years and tracks the development of 167 of the most significant emerging exponential technologies across 13 major categories.

together to help you meet new market needs and solve problems, create next generation customer experiences, as well as new products and services, and make our world a better and fairer place for everyone.

"SEE THE NEXT 50 YEARS OF TECHNOLOGY."

It also visualises 24 General Purpose Technologies which will drive and accelerate continuous innovation and disruption across entire economies and sectors and, needless to say, you can find every exponential technology listed on this year's Starburst, as well as previous years Starbursts, covered in detail in this codex.

Collectively these technologies will disrupt and transform every corner of global business, culture, and society, at an accelerating rate. Consequently, I strongly suggest you and your organisation's stakeholders explore them in depth, and more importantly, understand how they can be combined

CODEX

FREE DOWNLOAD

EXPONENTIAL TECHNOLOGY CODEX

EXPLORE EXPONENTIAL TECHNOLOGIES

EXPONENTIAL IMPACT

HUMANITY'S STORY is one that is inextricably intertwined with technology, in all its forms, from, for example, the early railways that connected our early cities to the telegraph lines that connected our early communities. But, as generations came and went the memory of the power and impact of these early exponential technologies faded, and now they're consigned to the history books and museums as relics of the past.

However, while our memories of those early technologies might have faded their legacies live on, and today the transformative power of the descendants of these and other exponential technologies have become even more impactful, and they're transforming our world in new previously unimaginable ways at an accelerating rate.

The telegraph, for example, was replaced by faster more convenient fixed line telephone systems, which in time were themselves usurped by faster, superior mobile communications technologies.

First came 1G, then 2G, 3G, 4G, and now 5G, and just eight generations on from the original telegraph system that connected people using mechanical clicks and whirs our world lives online, and

FORGET ABOUT EXPONENTIAL TECHNOLOGIES ...

... THINK INSTEAD EXPONENTIAL COMBINATIONS!

people have embraced a new type of clicks, and communicate and experience life in bits and bytes in a world where science fiction is increasingly difficult to differentiate from science fact.

However, the transformations we've witnessed over the centuries aren't thanks to the development of any single technology, they're the result of many technologies all working in combination with one another, and this is why individuals, as well as enterprises, must move away from today's rather siloed thinking where we tend to talk and think about the impact and opportunities of singular technologies, and instead think about the impact and opportunities of "Exponential Combinations."

After all, even today's most powerful exponential technologies are simply blank slates that themselves rely on the development of a host of other exponential technologies, as well as an army of human and increasingly machine based entrepreneurs, that prod, shape and combine them to create new amazing concepts, to drive their development and eventual adoption.

It's these combinations, of not tens, but hundreds of exponential technologies, like the ones displayed on my Starbursts, that enable us to transform every corner

of society, from the way we live our lives and how long we live, to where and how we work.

Furthermore, thanks to technologies such as those I mentioned earlier, communities and individuals that were once limited by connectivity and distance now all have increasingly easy and low cost access to a single "global brain" and global resources that can help even the most modest among us transform the world in new and exciting ways, and as these technologies become increasingly digitised and democratised the speed and impact of that transformation, as I also discussed in earlier chapters, will only increase from here.

TECHNOLOGY IS JUST A BLANK SLATE...

AND... EVERY TECHNOLOGY HAS TWO SIDES.

GOOD
DYSTOPIA
UTOPIA
EVIL

TECHNOLOGY IS A BLANK SLATE...

AS WIDE ranging and as powerful as all the exponential technologies that I discuss in this codex are though the fact remains that until someone uses them and combines them together to innovate new products and services they're all just shelfware - blank slates, and technologies without a purpose.

Every technology is a blank slate that can be used for both good or bad purposes. It's down to us to develop and use them in ethical and moral ways that benefit society.

Furthermore, as these exponential technologies and the products and services they can be used to create become more powerful they then give us a moral and ethical dilemma because, just as they can all be used to do great good and benefit society, in the wrong hands they can also be weaponised and cause great harm in a huge variety of ways - many of which we have yet to even imagine.

Take, for example, Artificial Intelligence. On the one hand it has the power to revolutionise healthcare, identify, treat and cure disease in new ways, and discover new powerful drugs and vaccines, but on the other it's also already being weaponised to create a new generation of Robo-Hackers that can hack and exploit vulnerabilities in critical computer systems hundreds of millions of times faster than human hackers, and that's before we discuss how it's also being used to generate fake content and fake news that undermines our trust in one another and democracy.

These world changing examples are just the snowflake on the tip of the giant melting iceberg, and an example of what good and bad actors alike can do with just a single powerful technology. But there are billions of other examples I could use, including our ability to save lives by using drones to deliver critical first aid supplies including blood and medicines to remote areas, or spray crowds with bullets from drone mounted machine guns.

While this is where I'm going to leave it for now I can spin similar examples and stories for every exponential technology which is why it is absolutely vital that as organisations and governments, as leaders and individuals, and as a global society we do our utmost to understand the pros and cons of these technologies and work together to maximise the upsides while doing our best to mitigate, regulate and police the downsides

THE ERA OF CREATIVE MACHINES

WE CAN now see a day when Creative Machines, either autonomously or in unison with humans, will be able to design, innovate, and mass produce new digital content, and new digital and physical products, in real time and on demand at global scale. And while this reality is already here and being leveraged by companies, to some extent, given the inter-connectedness of our society it's no small leap to say that these machines will, sooner than later, revolutionise every corner of global culture, industry, and society, and forever change how we create and innovate products from A to Z - from AI software and Augmented Reality gaming arenas to Zebra burgers made from lab produced meats, and way beyond.

A NEW NARRATIVE

Machines can never be creative. And machines can never innovate or be innovators. That's been the false narrative spun by analysts and experts alike over the past few decades. It's also a narrative that, at best, has been counter balanced by analysts and experts elsewhere who have spun the narrative that posits when, not if, machines are capable or creativity and innovation then that time will be a long time coming with the average estimate being that these so called Creative Machines arrive in the year 2035.

However, as any of you who have ever watched my keynotes or read my blog know, firstly never say never, and secondly, remember that everything is accelerating exponentially. Needless to say, not only is it possible for machines to be creative and innovative, but they're already here, and ironically they're here because of our own insanely brilliant human creativity and inventiveness.

There is an important point to highlight here though. While today's Creative Machines can all innovate and produce a wide variety of different types of content and products how they innovate them isn't too dissimilar from how we humans do it, except for the fact that at this point in time their process is much more logical and data driven rather than emotional or empathetic.

As a species humans have long been of the opinion that what sets us asides from all other living things on this blue planet of ours is our seemingly unique ability to create and innovate new products and tools - including technologies. But what all the aforementioned analysts and experts seem to have forgotten is that creativity, without entering into a theological debate about the act of

Notes:

creation or the soul, is subjective, and innovation is merely a process - a process that can be broken down and replicated in algorithmic form and embedded into a machine.

INNOVATION AS A PROCESS

Today Creative Machines are only capable of iterative innovation and not Primary or Disruptive innovation, yet, so just to drive home the point that most innovation is a process, asides from all of the innovation methodologies that lay it out as a process, if I asked you to reduce the weight of a cup by half, which is a simple example of iterative innovation, in your head you're already going through a series of, albeit complex, mental steps and weighing them all against the desired objective. And here's the magic, here's how we now create our own Creative Machines.

If I can understand what those individual process steps are and their consequences and outcomes then, with some data science magic, I can convert them into an algorithm - a Creative Machine. Furthermore, the more complex the algorithms and models are the more capable these Creative machines become and the better able they are to design and innovate increasingly sophisticated

products, whether it be new movies or interplanetary rovers, or new drugs or even new AI's and robots.

A CROWD OF MACHINES

There's more to developing Creative Machines than you might imagine though because it's not simply enough for these machines to be good at or to be competent in one discipline or one skill. They have to be competent in many different disciplines and skills, and the best way to explain this is by using an example.

A Creative Machine that's been tasked with generating a piece of new Synthetic Video content will need to have a grasp of atmosphere, context, flow, human emotions, natural language, perspective, scripts, tempo, tone, and much more, as I'll discuss in later chapters.

Meanwhile a Creative Machine that's been tasked with creating a new physical product, for example, will perhaps need to have a grasp of bio-mechanics, context, design thinking, durability, function, materials science, manufacturing processes, physics, reliability, supportability, usability, and, again, much more.

In short, just like we humans, in order to master their respective "trades" these creative machines have to be well rounded, be well versed in multiple disciplines, and then be able to intelligently combine all of these disciplines together within the context of the task in order to achieve their desired objective. And that's what researchers around the world have been developing, and that's what we're going to explore in more detail in this Codex.

Concentric circles (from outer to inner):
- BEHAVIOURAL USER INTERFACES
- SYNTHETIC AUDIO
- SYNTHETIC WORLDS
- SYNTHETIC INNOVATION PLATFORMS

Surrounding labels:
- SYNTHETIC VIDEO
- SYNTHETIC IMAGERY
- SYNTHETIC TEXT

Orbiting element:
- ORBITING COMPLIMENTARY TECHNOLOGIES ...
- ADVANCED MANUFACTURING TECHNOLOGIES
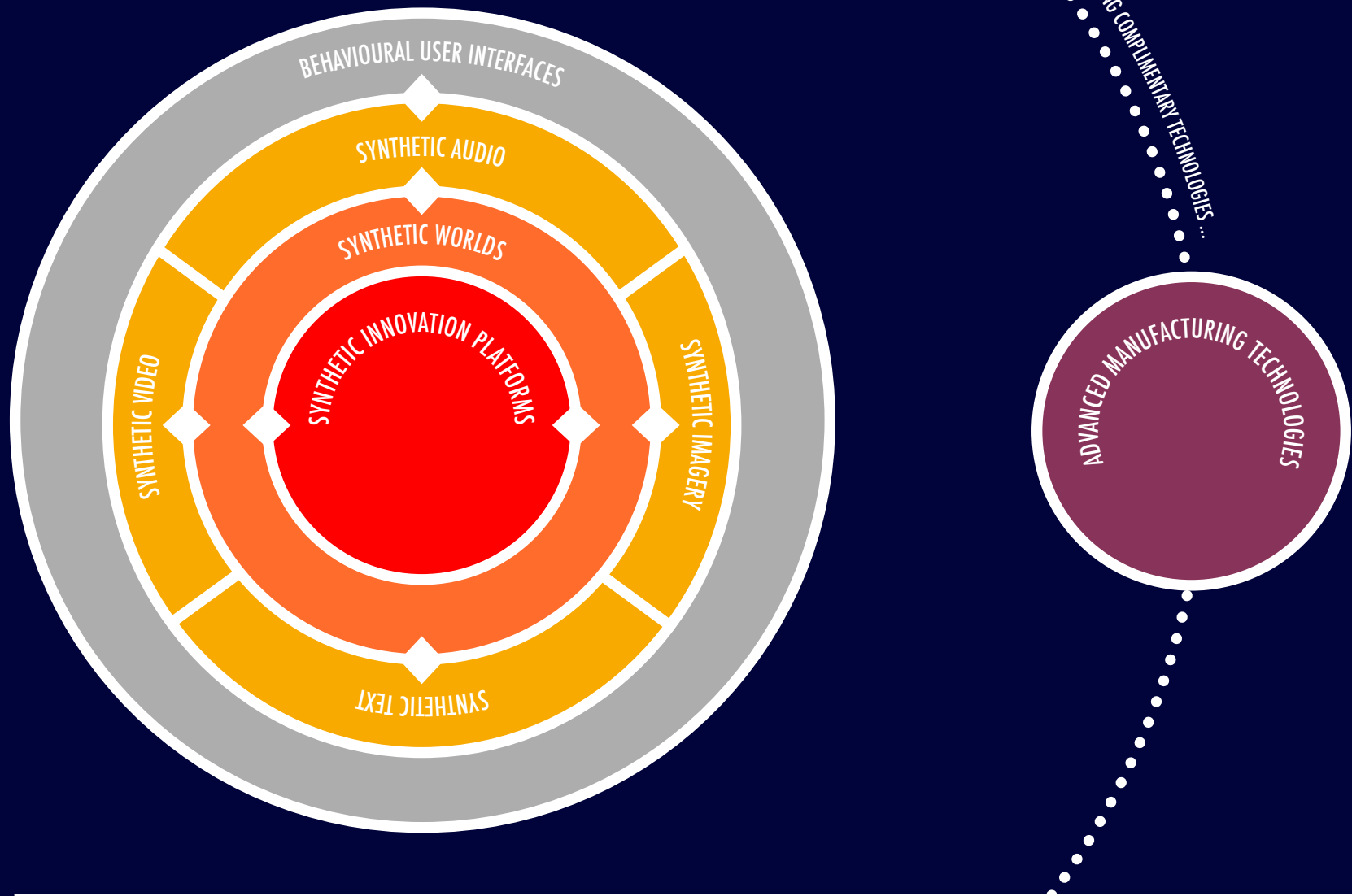
EVERY TECHNOLOGY ACCELERATES THE OTHER

These technologies, whether they are used to generate synthetic audio, imagery, text, video, or Synthetic Worlds, will disrupt the entire global content industry - from the production of art, books, games, and movies, to Virtual Influencers and VR. They also compliment one another and accelerate each others development, including the development of Synthetic Worlds which Synthetic Innovation platforms will use to virtually innovate, model, and test new product concepts at speed.

MULTIPLE FORCE MULTIPLIERS.

WHEN THINKING about how to harness the potential of these Creative Machines, that can arguably create and innovate anything, for maximum advantage and impact, whether you're interested in machines that can innovate new content in all it's forms, from audio, imagery, text, and video, to Synthetic Worlds, or machines that can innovate new digital and physical products you should also think about what happens when you combine those powerful exponential tools with other powerful exponential technologies because this is where you really unlock their true potential.

For example, combine these Creative Machines with 3D and 4D printers and you now have a way to innovate and produce products in real time and on demand at a rate and speed that was previously unimaginable.

Furthermore, not only does this mean you can dramatically reduce your time to market by multiples, but it could also have a dramatic impact on your business model, go to market, and open up a wealth of new opportunities you'd never dreamt of before - all this is only possible though because there have been multiple developments in multiple technology disciplines in the field that are now becoming mature enough for companies and researchers to integrate together to create increasingly capable and usable creative machines.

TECHNOLOGY COMBINATIONS

When you look at the diagram to the left you will see six distinct technology categories that each, within their own right, will transform the world and revolutionise how we create content and products. All that said though, and as impactful as they all are, when they're combined together that impact is multiplied thousands fold, if not more.

For example, Synthetic Text generators can write authentic news articles, novels, research papers, and scripts, for starters, with the obvious implications on industry and society.

When integrated into Synthetic Video generators though all of a sudden these generators, these machines, can write the script for a movie and then the Synthetic Video generator can use that input to auto-generate the corresponding movie.

Combine the same Synthetic Text generators with Synthetic Image generators and you now have a way to convert text into imagery. Combine them with Synthetic Audio generators and now you have a way to create music with lyrics and human vocals. And so we can keep going through the wheel, so try thinking about the potential of these combinations for yourself.

Furthermore, and diving further into the wormhole, by combining all these generators together we then use them to create increasingly sophisticated and realistic synthetic virtual worlds that on the one hand could become new Virtual Reality game environments, as well as even movie sets, as we recently saw with the production of Disney's Lion King, but that also become the ideal digital environments that let Synthetic Innovation platforms design, model, test, and then train and evolve their new product concepts at extreme, or "digital" speed.

ORBITING COMPLIMENTARY TECHNOLOGIES ...

BEHAVIOURAL USER INTERFACES

SYNTHETIC AUDIO

SYNTHETIC WORLDS

SYNTHETIC INNOVATION PLATFORMS

SYNTHETIC VIDEO

SYNTHETIC IMAGERY

SYNTHETIC TEXT
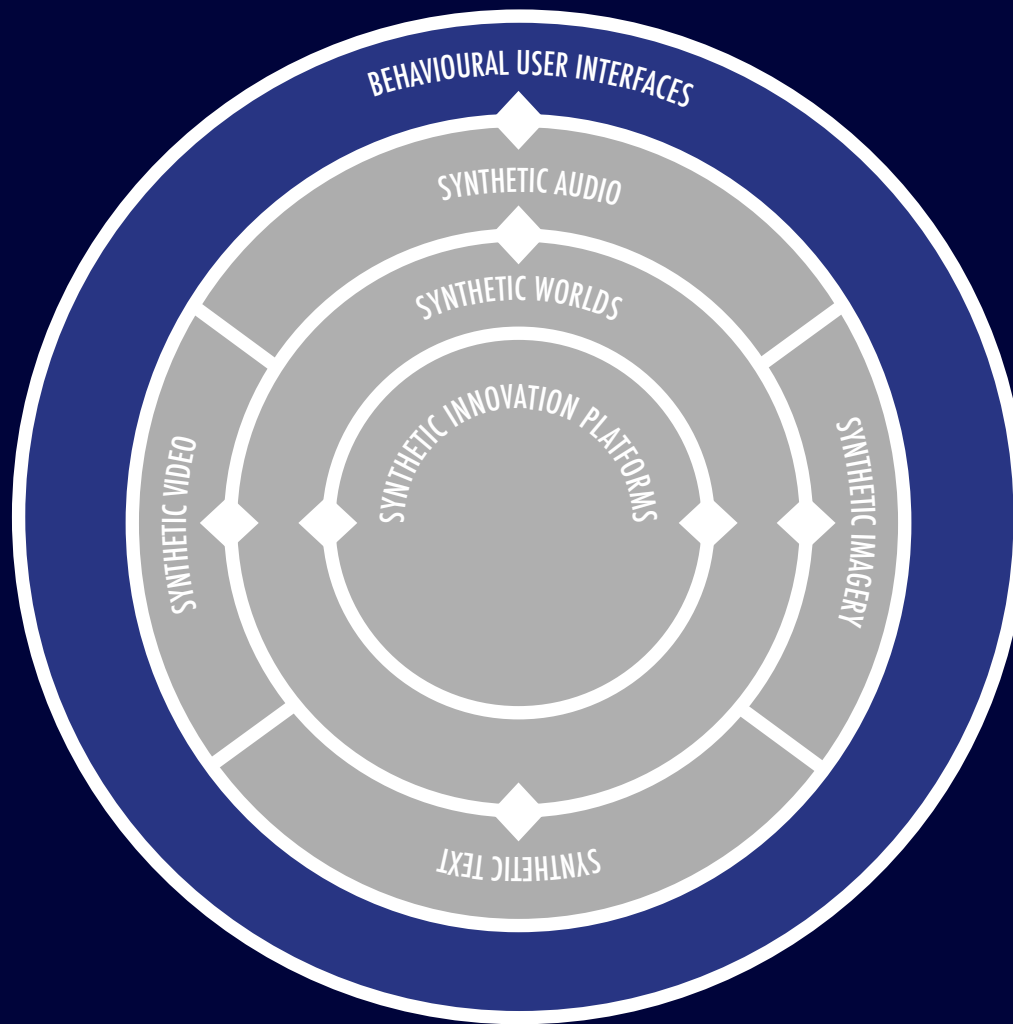
ADVANCED MANUFACTURING TECHNOLOGIES

UNLOCKING CREATIVITY AND INNOVATION FOR ALL

As Creative Machines become increasingly advanced behavioural user interfaces will let everyone with a smartphone and an internet connection tap into their power using just their voice, as well as a variety of other means. In short, these behavioural user interfaces will be the secret ingredient that democratise access to creativity and innovation for the billions of people on the planet who today have great ideas but have little or no way of making them a reality.

DEMOCRATISING CREATIVITY AND INNOVATION.

AS THE development of these Creative Machines, in all their variants, continues to accelerate the next step will be to simplify their user interfaces and make them increasingly accessible and easy for people to use, at which point the technology will be democratised.

EVERYONE IS A CREATOR

The impact of the democratisation of these technologies on human society, as well as industry, will be nothing short of revolutionary. The result of which will be that we will be able to create and innovate content and products not at traditional human speed, but at exponential digital speed.

In just a three year period, for example, we've already seen convincing DeepFake content, which is just one form of synthetic content, move from being a high tech lab experiment that requires a team's worth of PhD's to create to being integrated into smartphone apps that allow anyone with a camera and a face replace Hollywood A-Listers likenesses for their own.

Now take this development a step further and all of a sudden the billions of people with nothing more than a smartphone and a lousy internet connection will be able to just ask an app to design a new product for them and make modifications to it using nothing more than their voice.

Furthermore, when this technology is combined with 3D printing, for example, those products can then be manufactured anywhere on demand - time and time and time again.

Ultimately, we are now starting to bear witness to the exponential acceleration of global innovation, but it's not just constrained to content or physical products, in time it will apply to everything - from AI software and computer chips all the way through to new pharmaceutical drugs and other increasingly sophisticated products.

We are nearing a tipping point and make no mistake that the rate of global change, that we already think is fast today, is about to be kicked into overdrive.

AUTONOMOUS CREATORS AND COMPANIES

However, as fast as human creativity and innovation is at digital speed it will be nothing when compared to the rate of creativity and innovation when autonomous Creative Machines and autonomous companies, driven by machine entrepreneurs not human entrepreneurs, emerge and combine - something that is already starting.

At this point not only will the machines be able to identify problems to solve, or opportunities, and create the content or products to match, but they will then, thanks to the nature of our increasingly digital and interconnected society, be able to build and scale companies, and market and sell these goods to a global audience and at global scale at exponential speed.

MACHINES THAT INNOVATE PRODUCTS

INNOVATION IS one of humanity's most exalted skills and crowning achievements - one that, as we are almost continuously told, separates us from many of the other animals and arguably makes us the "most unique species in the known universe."

Naturally then you can imagine the fallout that the arrival of so called Creative Machines, machines that share this trait and that can autonomously design any kind of product, from a building or a computer chip, to a piece of AI software or an item of clothing, will have on human culture and society. And that's before we discuss their impact on the global business environment, the impact they'll have when they eventually exceed our own amazing talents, and then are able to innovate and produce products at digital speed, millions of times faster than humans could.

Furthermore, and as if this breakthrough alone wasn't enough, as I'll discuss in more detail later in this chapter, when these machines are combined with new advanced manufacturing technologies like those laid out in the Griffin Exponential Technology Starburst, not only will they be able to scan social media and other big data sources for problems to solve and new market opportunities and then innovate

new product concepts but they'll be able manufacture and evolve them too - irrespective of whether those products are hardware or software based.

The result of all this will be that eventually they'll be able to identify opportunities, innovate and manufacture new products at such speed that they'll be able to take the Concept to Market times down to just days, and potentially, as I alluded to earlier in this Codex, disrupt global industries within just hours and days not decades or years as it takes today.

WE CREATED THE IMPOSSIBLE. AGAIN.

Ironically the arrival of these types of creative machines has only been made possible because of our own human ingenuity and inventiveness, and given the scale of the task of creating them it's little wonder that so many people never thought these types of machines would ever exist. But, here we are, and here they are.

Humans are amazing at many things - especially our ability to break large tasks down into simpler, replicable steps that can then be scaled up and developed further, and that's precisely what's happened in this instance.

After all, as I explained in the previous chapter innovation is a process, and processes, no matter how complex they are, once understood can be replicated, and if you skipped that chapter then let's run through it again with a simple exercise because it's a very important point. Let's begin: Take a cup and make it half the weight. This is an example of what's known as Iterative Innovation where we take a product and improve it, and it's just one of several types of innovation.

In your mind you're already going through a process and weighing the results against the desired outcome. So, for example, no doubt you're wondering if you can cut the glass in half, change it's size, or the materials that it's made out of, and so on, until eventually you settle on a solution.

By understanding this process and by mapping out all of the individual steps involved we can now digitise them using machine learning to create an AI capable of mimicking it and this AI becomes our first basic Creative Machine. Then, in order to improve it, we iterate it and continue improving it until we have a machine that can solve the problem and innovate a product.

And as for creating machines that can create well designed products that meet the briefs, rather than creating products that noone wants to use or buy, well, that's an innovation problem, and we're solving that too so let's move onto the next section.

BUT IT'S NOT AS SIMPLE AS THAT.

Creating a good creative machine that's capable of innovating well designed products that meet the brief, whatever that brief is, isn't just as simple as digitising a few steps though - just think about all the different permutations and thoughts your mind had to run through just to create a lighter glass, let alone a more complex product.

Not only did you have to understand the context of the brief and the outcome we were looking for but you also had to take into account the purpose of the product and the final products usability. However, while you were running all the permutations in your head you also had to consider all of the different properties of the materials you could have used - concrete, for example, wouldn't have met the brief from a weight perspective, meanwhile paper would have met the brief, but the product would have been all but unusable. And so on.

Innovation is anything but simple, even for a human, and it's even more difficult for a machine whose knowledge and experience is starting from scratch.

So, while developing a creative machine might sound straight forward in order to mimic even the simplest skills of the human mind researchers in the field have had to develop complex multi-disciplined AI's capable of understanding everything from context and natural language, through to materials and the laws of nature, and much more besides. Then, naturally, as they have to code in more information and "intelligence" into these machines the complexity of the models increases exponentially and that's a real challenge.

That said though we are now at the point in time where AI's capable of Iterative Innovation have arrived, and they are only going to improve and get more capable from here.

FROM ITERATIVE TO DISRUPTIVE

Being able to develop machines capable of basic, iterative innovation is obviously just the first stage of what will be a very long and protracted journey, but as the platforms develop they will in time be capable of much more including,

eventually, Disruptive and Primary Innovation.

Disruptive innovation is where they are skilled enough to design new product concepts that are significantly better than anything we've ever seen before that can disrupt existing products and markets, for example, a disruptive new game, healthcare treatment, material, or vehicle, and many millions of other things besides.

Next up comes Primary Innovation - the point in time at which they become capable of ingesting data about problems to solve and designing new product concepts we've never seen before - a skill that could also help usher in new industries. An example of primary innovation could be anything from the development of interstellar space travel through to cracking the secrets of fusion and human immortality, creating a new healthcare treatment, and again many million other things besides.

As researchers, and then the creative machines themselves, as we're already seeing today, work together in tandem to develop more capable machines in time we will see them become so good at what they do and so plugged into the digital fabric of our society that they'll be able to spot problems and opportunities
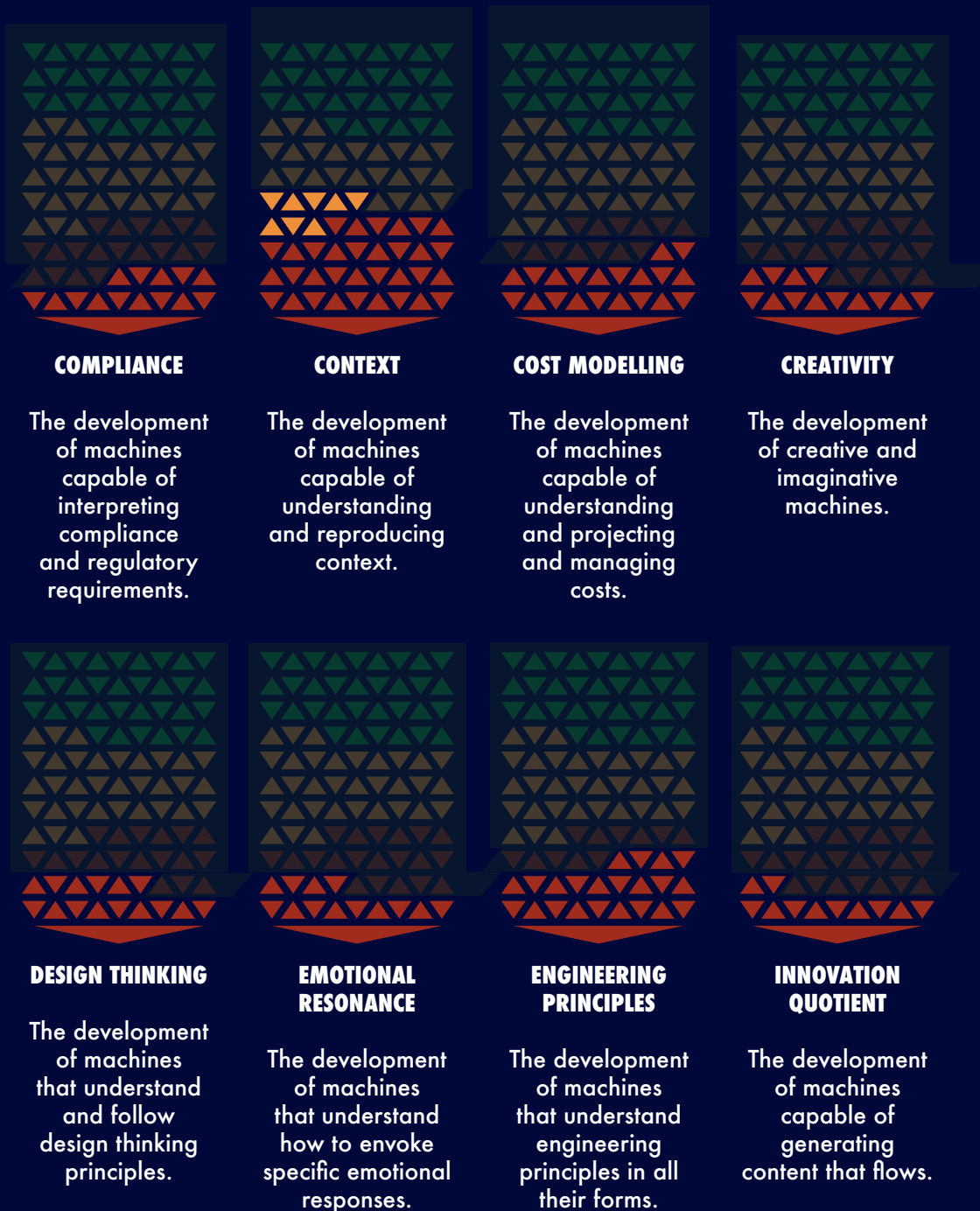
COMPLIANCE

The development of machines capable of interpreting compliance and regulatory requirements.

CONTEXT

The development of machines capable of understanding and reproducing context.

COST MODELLING

The development of machines capable of understanding and projecting and managing costs.

CREATIVITY

The development of creative and imaginative machines.

DESIGN THINKING

The development of machines that understand and follow design thinking principles.

EMOTIONAL RESONANCE

The development of machines that understand how to envoke specific emotional responses.

ENGINEERING PRINCIPLES

The development of machines that understand engineering principles in all their forms.

INNOVATION QUOTIENT

The development of machines capable of generating content that flows.

Figure 3. Current state of Creative Machine development by individual AI discipline.

Source: Multiple Sources

as they appear and design new products that solve them in real time.

For example, imagine everyone complaining about a product on a social media platform, whether it's a hardware based product or a digital one, and a Creative Machine being able to understand the context of their complaints and design a better product - something that leveraging the massive computing power and resources of AI and the cloud it could do in real time.

STILL WORK TO BE DONE

While many of us might think that building effective Creative Machines might be a herculean task in itself the truth is that it's actually harder than that, and it goes without saying that the more complex the products that these machines are tasked with designing the more complex the algorithms underpinning these Creative Machines need to be.

To the right and left of this column you'll see just a small number of AI disciplines, out of many, that all need to mature and then be combined and integrated with one another before we get close to creating what will be known as a General Creative Machine, in other words, a Creative Machine that can best

any human in almost any innovation task.

Take my glass example in the above chapters, in order to design an effective glass the machine first has to understand the context of our request, it also has to have an understanding of the purpose of the glass - which is no small feat for a machine that doesn't need to drink and doesn't have any way to physically hold or interact with a glass with in the first place. Ironically, this latter problem is where virtual modelling, in the form of Simulation Engines, which are being generated by another form of Creative Machines that I'll discuss in a later chapter in this Codex, become especially helpful during the innovation process.

Then, add into this that while it's always possible for the machine to meet the black and white brief, namely to reduce the weight of the glass, the final product it designs has to be not just functional but also has to meet other criteria as well, such as affordability, desirability, usability, and more. And, as mentioned, as the products become more complex it's therefore easy to see how the level of difficulty in creating creative machines that can meet the briefs demanded of them become exponentially more difficult.
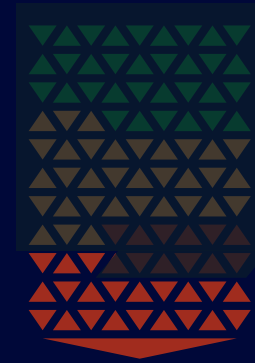
LAWS OF NATURE

The development of machines that understand the laws of nature, including materials and physics.
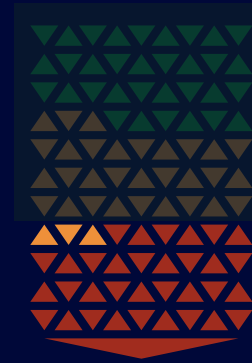
MATERIALS SCIENCE

The development of machines capable of understanding material properties.
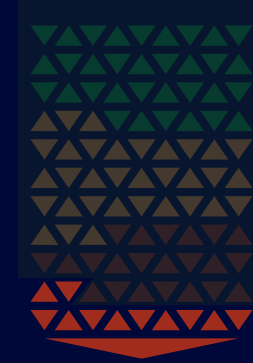
SUSTAINABILITY

The development of machines capable of understanding and meeting sustainability requirements.
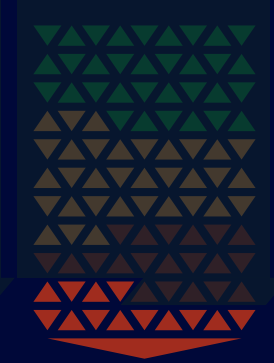
SYSTEMS THINKING

The development of machines capable of systems thinking and the impact it has on the design process.
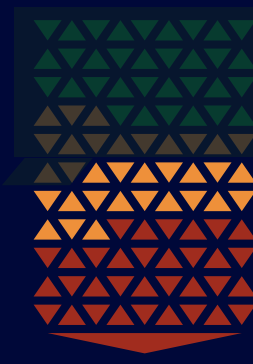
SYNTHETIC SIMULATIONS

The development of machines capable of creating realistic virtual environments to aid modelling.
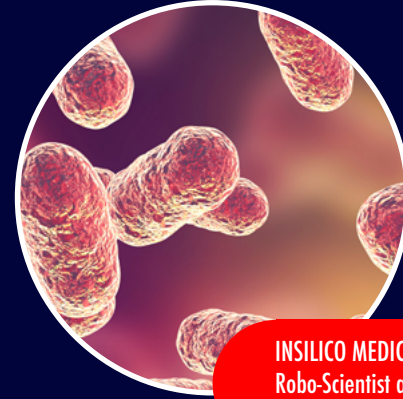
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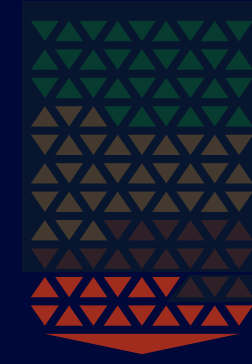
The development of machines that understand the principles of usability and that can create usable products.

KEY:

Each triangle represents 1%. The more triangles the more mature the discipline, until it reaches 100%.

AIRBUS are using creative machines to design and innovate new ultra-lightweight components for their A330NEO and A380 aircraft.

INSILICO MEDICINE are used an early example a Robo-Scientist and it designed 30,000 new drugs in 21 days, some of which were winners.

NASA are using creative machines to help them design new ultra-lightweight interplanetary landers and martian habitats.

UNDER ARMOUR are using creative machines to design new trainers and sports apparel which are then 3D printed in shops.

PRODUCTS DESIGNED BY CREATIVE MACHINES

As the capabilities of Creative Machines improve more and more companies are starting to experiment with them to create new product concepts, so here are some examples. And I could have also included Amazon and General Motors who are using creative machines to help them design fashion lines and cars - the floodgates are opening.

Notes:

BROADER AND BETTER

As our ability to create machines that are good at innovating specific products improves naturally over time the breadth and the complexity of the products they'll be able to innovate will also naturally improve.

Today, for example, they're already innovating everything from aircraft parts and apparel as well as cars and furniture. But, even though it's still early days we're already seeing the emergence of so called Robo-Scientists, creative machines that are designing new healthcare treatments and drugs, as well as new materials, so if you think that creative machine innovation will simply be confined to specific product categories then you'll be very wrong and at some point they'll likely cross every field.

SUMMARY

We are starting to see the emergence of a new world order and economy, one that is built and led by machines, and as humans we need to gather a point of view and understand the strategies our enterprises need to design and embrace in order to reap the significant benefits of this new reality while minimising the threats and the down sides.

MACHINES THAT INNOVATE CONTENT

IT GOES without saying that not all content is created equal. That said though every piece of content, whether it is an individual piece of content or an entire virtual arena, environment or world, has its place and its own special intrinsic value, from a pamphlet whose commercial value is relatively low and fleeting, or a blockbuster movie or AAA game whose value is substantially greater and much longer lasting.

> AS RESEARCHERS get better at creating Creative Machines that generate Synthetic Content the next battleground will be creating the techniques and tools to direct, edit, manipulate, and control the outputs.

Over the past few decades there has been a paradigm shift in how the world creates and consumes content as people embrace new content formats, techniques, technologies, and tools, and move from creating and consuming mostly physical content to creating and consuming digital content instead.

It's this shift from physical to digital, combined with the emergence of increasingly democratised and powerful exponential technologies that are helping developers build the first generations of

Creative Machines that are capable of generating a wide variety of so called Synthetic Content - either automatically or on command - which will change the way content is created forever.

Furthermore, asides from being able to automatically generate synthetic content on their own in time these creative machines will themselves become democratised which in turn will then help democratise content creation for everyone on the planet who has a smartphone and an internet connection. And one of the major implications of this, of course, will be that today's seeming torrent of content will end up looking like a mere trickle - especially when you consider that these creative machines will be able to generate and pump out content non-stop 24-7.

Today, we stand on the brink of a new era where these machines, that will be both the tools and the creators, will help transform every sector and corner of society in new and previously unimaginable ways - from the generation of DeepFakes that threaten to undermine democracy to putting the power to create blockbuster movies in everyone's hands - and where the rate of content creation only continues to accelerate exponentially.

Furthermore, it should not be lost on you that as the growth in digital content continues its meteoric rise many analysts estimate that, on the one hand it will help drive over $2.7 Trillion in GDP, and that the emergence of creative machines, like the ones I'll discuss in the following chapters, will impact the careers of over 375 million people.

DEFINING SYNTHETIC CONTENT

As the way we create content continues to evolve, moving from human generated content to machine generated content, and moving from the generation of physical to digital content, one of the pedantic challenges that we face is accurately defining what we mean by the term synthetic content, so let me clear that up now - bearing in mind of course that today there still isn't a formal definition of the term.

In some people's minds digital content is already synthetic content, irrespective of who or what creates it, but for the purposes of this codex when I refer to synthetic content what I am specifically referring to is the digital content that is synthesised by machines.

THE NEW ERA OF SYNTHETIC CONTENT

As creative machines get more adept at generating synthetic content from scratch, whether it's in the form of synthetic adverts, articles, books, documentaries, imagery, movies, soundtracks, or video, they will bring about a new content revolution unlike anything we've ever witnessed before where the variety, velocity, and volume of the content being produced will be unfathomable by modern standards.

That said though, in order for future creative machines to conquer the proverbial content mountain and become the primary way that all digital content is generated - whether it's generated automatically or with some level of human involvement - not only will all of the individual content types that these machines need to draw on need to be mature, for example, synthetic audio, imagery, text, and video, but furthermore they will need to be able to combine them together accurately, and then also - as if the above isn't enough - draw on a whole variety of skills that are completely alien to them, including contextual, emotional, and semantic understanding, flow and rhythm, storytelling, and much more. And it's the combining together of all of these individual content elements, within the bounds of a storyline, that will be researchers greatest challenge.
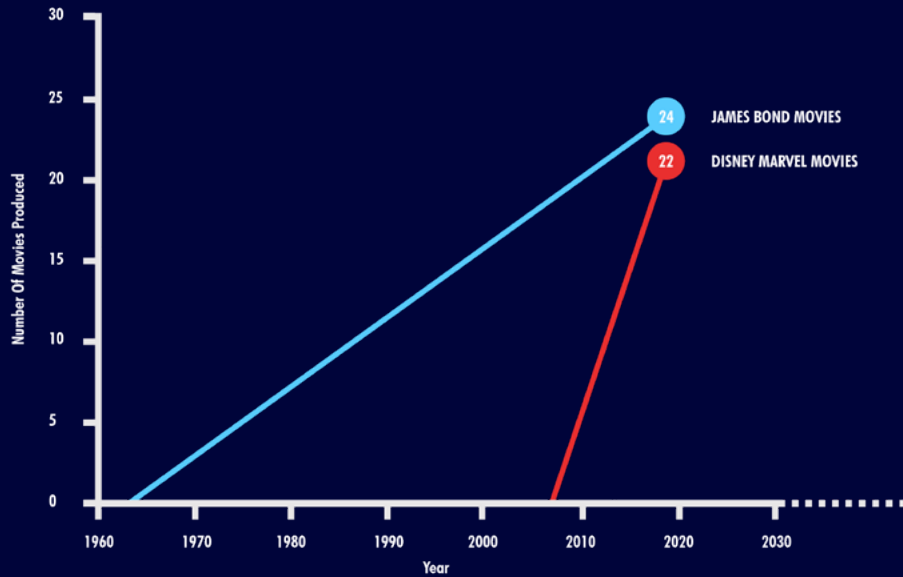
Figure 1. The rate of movie production.

Source: Visual Capitalist

While it can be said that there are creative and technological differences between the two studios when it comes to the production of movies the impact that new technologies, techniques, and tools, have on the speed of movie production cannot be denied.
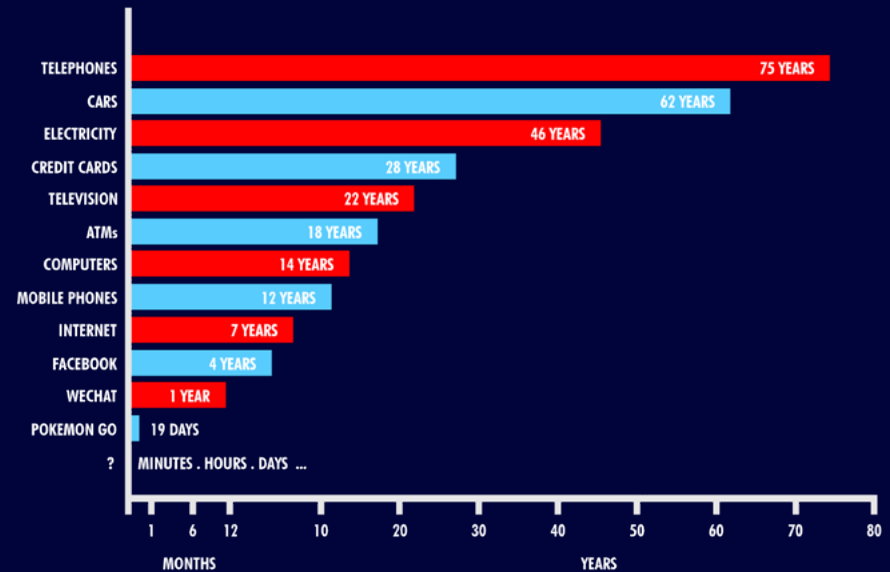

Figure 2. The rate of content and technology adoption.

Source: WSJ

However the data is presented it is undeniable that, thanks to the collision of different trends, including a more connected and digital society, that the pace of product and service adoption, in all its forms, has accelerated dramatically.

DIGITAL TECHNOLOGIES AND AN INCREASINGLY CONNECTED SOCIETY ACCELERATES DISRUPTION.

GOOGLE used synthetic audio generators to create Duplex, an AI assistant whose voice blew past uncanny valley.

NVIDIA used synthetic simulation generators to create the world's first computer game intro made by an AI.

OPENAI used synthetic text generators to create the world's first procedural text based games, which one day will include graphics.

SPRINGER used a synthetic text generator to create the world's first research book written completely by an AI.

SYNTHETIC CONTENT GENERATED BY CREATIVE MACHINES

As the capabilities of Creative Machines improve more and more companies and individuals will use them to push the boundaries of synthetic content creation and use them to generate everything from simple adverts and art, all the way through to using them to generate books, games, movies, and even digital humans.

However, once researchers manage to create the first creative machines adept enough at combining all of these individual elements together to create realistic, high quality content - whether that content is 2D or 3D, static or dynamic - then, and only then, will the balance of creativity and creation finally and fully tip into the machines favour.

AND THEN COMES PROCEDURAL CONTENT

When researchers finally manage to crack the code of developing creative machines that can produce content that rivals the content put together by today's human professionals, especially video content, then fortunately they'll still have work to keep them occupied. And this is where now they start ratcheting up their pursuit of creating what's known as Procedural Content, and it's arguably one of the most exciting content categories.

For those of you who haven't heard of procedural content before it's the ability of machines to take in a variety of different data sources, which I'll come to in a moment, and then automatically and in real time adapt the content they're generating accordingly.

So let's run through an example, and, just in case you are wondering everything I'm going to run through in this example is based in real technologies that we're seeing emerge today.

It's Friday night and you're sitting by yourself on your favourite sofa - the one that you've sat in so many times before that it's now permanently moulded to the shape of your body. You finally flick on a movie from your favourite provider, and while you're sitting on your sofa the Creative Machine platform that's running in that providers cloud environment is ingesting data about all of your behaviours, emotions, mood, and preferences, from multiple sources - everything from your Facebook profile and so called "Big Data" footprint, all the way through to the UHD video feed from the camera on your Smart TV that's capturing all of your biometric information and micro-facial movements.

All the time the movie's playing the platform's analysing huge volumes of information in real time and after a while it notices you're looking bored - your attention's waning, you're facial expression's changed, and your heart rate's slowed. As a result of this analysis it makes the decision to dynamically re-write the movie and generate new more exciting content in order to get

your attention back, and now rather than showing you the stock version of the movie that everyone else is watching elsewhere it's creating a perfectly tailored movie, just for you.

That is what we mean when we discuss procedural content - the ability of a creative machine to dynamically generate new content and storylines on the fly with no human involvement.

THE ENDGAME

The ultimate endgame of all this work and research, of course, will be to develop creative machines capable of generating human grade, and better than human grade synthetic content in real time without the need for any human involvement or intervention - a Master Creator, the impact of which will be revolutionary, in every sense of the word.

SUMMARY

Today, we are creating a whole new range of Creative Machines that are capable of generating increasingly high quality and sophisticated synthetic content in a wide variety of forms and formats. This is the first battle ground for developers to conquer. And when they

do they will then swiftly move on to the next task of creating the technologies, techniques and tools, needed to control, edit, and modify all of the various outputs.

However, like any good story the story doesn't end there, because once we have mastered creating these sophisticated machines it is inevitable that many of those same researchers will then turn their attention to integrating the technologies and creating the machines that can edit and modify content in real time, on the fly, in response to consumers behaviours - at which point the era of Procedural Content will have arrived.

Notes:

BUILDING EXPONENTIAL ENTERPRISES

CONTRARY TO popular belief, and as obvious as this sounds, there are two reasons why individuals and organisations get disrupted.

Firstly, there are the things that disrupt you because you never saw them coming. In short they blind-sided you and, if you have them, your foresight teams.

Secondly, there are the things that disrupt you because even though you saw them emerging and then ascending you never took the necessary actions to counter them. And while the markets and stakeholders will sometimes forgive executives for the former, they rarely forgive them for the latter - especially in a world where disruption is an ever present stalking horse.

Needless to say, disrupting a competitor, an industry, or even a country, is complex, but while many people often like to think of disruption as a singular event it's actually a series of events that, in the majority of cases, have clearly identifiable milestones and markers that we can monitor and track.

However, while everyone agrees that disruption has always been with us and that it can take many forms, from the asteroid that wiped out the dinosaurs

to the emergence of Netflix who wiped out the video-saurs, one thing that many people still struggle to understand is how the nature of the animal's changed over time and how it will continue to evolve in the future.

Often the reason for this is because sometimes they're looking for disruption in the wrong places, trying to predict it based on historical perspectives, and sometimes it's just because they haven't been exposed to it before. And as for those among you who believe that the majority of disruptions are behind us I can assure you they aren't, and trust me when I say you haven't seen anything yet.

MAPPING THE DISRUPTION LABYRINTH

The process of disrupting anything, whether it be a competitor, an industry, or even perhaps a country, is generally so complex it's positively labyrinthine.

Like all of us though I've lived through many disruptive events and it's these experiences and the impact they had, on enterprises and workforces alike, that drove me to map the labyrinthine-like process of disruption so that companies could understand it, navigate it, use it to their advantage, and ultimately come to
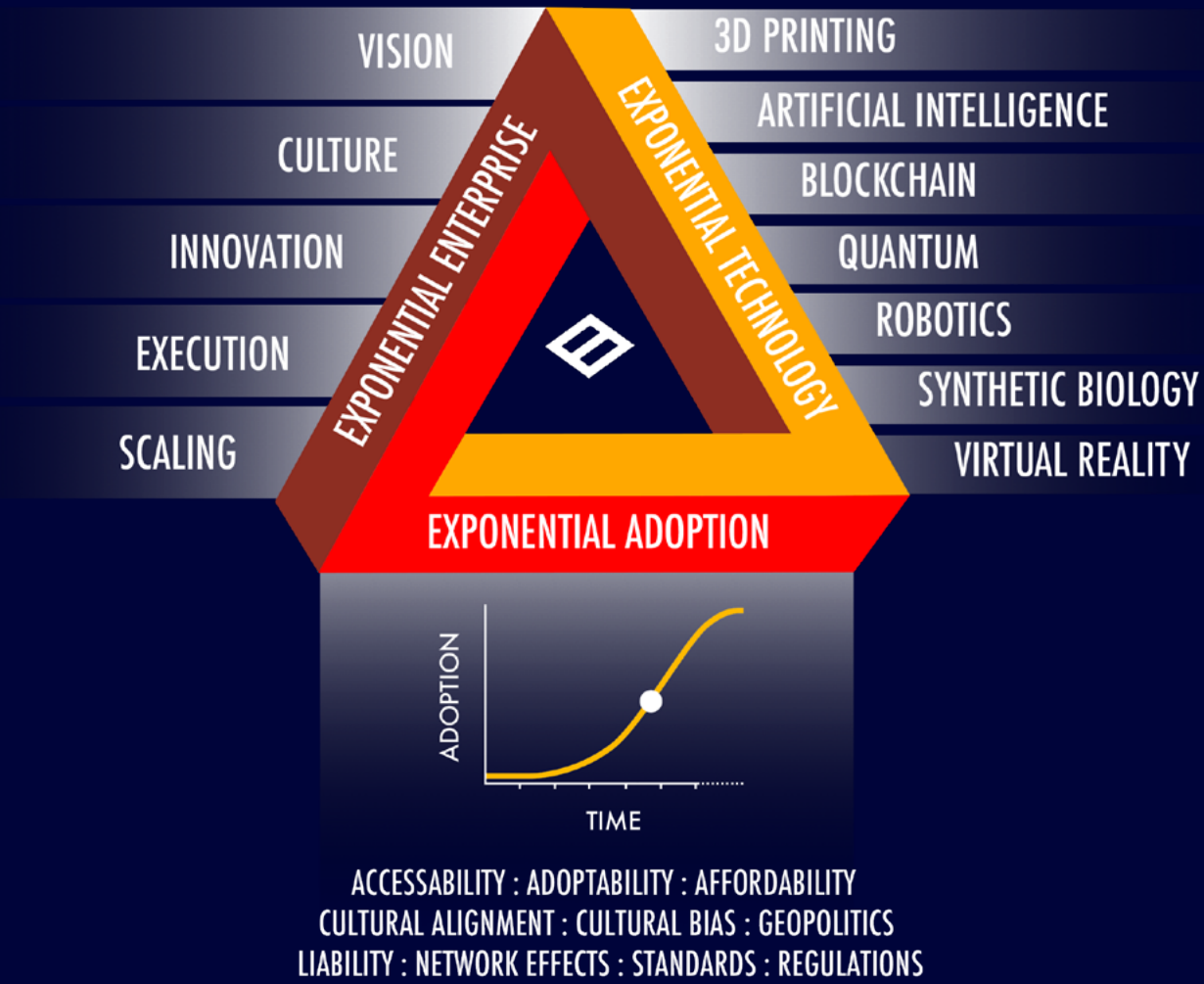
terms with a world that operates using a new rule book and that no longer behaves like it used to.

As highlighted in earlier chapters, irrespective of how fast disruption seems to materialise it isn't a single event - it's a complex series of events that, in the majority of cases, have clearly identifiable milestones and markers that we can monitor and track, and it's these events that will be the focus of at least part of your discovery process and that will help the vigilant among you identify the next disruptors and disruptions long before they have a chance to wreak their havoc on our companies.

Similarly, these events, and how they combine and the timings of their combinations, also help explain why only a fraction of companies ever make it through the labyrinth to claim cult disruptor status, so let's dive in and have a look at them.

"DISRUPTION ISN'T A SINGLE EVENT. IT'S A COMPLEX SERIES OF EVENTS WITH CLEARLY IDENTIFIABLE MILESTONES AND MARKERS."

- Matthew Griffin, 311 Institute

VISION

CULTURE

INNOVATION

EXECUTION

SCALING

EXPONENTIAL ENTERPRISE

EXPONENTIAL TECHNOLOGY

3D PRINTING

ARTIFICIAL INTELLIGENCE

BLOCKCHAIN

QUANTUM

ROBOTICS

SYNTHETIC BIOLOGY

VIRTUAL REALITY

EXPONENTIAL ADOPTION

ADOPTION

TIME

ACCESSABILITY : ADOPTABILITY : AFFORDABILITY
CULTURAL ALIGNMENT : CULTURAL BIAS : GEOPOLITICS
LIABILITY : NETWORK EFFECTS : STANDARDS : REGULATIONS

THE DISRUPTION TRIANGLE

The likelihood that a new product or service an enterprise or industry, can be assessed by its progress against three main axes - namely the Exponential Enterprise axis, the Exponential Technologies axis, and finally the Exponential Adoption axis, all of which are intrinsically inter-connected with one another.

THE THREE AXES OF DISRUPTION.

IN MY experience the likelihood that a new concept will disrupt a market can be assessed by its progress against three main axes as shown in the diagram on the previous page - namely the Exponential Enterprise axis, the Exponential Technologies axis, and finally the Exponential Adoption axis, all of which are intrinsically linked with one another.

EXPONENTIAL ENTERPRISE

If you're one of those individuals who doesn't want to change the world, and let's face it, not everyone does, and that's fine, then it's unlikely you ever will - at least on purpose. But, if you feel that it's your calling and you can't think of anything else then with the right approach and support you may well just pull it off - never say never, especially in a world where it's easier than ever before for one individual or one company to impact and influence the lives of billions of people.

However, while a determined rebel unit with a disruptive mindset within an enterprise will often be able to change the attitudes and opinions of those who fall within their sphere of influence it has to be argued that true change within an enterprise must be inspired and promoted from the top down.

Over the past decade I've made it my mission to understand what sets enterprises that achieve cult disruptor status, as well as fabled Unicorn status, apart from the rest of the pack and frankly it's a myth that a company's ability to disrupt itself or a market is based on its ability to outperform its competitors in just one single area. In my estimation it's their ability to outperform them in over thirty different areas, often simultaneously, that makes the difference. From the way they build and communicate their culture, values, and visions, to the way they identify valuable problems worth solving and develop their products, ecosystems, and go to markets, and much more, it all counts.

In short, and to be crystal clear, it's not any one thing, it's many, and that's the reality that anyone wanting to build an Exponential Enterprise has to contend with - you're either all in or you might as well go home, anything less and you'll be increasing your likelihood of failure.

Furthermore, it's not simply enough to be moderately better than your competitors, whoever they are and whatever industry they hail from, you have to outpace, out perform, and out think them all in almost every one of these areas.

Now we've covered the basics let's dive in and have a look at what makes these serial disruptors we're all fond of so special.

In order to make it easier to digest I'm going to divide the DNA of an Exponential Enterprise into five foundations. In order these are Vision, Culture, Discovery, Prototyping, and Execution, and within each of these individual foundations there are at least six main areas that, when performed well and combined, will move the dial in the company's favour.

Firstly comes their Vision, something that conveys a huge amount of information about their over arching purpose and

Notes:

culture, and ultimately acts as their North Star.

Visions and vision statements are normally the aggregated result of a company's ambition and purpose, their discovery and due diligence process, their internal and external deliberations, their framing and the time frame they're working within, and their view of the intersecting trends that they believe will help them achieve their goals.

Generally speaking many of the enterprises that have the greatest impact on the world today and the ones with the greatest disruptive potential are the ones that have bold and ambitious visions with grand aims that, in the words of Elon Musk, get people excited about waking up every morning and feeling inspired by the work they do.

Secondly, and by far the most important of all the five foundations is Culture, which is, among other things, the aggregated result of structural and behavioural company alignment, authentic, inspirational leadership, honest communication, and, again, the company's vision.

We are continuously reminded about the power of culture and it's power to help companies overcome all manner of

obstacles. But while creating a winning culture can take years to build and is arguably one of the hardest things for any leadership team to accomplish if you aren't vigilant it can be torn apart in just months.

Furthermore, from a disruptors perspective at least, I like many people have lost count of the number of times I've heard stories about how a company's corporate immune system was responsible for killing the latest innovative concepts - either because they were disruptive to the company's core business, which is obviously laughable under the circumstances, or because of some other political motivation.

Thirdly comes one of the most exciting foundations, in my opinion at least, Discovery, which is the aggregated result of internal and external conversations, collaborations, and partnerships, exploration, envisioning, and observation, and much more. This foundation is also often the natural home of the majority of a company's entrepreneurs, rebels, and visionaries - the teams of individuals who all too often want to rip up the rule books, go above and beyond, and disrupt the status quo.

And as the rate of disruption accelerates, and as more enterprises feel the effects

of disruption on their balance sheets it's no surprise that over the past number of years many of the teams in this space have been the beneficiaries of significant uplifts in funding and new programs as the companies work hard to improve their competitiveness, and defend and extend their consumer bases.

All that said, however, it obviously goes without saying that new funding and programs by themselves can't be counted on as magic bullets that guarantee success. Again, it's not one thing, it's many things working in harmony, which, neatly brings me back to the importance of having the right culture and environment.

Fourthly we have the Prototyping foundation, where companies begin to build products that address the problems and opportunities uncovered during the Discovery foundation. This foundation is the aggregated result of conversations, collaboration, and partnerships, experiential and design thinking, ideation and problem solving, to name but a few. One of the most understated areas of this foundation though is the use of beta consumers and, where appropriate, the importance of the investors black books - both of which help companies secure early testers and consumers that eventually hopefully convert into

paying consumers and references, with the added benefit that, with the right management these activities and consumers will help generate hype around the products that then, in some cases, propel them into the hands of millions of consumers.

Fifthly, and by no means least is the Execution foundation that, when done right, which is obviously harder said than done, ensures your amazing new product doesn't get left on the metaphorical shop shelf to die.

The aggregated result of everything from ensuring the right balance of consumer value and the right business model and go to market strategy this is where many companies ambitions to disrupt markets fail. As they say - everyone has a plan until they're punched in the face, or in company speak everyone has a plan until it meets reality.

However, for the lucky companies that do make it past this last hurdle to disrupt a market - whether they're lucky by design or by fluke - this is the stage where all their hard work, everything I've discussed, albeit lightly so far, pays off.

This is also the point at which the incumbents in a market realise that a disruptor has just parked their UFO

on the company's front yard, before laughing at it, shrugging it off, and getting eaten by the aliens hoards inside...

Noone ever claimed disruption was easy but throughout my travels and conversations with executives from all manner of industries all around the world it's clear that almost everyone underestimates the complexity and size of the challenge. However, while disrupting any market is difficult it's also clear that the size of the prize, which is often the opportunity to lead and own a market, is worth the effort.

EXPONENTIAL TECHNOLOGIES

Once a company has started its journey to become an Exponential Enterprise and found interesting and valuable problems worth solving next they turn to technology, explicitly combinations of technologies, to develop their products and help get them into the hands of consumers.

And, as you can see from the Griffin Exponential Starburst in the earlier chapters and by reading the other codices in my Codex of the Future Series, there are hundreds of exponential technologies that enterprises can choose

from to help them change the economics of their industries, and develop new disruptive products. And more are appearing all the time.

One of the phrases you'll hear me refer to many times throughout this codex is the word exponential, a term that I'm sure you've heard a million times that's often used to refer to technologies that emerge, develop, and mature very quickly, and often at a rate that very few people anticipate or predict.

The term is also a hangover from Moore's Law where Gordon Moore, Intel's co-founder, in 1965 predicted that the number of transistors on a computer chip would double every 18 months, leading to an exponential increase in computing Price-Performance, and today we're seeing the same pattern emerge in many other technologies - from Artificial Intelligence (AI) and Quantum Computing, to 3D Printing and Gene Editing, and many others.

Although, when it comes to digital technologies, such as AI and Creative Machines, for example, their rates of development even make Moore's Law look positively lethargic, and this is yet another trend that's accelerating disruption.

As the rate of technological development accelerates though there is also another trend you should familiarise yourselves with called "Jumping the S-Curve," and it's important because, in short, it refers to the way that different technologies supersede one another. Furthermore, as the number of exponential technologies that are emerging continues to accelerate and increase this is yet another accelerating trend that you have to take into account when deciding which technologies to use to build your new products and go to market strategies.

The phrase S-Curve refers to the rate of development of a particular technology - like a squashed S first the rate of development starts slow, then it accelerates dramatically, and then it flattens off as researchers struggle to eke out further gains. Furthermore, today, and more so in the future, as the period of time it takes to reach higher levels of Price-Performance accelerates you'll no doubt find that trying to keep pace with all these developments gets even harder.

Jumping the S-Curve then refers to a company's ability to move from one older technology to a newer one, for example, moving from the logic based x86 computers that we use today to tomorrow's ultra-powerful Quantum Computers. Unlike the past though where

there were only a few S-Curves to jump now there are potentially hundreds - all of which can be combined in new and interesting ways to further fuel the rate of disruption.

EXPONENTIAL ADOPTION

Of course though, while having an enterprise with the right culture that's capable of identifying valuable problems and opportunities, and which is highly adept at leveraging talent and technology to build great products is a great start the fact remains that you have to get those products into consumers hands.

So, as part of your Execution strategy, it should come as no surprise that there are plenty of areas left that, on the one hand could stop you dead in the water, or, on the other boost you into the hall of fame. And these areas are so important that I decided to give them their own axis.

While I've already discussed how disruption is a process and not a single event this is the stage where, if you want to disrupt a market, you have to gain as much traction as possible in as short a time frame as possible in order to stymie your competitions ability to counteract you with their own messaging and

variants.

Getting your product into the hands, hearts, and minds of consumers though at enough scale to disrupt a market and permanently change the status quo though is obviously difficult. But that said while, yes, you still have to overcome many hurdles, and successfully pull all the right levers you should be able to take comfort from the fact that today, as I've highlighted in previous chapters, it's easier to disrupt the status quo than it ever has been before.

Navigating this part of the labyrinth though is complicated which is why the majority of enterprises struggle to realise their lofty ambitions, and sometimes all it takes is for one key piece to be out of alignment and everything falls down like a deck of cards.

For example, build a great product that the regulators block and you're going nowhere, or build a great product that the regulators approve that is unethical, and yep, again you're going nowhere. And so it goes on - you get the picture.

So, as you can see again gaining mass adoption of your product isn't down to getting one thing right it's down to getting many things right. These include, but are not limited to, your

products accessibility, adoptability, and affordability, as well as other factors including cultural alignment and bias, ethics, the geo-political situation, the impact of insurance and liability, network effects, and, of course, standards and the regulatory environment.

Get one of these wrong or get side slammed by one of them, as well as fail to adequately address or solve your company's culture and resolve the vagaries of your company's corporate immune system or shareholders, and it could be game over for you and your new products.

SUMMARY

Today we live in a world full of opportunity where the rate of change is accelerating every day, and where exponential technologies are force multipliers for multi-national companies, and levellers for startups - the result of which means that whereas yesterday you had tens of competitors in your rear-view mirror today you have hundreds - or more. It's fun to be you.

However, as amazing as all this is it will all soon be eclipsed by an even bigger, and even more disruptive revolution, because a new breed of entrepreneur,

one that can out think and out perform humans a million fold to one, and build fully autonomous multi-billion dollar empires within days and months is already emerging.

I am, of course, talking about the rise of Creative Machines, synthetic entrepreneurs if you will, and for those of you who think that such talk of machines that can design and innovate products, and operate and scale companies is far fetched the first fully autonomous enterprises have already been built and they're already operating on two continents.

Today is the slowest rate we will ever move again, but you've seen nothing yet. So pause, take a deep breath, and prepare yourself for what's coming.

CODEX

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HOW TO BUILD
EXPONENTIAL
ENTERPRISES

CREATE . BUILD . LAUNCH . REPEAT

CONCLUSION

PEOPLE SAY change is a constant, but in today's technology fuelled world this simple phrase is a deceiving, and often comforting, misnomer because change isn't constant, it's exponential, and the only boundaries to what we can achieve as individuals and as a global society are the ones that we invent for ourselves.

As researchers and scientists increasingly prove that nothing is impossible, that yesterdays science fiction is simply the future generations status quo, and as we all continue to bear witness to an increasingly rapid rate of change that's affecting and transforming every corner of global culture, industry, and society the future belongs to all of us equally, and we should never loose sight of that.

As you race into your own future I wish you well, and never forget you have all the friends and support you need around you as we all voyage through time and space together on this fragile living spacecraft we call Earth.

Explore More

MATTHEW GRIFFIN
Founder

Notes:

THIS IS NOT THE END.
EXPLORE MORE.