THE POST-ECONOMIC INSTITUTE

The Theory of Post-Economics

Part I – More than a Michael Fish Moment

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December 2019

http://posteconomic.org

Economics, for many people, not only represents the unknown but also the unknowable.

Most people are not economists, didn't study economics at university, don't watch market fluctuations all day long nor analyse the highly convoluted long- and short-term factors influencing them. They can't explain the difference between bonds, yields or derivatives, nor quite comprehend how it can be possible that governments can 'invent' money through schemes such as quantitative easing, in apparent circumvention of the rules of economics when they, as the very regulators of economic activity, should surely be most concerned with adhering to its rules stringently. For, evidently, it is not merely the banks that are 'too big to fail', but economics itself.

An average person might be able to understand why a fall in the price of crude oil means the cost of petrol changes at their local pump, or why a rise in demand for something in one country stimulates the supply of it from another. But what most people can never truly hope to understand is the full economic picture captured within a single, complete frame – interpreted, solved and steady.

And they are not alone in this limitation. We now appear to have reached a point in human evolution where economists don't understand economics. It's just too complex to assemble, with too many 'moving parts', to untangle on a daily (never mind real-time) basis and communicate in a coherent way that people en masse can engage with and comprehend fully. Our faith in economics as a competent governing force is being challenged; it is facing an existential crisis.

Now, to state the bleeding obvious: we don't know what is going to happen in the future. This has ever been the case and, to give economists their due, forecasts often come with variables to cater for the potential impact of various external influencing factors and allow for this unpredictable element – '*if this election goes that way, it may have a knock-on effect on this industry*; *if consumer confidence falls, retail growth may come in lower*' – and so on and so forth. They have never claimed to be able to predict exactly what is going to happen, so chastising them too harshly in situations where unforeseen circumstances derail perfectly sensible estimations would be somewhat unfair.

It would be further unreasonable to suggest that economics is over just because a few forecasts were inaccurate. That said, we do have to accept that two in recent memory – the failure to predict the market crash of 2007/08 (which required the economic system itself to be bailed out by taxpayers) and the widespread warnings of immediate economic Armageddon post-Brexit (which failed to materialise; many economic indicators in the second half of 2016 following the vote were far more positive than expected) – have been so wrong as to shake confidence in the very medium. Since the wave of so-called 'political populism' really kicked into gear in 2016, voters don't appear to listen to economic experts with the same level of respect anymore. Michael Gove's notorious Brexit campaign assertion that '*people have had enough of experts*' may be amongst the most derided comments of the 21st century so far, but it's hard to deny there is some deep-rooted truth to it. Indeed, in early 2017 it prompted the Bank of England's chief economist to acknowledge a degree of crisis in the profession, stating that economists were facing their '*Michael Fish moment*'[i] in reference to the weatherman's notorious 1987 forecast in which a fierce and devastating storm was missed.

It was a clever quip, but also a revealing comparison that rather masks the actual significance of the crisis. The fault in 1987 was neither one of individual error nor critical systemic failure; it was due to the fact that the forecasting models used proved inadequate in that specific instance. The logical implication is that, just at those weather models merely needed to be adapted slightly, so economics will get right back on track with a little tinkering. It's a temporary blip and, before we know it, normal service will be resumed. In fact that message has been drilled home repeatedly, with the crisis of 2007/08 providing a convenient scapegoat. Today, when commentators from the financial sector speak about that crisis, it is of course with the benefit of hindsight. Although they couldn't see it at the time as it was a new and complex issue, now the faults in the system – reckless inter-bank, business and consumer lending, lack of requirements around the capital reserves banks have at their disposal etc – have been exposed and reconciled they say. The system was ill and unruly, now it's getting better again; we'll know for next time.

But when considered in slightly more depth, this comparison soon breaks down. The weather is still the weather; that term refers to the same specific segment of activity and its fundamental nature remains the same – even factoring in climate change and the potential for shifts in seasonal patterns across various geographical regions. Models can adapt to take account of those. The situation in which economics finds itself is different. Economics is one of those odd terms that simultaneously seems to cover everything and nothing at the same time – politicians connect '*the impact on our economy*' with almost everything that happens and, unlike the weather, the nature of the world that economics is trying to measure and make sense of *has* undergone a profound structural change.

There is almost no area of our lives that economics doesn't govern in some way, as its general function is to determine our capacity (or otherwise) for accessing things (products, services, travel, accommodation, pensions – this list could fill several pages), meaning it dictates our relationship to almost everything in the world around us. It has, therefore, long been essential to the maintenance of a decent standard of living to find a secure work position that guarantees a steady income. This requirement has been vigorously underscored over generations as the most common of common senses. If this cannot be reliably sourced, individuals find themselves lacking a job, money and the ability to consume. Which is far from being a functional 'person' under traditional economic thinking. You're just not able to take part without being economically viable.

Economics can be mobilised to make a virtue of its tangled, convoluted, even obfuscating properties. To give an example of this, the Scottish independence referendum in 2014 appeared to set a precedent for how to get people to reject seismic changes offered up through referendum votes. The No campaign took the political approach derided by the Scottish National Party as 'Project Fear', which involves focusing on all the potential negative economic consequences that may arise from voting *for change*, in a systematic and comprehensive manner, rather than trumpeting the apparent virtues of maintaining the status quo. Voters have to choose to believe something – and when economic impact is laid upon economic impact, penetrating to the truth of these claims is impossible for the average individual. In the end, fear of – or lack of genuine understanding of – the economic threat of independence meant that economics was able to be a determining factor, possibly even the lead one.

This is the great strength that politicians have consistently been able to utilise, particularly over the past decade or so. The 'economy' – this intangible, aloof, almost mystical entity

that controls our lives – cannot be comprehensively interrogated by the average voter. And if they can't understand economics, it is not possible to counter the idea that the economy is the most important element of our lives and that it must be sustained at all costs. It just seems too risky to go up against the economy, to question it, get rid of it or try to change its nature even in a small way – the consequences would be terrible, we are consistently told, if we tamper with a force that we cannot possibly hope to understand. Politicians even get possessive over it, constantly referring to it as '*our economy*' – something that unites us all and must be defended to the ends of the Earth as the most valuable expression of our national coherence. To do anything that would wilfully undermine 'our' economy would be tantamount to treason (or terrorism, if we remember David Cameron's accusation of Brexit voters putting *'a bomb under our economy'*[ii]).

And this is the point – we are not supposed to actually *understand* economics, we are merely required to be *frightened* of it.

Brexit, however, proved a bit of a shock to that system. When the referendum was announced, the tried-and-tested 'Project Fear' approach was mobilised by the Remain campaign. The British people were asked to vote on leaving or remaining in the EU, and the economy was held up as the primary factor upon which people should base their decision (by the Remain camp at least), with the claims coming thick and fast.

The Remain campaign said[iii] that, lest we forget, in the case of a vote to leave the EU (and note the balance of negative economic messages against positive ones):

- Each family would be £4,300 a year worse off;
- Each person in Britain would be on average £350 a year worse off due to losing the lower prices we benefit from as members of the EU;
- Energy bills would rise by £500m;
- The benefit of being in the EU is worth £91bn to the UK economy;
- The UK would lose £66m (in investment) every day from the EU;
- The average pensioner would lose between £18k and £32k; and
- The economic shock would force growth to be slower.

The Leave campaign focused far more on immigration, but did state that the gross cost of EU membership to Britain works out at £350m a week[iv]. Rather than putting out hard figures, they tended to point out that Britain would be in a stronger position as it would be able to negotiate specific trade deals with other countries, which would all be good news for our economy.

The average voter, being neither an economist, bureaucrat nor member of the European Parliament, had to make a decision on whether to believe these claims (and counter-claims) or not. But, either way, they had no realistic way to interrogate the genuine essence of them.

Now let's recall what some of the world's most influential people (in terms of economic authority) threatened would happen if the British people voted to leave the EU.

The president of the United States, Barack Obama, said that the UK would be at the "*back of the queue*[v]" when it came to trade deals. The head of the International Monetary Fund, Christine La Garde, said that the consequences of Britain quitting the EU would be *"pretty bad to very, very bad* […] *We have looked at all the scenarios. We have done our homework and we haven't found anything positive to say about a Brexit vote*"[vi]. The head of the Bank of England, Mark Carney (who is supposed to be neutral on such politically-volatile matters), said: "*A vote to leave the EU could have material economic effects – on the exchange rate, on demand and on the economy's supply potential – that could affect the appropriate setting of monetary policy*"[vii]. The question was '*should the UK remain a member of the EU or leave the EU?*'. The answer was *economy, economy, economy*.

These were all negative, but carefully phrased – although some were a little more frank in their language. The president of the European Commission, Jean-Claude Juncker, stated that British people would be deserters if they voted to leave the EU and that "*deserters would not be treated kindly*"[viii]. It's difficult to avoid the image of being put against a wall and shot for crossing economics.

So all the great and the good of economics said '*don't you dare*', yet we all know how that vote turned out. It went against all economic logic and polls. It seems the capacity for economic threats to frighten people into voting a certain way has become severely neutered recently, and since 2016 to a critical level (though subsequent votes in the Netherlands, Germany and France didn't go the way of populism overall, the political battlegrounds for each tended to have a clear immigration slant to them rather than being won through the promise of economic policies; economics found itself lower down the pecking order than it may have expected).

And this introduces a question that is central to the theme of this text – if economics is in crisis, just how fundamental is that crisis? Is there something wrong with how economics is currently being applied, or is it becoming a redundant medium? Economics is, after all, a fabricated concept that doesn't have any tangible reality – it is just something enabled by the laws passed within a state, which might tightly regulate activity in some areas and peel it away in others. Different kinds of economics (such as those associated with various forms of political systems – capitalism, socialism, communism etc) are possible; all it requires is amendments to be made to the laws that govern states, which then impact upon people's behaviour, how value is created, things are traded and work is incentivised.

Capitalism, specifically neo-liberal capitalism (a version that some say doesn't exist, others that it's a highly aggressive expression of capitalism that drives inequality), is underscored as our governing system for a specific reason. Politicians such as Ronald Reagan and Margaret Thatcher, heavily influenced by the writings of Friedrich Hayek, promoted and formed policies around the values of capitalism that we would recognise today as being common sense. Everyone is supposed to buy into – and receive their stake of – the economy in a way that puts it front and centre and elevated above all other conceivable issues. You can't have a future, a stable society or anything good and reliable without a strong economy to underpin it, we are asked to believe. Not for no reason did Bill Clinton's 1992 election campaign manager, James Carville, display a sign on his desk that read '*it's the economy, stupid*', in case anyone thought to question what the primary campaign issue should be. For anyone too young to remember life prior to the 1970s, this is just the way of the world; that the economy is everything and everything is the economy. There isn't anything that can exist independently of it.

Yet if we were to ask the average person in the street what the economy actually is, they might struggle with a coherent definition. In a simple sense, it just means a country's gross domestic product (GDP), but this is evidently too reductive. The economy seems oddly entwined with everything we do, it gets suffixed to terms to create sub-economies (the web is sometimes referenced as little more than 'the digital economy') and everything that either has happened, or can be imagined to happen, comes complete with economic impact assessment ('*sick days cost the economy x billion*'; '*better recycling could save the economy x billion*'). However, if we go back further than the 1970s, particularly before the 20th century, language just wasn't used in this way. While there are numerous records of medieval kings saying they want to increase taxation to fund a war against a rival nation, you'll not find anything from that time infused with the complexity of modern economic discussion: '*Due to the relative collapse in yields from the gas and oil markets, coupled with suppressed consumer spend and inflationary pressures arising from the volatile exchange mechanism, it has become necessary to leverage our assets and diversify our investment portfolio*'. The king's coffers were an important element clearly, but as a concept it wasn't as complex, entangled and impossible to penetrate as it has become over recent decades. The impact of one activity on another is far more trackable today and economics is the concept we have settled on that enables us to measure and understand these impacts. It's a different beast now, one of a different nature – which is not to say that it is *natural*; economics is the system of measurement we are using, but there is nothing inevitable about it.

This text is concerned with the validity of economics in the modern world, yet the introduction has leant heavily on recent political events such as Brexit, the 2007/08 market crash and the Scottish independence referendum. Why? Because the political situation, particularly the rise of so-called populism in politics – a trend that is generally viewed as being influenced by the perception of growing inequality and the idea that contemporary capitalism has 'left' swathes of people behind – has stimulated interest in debates around whether an alternative form of economics might be possible. Some argue for a greener version of capitalism, where energy-efficiency and sustainability are financially encouraged, others for a fairer distribution of wealth among populations and higher taxation for those able to afford it; the journalist and commentator Paul Mason even suggested dividing up elements of governance between political factions to suit their strengths, with defence and security overseen by the right while the left manage the overall economy. There is a widespread sense that something needs to change, that things just don't seem to be quite right anymore – that capitalism may have reached some kind of logical conclusion to its 500-year reign.

The problem with this discourse is that, while it may seem progressive and disruptive, all these ideas make the same assumption that roots them in traditionalism; that economics *has* to exist, that it is still a valid and unquestionably essential component for the requirements of a 21st century society. But – technology in this period is different from anything that has come before due to one concept in particular that it enables and that this discourse tends to gloss over: *the recognition of people as individuals by the surrounding infrastructure of society in real time*.

The profound change, alluded to earlier in this chapter, that the world has undergone can be best summarised as the launch of the world-wide-web (which made internet connectivity publicly-accessible). We take it for granted now, consider it to be part of the fabric of life, yet there is perhaps a tendency to think of this kind of digital connectivity as

something that exists behind a browser session, that is actively accessed by an end-user and can therefore be switched on and off; that there is an online world and an offline one, which exist independently of each other. As we'll see later in this opening part, digital connectivity is actually well on its way to becoming something very difficult to avoid across almost any area of our lives – and this is highly significant because it means information becomes trackable on everything we do. It has become a new form of currency and, if the enabling form for this information – data – is to be used effectively to transact (ie exchanged to gain access to something), which is the role that money currently performs under our economic system, then we have to assess whether it works in the same way as money. Whether economics just needs to be translated for the digital age, or whether it is actually rendered obsolete by it.

The thinking that underpins economics has been developed over centuries, so much of which fell in the unconnected (pre-web) period, with certain required elements (chiefly businesses, jobs, money and consumers) working in tandem to support its successful operation. Economics espouses the prominence of business, the need to have a job, the definition of people as consumers and the need for those people to have money to access things as necessary components of a functional system.

Yet if this idea of 'the economy' is to remain our primary medium for measuring and understanding human activity, it has to be accepted as a system that can be adapted not only to work in the connected age, but be wholly appropriate as the means for doing so. The title of this text is *Economics is Over*, but obviously economics won't just end naturally simply because the web exists, there are far too many people with vested interests who would like to see it continue for that to happen. In all likelihood economics could be forced to work alongside the web, but to just follow a route that doesn't seem to make sense anymore without considering the alternatives offered up by the transformational new technology and processes that the web makes possible would seem an odd approach.

Part of the problem here is that this fundamental question – whether economics is relevant anymore – doesn't seem to feature very high, if at all, in debates on our digital future. The primacy of economics is something of a given, which is evident in the way that it is routinely suffixed onto any new technology or approach – *the fitness economy*, *the mobile economy*, *the sharing economy* – it is universally assumed to be a central element of anything that seems contemporary or futuristic. It is how we look at the future, but there is no evidence that economics *is actually even needed* for the future, let alone be so core to its expedition.

Economics is regarded as natural, inherent and unquestionable. It is an enabler – something that governs the capacity for human societies to work and that must be obeyed at all costs, blindly so even. It is heresy to suggest we can do without it.

If we consider Brexit again briefly, we can trace a telling historical parallel in the UK for these kinds of 'break away at your peril' threats to illustrate how using fear of omnipotent forces to maintain an existing order is nothing new. An example exists in the guise of England's split from Rome in the sixteenth-century.

When King Henry VIII, frustrated over the inability of his first wife (Catherine of Aragon) to bear him a (surviving) son and heir, petitioned Pope Clement VII to annul his marriage so he could marry Anne Boleyn, he was refused. This forced Henry to openly defy the

authority of the Catholic Church in Rome, setting in motion the start of the English Reformation and getting excommunicated in the process.

Henry may have been an absolute monarch, but ultimately Rome still held the reins when it came to getting the blessing of God for ceremonies such as marriages, christenings and burials.

Should that happen today, it would probably be regarded as a nuisance by many westerners rather than a disaster, but for a sixteenth-century Catholic populace for whom papal authority was final and where the idea of scientific enquiry was still fairly rudimental, this essentially prevented any new-born children from being baptised and therefore from being able to go to heaven – and child mortality rates were extremely high, condemning huge numbers of souls to eternal damnation and leaving parents wracked with guilt. Everything that happened was strongly related to how pleased or displeased God was with his flock, and having access to His grace cut-off must have been incredibly distressing for people.

Returning to the present age, Brits now find themselves in a comparable situation with the break from the EU to be negotiated over the coming few years (if it happens at all) and the similarities between these two events are striking. An entity (king / EU member state) indicates that they want to make some changes to a contract (a papal edict / EU regulations), and meet with either a flat refusal (Pope) or an unsatisfactory compromise (minor EU reforms). The institutions being approached (the Catholic Church / the EC) as part of this process are political entities that control access to something intangible (God / the economy) and failure to remain a part of them leads to threats of being punished by these intangibles.

The message is the same – '*don't mess with this intangible force, as you don't understand it and only we, the institutions, know how to make it work*'. It's the political equivalent of '*don't worry your pretty little head about it*'.

Where once we had religious heresy, we nowadays appear to have entered the age of economic heresy. People may once have debated, agonised even (and still do in some cases, of course), over whether Protestantism or Catholicism represent the true Christian faith. But in the Tudor period few questioned the *need* for faith, the *veracity* of organised religious belief. Equally today, while many may question the claims made by those who subscribe to certain approaches to how economics is managed – such as the modern debate over whether free markets or protectionism is the most appropriate model for a country – no-one questions the required existence and ultimate authority of economics. Indeed, to do so would be to convey oneself as a bit of an idiot who doesn't understand how the world works.

And yet – there is something that seems wholly unconvincing in the supposed omnipotence of both these mighty governing forces of human endeavour. Just as how those of religious faith may regard an earthquake or tsunami as evidence of God's displeasure at our increasingly irreligious behaviour, so economics brings with it the continual threat of crises expressive of its authority – sometimes restricted to a specific area (a housing crisis, an investment bubble) and at other times hitting people on a far wider scale (the market crash of 2007/08).

Are we to understand that we are being punished for our growing lack of faith in economics, when rumours of market instability spook investors and people tighten up on their expenditure, triggering recessions in the process?

The problem with something utterly intangible – like religious faith, like economics – is that it can never truly be grasped or understood and must therefore be accepted by the overwhelming majority of people based almost entirely on unquestioning belief. If no-one believes in it however, then these institutions can just end up looking a bit silly.

And we don't have to believe anymore, as we are moving past the need for economics without even realising it.

The move toward 'free'

The most likely reason we haven't realised economics is over is that we're not ready to. Economics has become so ingrained in how we manage everything we do – or, arguably, how it manages us – that the very idea we could function without it seems absurd.

It's become natural to our thinking over time. Our approach to implementing new technology is to assume that economics still needs to be the chief functioning element underpinning everything, even where it makes little rational sense and, as a consequence, we are at risk of hugely limiting the potential that digital connected technology (DCT – and by which I mean anything with digital capability that is connected to the web) offers.

With the launch of the web and move toward the digitisation of everything (the following chapter explains what I mean by 'everything'), there has been a nagging sense building for a while that money needs to evolve in some way – that its existing form has suddenly started to seem a bit outdated. The response has led to what we might think of as 'digital capitalism', a form in which money still underpins all our interactions but in a less visible manner than has been the case previously.

A key indicator of its demise is the fact that money just doesn't seem to function naturally online – where lots of stuff is, ostensibly, 'free' at the point of use. Joining networks, using messaging services, reading newspapers – all things that would cost you in the physical world can be accessed and used at no 'cost' when they're digital. Facebook and Google are among the biggest companies in the world in terms of revenue, yet their services can be accessed and used at no overt financial charge (by the end-user at least).

This isn't to say that it's therefore as straightforward for, say, apples or stereos to become free too. But there's clearly a disconnect here. If these online services can be free in the digital age, are we to understand that they are the economic exception and that anything physical will continue to carry an overt cost for access in the traditional sense? That economics should be split into two domains where the rules apply in varying ways?

Of course, these things are not really currently free anyway – when economics is the measurement standard of success, such an outcome wouldn't be particularly desirable. The perceived value in any activity is exclusively linked to money under an economic system, but this is not the only way that value could find expression. This is the major mistake of our time – the way that we assume DCT presents an economic problem that requires an economic solution, rather than coming up with something entirely different and appropriate to suit the technology and what it enables. The way economics has been interpreted to stay relevant in the modern age is by getting individuals to 'pay' indirectly –

providing personal data with every interaction that enables digital businesses to build up a profile of them and push relevant marketing messages from paying advertisers. As the business axiom would have it – *if the service is free, you are the product*.

This is not to say that economics is all about transactions though. Some economists and academics have speculated as to how 'non-economic' activities – which refer to those that do not directly contribute any overt monetary gain to the economy – could be factored in. These include things such as 'likes', 'shares' and photo uploads on social networks – activities where people have undertaken some form of action that has resulted in a degree of value being built (granted, for 'free'), as an engagement between individuals or an individual and a business has taken place – yet nothing economic in character has been created in the process to influence hard GDP data. From a traditional measurement perspective, nothing has technically happened as nothing representing a tangible economic transaction has registered, even though people spend a lot of time performing such activities today. Youtubers are a primary example of this, sometimes amassing millions of subscribers who don't pay them anything for the service they are providing, so economics has to be covertly inserted into these relationships in other ways (once again, usually through advertising or brand endorsements).

This is just one area where traditional economic measurements (as in – '*someone did something, the financial value of it was x*') don't seem to be quite appropriate to cover modern life to the required level anymore. Elements of our personal data, which is what qualifies as currency in the digital world, would also need to be considered within this non-economic bracket. It's worth taking a moment to define what the term 'personal data' actually refers to. Many people probably assume it means the important stuff that a cybercriminal might want to steal and ultimately profit from – bank account details, site logins, passwords – but it goes much deeper than this. As we'll see, as DCT starts to play an ever-increasing role in every aspect of our lives, almost nothing – in principle at least – will be wholly exempt from being tracked as data. Personal data will eventually refer to everything that someone can do, more or less. It already extends to the books you've read, music you like, dietary choices you make, websites visited, pages viewed, amount of time spent per page, where you've been, who you were with, even the number of steps you've taken in a day. And the volume and variety of data provided by you is set to grow exponentially over the coming years; after all, it's all part of the contract for how you are able to access things for free – because it's *not* free really.

In fact, it couldn't be further from free if you think about it. You're giving up (often without fully understanding it) your freedom from commercial tracking, your right to act without being targeted as a consequence; your personal data which, in the fully integrated digital world to come, is actually *yourself*. It's non-economic because data is essentially a descriptive medium. It's not transactional in nature – transferring an amount of something from one place to another to act as recompense for gaining access to something – data either just says that something is a certain way (this person lives at this address, is this age, is this height) or tracks an activity that has occurred (this person went there, spoke to that person, viewed this, bought that). To simply append economic measures on to each area of personal data would be to commercialise them, legitimising the role of economics in digital in the process, which is currently the direction of travel.

People have responded to this penetrative and secretive tracking of personal data in exactly the way you might expect them to – by saying 'no'. An estimated 18% of UK web

users were reported to be using ad-blocking software in 2015 according to an Internet Advertising Bureau (IAB) survey[ix], with a full 35% of 18- to 24-year-olds actively blocking the backdoor through which money was supposed to remain a relevant part of interactions between businesses and people online. A 2015 report by PageFair and Adobe[x] estimated that there are 198 million active users of ad-blocking software around the world, with ad-blocking growing by 41% globally over the previous 12 months. In the UK, it was up a whopping 82%. Where the ads do get through, a Kantar TNS survey[xi] found that 40% of Brits (26% globally) 'actively ignore' social posts anyway. It's a broken system that marketers pretend is working fine. Overall they are still able to secure a return on investment (ROI) from this activity, so they don't spend much time worrying about whether the user backlash could derail this kind of approach in the long-term. Indeed, a common message I hear from ecommerce directors in the UK is that they don't understand quite what the ROI is from social media, but they know that they have to be very active on there anyway. It's an arms race where the eventual weapon being designed remains almost entirely unknown.

It's fairly telling that a 2016 Chartered Institute of Marketing survey[xii] found that even 68% of marketers are reluctant to provide personal data to brands, due to the fact they know how it might be used.

It may seem anti-logical for businesses to treat their customers in ways that clearly annoy them – surely a risky strategy when the web can make the full range of competition readily available at the click of a button. The reason that they do it relates to the way in which economics has been mapped across onto the web. It doesn't make economic sense to have businesses providing services against which they can't accrue income, so more covert ways need to be introduced. If a site visitor isn't paying in conventional ways (ie using money), they need to pay using an alternative form. The form that has apparently been settled on is data, but this is to assume that data is the same as money (ie that it represents a viable replacement) in some fundamental aspect – yet these two forms do not appear to present any direct, rational or meaningful comparison. In fact, finding functional similarities between the two is not a particularly logical process to follow – it makes about as much sense as asking someone to identify the ways in which a traffic cone is similar to a tree.

Instead of undertaking such a thankless task, here I will just focus on two major points of difference between them that illustrate how assuming data to be some kind of natural, seamless digital replacement for analogue money – keeping economics relevant in line with its current definition – does not make sense when the nature of individuals' interactions with anything external changes from being governed by economics to being defined by information; which is what digital interactions, transactions and engagements are all about.

1. Quantity

Money has to be finite in order for economics to function – it cannot just be inflated and deflated without limit whenever it suits. So an economy is calculated to be 'worth' a certain amount; the UK economy was adjudged to be worth £1.2trn in 2016, for example. The size of an economy and subsequent quantity of money available to the people under it is linked to a number of criteria, such as the value of products and services in a given territory, the strength of the employment market, business productivity and a number of

other factors related to the range and depth of business activities undertaken there. An economy might be buoyant, but too strong (or, by extension, weak) is considered a bad thing; the ideal is for a 'Goldilocks' economy that is neither too hot nor too cold. Even when strong, it is a relative term ('strong' might mean growth of 8%, but not 100% or higher unless the economy was extremely small to start with) and advanced economies tend to grow very slowly, often by just a percentage point or two annually, or even less than a percentage in times of uncertainty and difficulty. An economy growing too strongly brings with it the prospect of ballooning inflation, while those growing too weakly can cause uncertainty for businesses, leading to investors pulling their money out and employment levels threatened. Hence steady is best, and uplifts of tens or even hundreds of percent are not always as welcome as they might sound.

If money was not restricted, with the overall quantity controlled by a set of rules and regulations around taxation and other controlling financial measures, every government could inflate its economy artificially to eradicate debt and increase their capacity for spending (so the UK government could just say '*on Monday our economy was worth £1.2trn, on Tuesday we decided to up it to £10trn to get us out of a hole*'), enabling them to engage in far more ambitious spending programmes, but it wouldn't translate to there being unlimited supplies of the resources they may require as part of those programmes. They may say '*we want a million tractors*' but it wouldn't mean they are suddenly available just because they have sufficient money to purchase them.

By contrast, data, while not necessarily infinite by definition, is something that can be generated in quantities – and at a pace – that make it futile to attempt to plot reasonably predictable boundaries for how vast it can become. So, while the UK economy grew just 0.6% in Q4 2016 with forecasts for the coming years not much higher, the increase in data produced by every device capable of doing so over that same period would be astronomical by comparison. And, as data can technically be tracked on anything that can be measured, it isn't restricted to just to denoting something specific like financial value. The role of data is to provide information, which can extend to any area of activity, financial or otherwise.

The amount of money available at any given time and, of course, the actual value it holds, is anchored to people and resource, regulating the relationship of each to the other to determine the capacity for people to access things and prevent imbalance. If an individual could have unlimited stores of money, with each unit holding a high value, the availability of actual things would never be able to meet potential demand. Data, on the other hand, works by providing information – describing things, basically – in relation to things, but also people, activities, places, businesses, governments, bodies and any entity that performs any role. Neither does it stop at these high levels – data can technically be available at depths that are only limited by the capability and ubiquity of DCT. As digital tracking becomes ever-more pervasive and penetrates deeper into our lives, it becomes possible for fresh streams of data to be generated every time someone moves, speaks, steps or interacts with things around them. Multiply that by billions of people and billions of smart pieces of technology, and the scale of data created rapidly becomes incomprehensible to – and uncontrollable by – the human mind.

The amount of money available needs to be controlled, or the concept of value becomes undermined. Managing the balance between people saving and spending is a major focus for economic regulators, who tinker with interest rates and the availability of financial

instruments such as bonds, based on perceptions of confidence and other economic indicators, to help stimulate activity in markets such as retail, housing and travel or to encourage saving. They do this because the amount of money that exists is finite, but not centrally stored or comprehensively categorised so that every penny is accounted for at any given time. It cannot be because physical cash may be withdrawn from a bank account and spent (or saved) in an untracked way. The apparent move toward a cashless society (one in which all transactions are completed through cards or digital means) would appear to overcome this, but either way economics would remain unruly – it requires the willing participation of people, who are all unique with different circumstances and desires, to channel their behaviour in a certain direction on a wide scale so that what is perceived to be the right balance for the economy at that time can be struck. This may mean incentivising general consumer spend, investing in home ownership, raising interest rates to make saving more attractive or encouraging companies to increase the amount they export or import. Achieving this is often a very delicate affair and people may respond, or they may not for a variety of unforeseen reasons, as the relationship of consumer to external entity under an economic system grants consumers the ability to accrue an amount of money (which may have some or no restrictions on the amount one individual can have, and may come in alternative forms under some systems such as rationing booklets or vouchers) which they then have a degree of choice (which, again, may vary) around when, how and what they elect to spend it on. When markets seem a little uncertain, people tend to tighten up their spending in case their job comes under threat so, although the total amount of money that exists at any one time is necessarily limited, there is no guarantee that a reasonable percentage of it is in active use. For a concept that features such complexity, large areas of economics can actually be relatively dormant, sat in bank accounts or stashed under someone's bed.

Data is different. The volume in which data exists can build almost without limit – there is no need to put restrictions in place around how much should be available at any given time to regulate access between one thing and another. Logically speaking, the greater the volume and variety that is available leads to a greater probability of making accurate matches between individuals and individuals, things and things or individuals and things. If data sources continually multiply and create vast new datasets at pace and at scale, the fact that more information is available does not only aid with making an accurate match in the first place, but helps to build an ongoing understanding of any activity that leads up to or follows that match being made.

So money needs to be restricted for value to make sense, while data creates the potential for more efficient value the greater the volume and variety that is available. In an economic transaction, where money is the currency, it is moved between one entity and another so the overall quantity is not increased (though it may be altered through taxation, charges and fees). In an interaction, where data is the currency and it can be created and tracked, the volume created augments on multiple sides so that everything that happens continually creates a greater volume of it, potentially generating value for both parties involved in the interaction but also for any number of other entities that may benefit from having access to that information.

2. It's personal

Monetary systems are concerned with ascribing economic value to things, typically in a generic fashion, in line with factors such as supply and demand, to help structure who is

able to access them and in what quantities. Otherwise unlimited numbers of people could make claim to any given thing at any given time. Value is set at a point of sale or interaction – so a pint of milk costs 49p, irrespective of who is trying to purchase it (there are some exceptions to this fixed-cost approach, such as in wholesale – where the price of a product may vary in accordance with the quantity of, or frequency with which, the specific item is purchased by a specific customer). Money is the system that makes sense when it's not feasible to track and understand huge amounts of detail about every area of any transaction made – so exactly who bought it, for what purpose, how they used it, what it achieved etc. Money performs the role of common standard essentially, to enable disparate individuals or groups to trade. If one person is a lumberjack and another works in marketing, it provides the common means for accessing or purchasing the various things to which they do not necessarily have any direct connection to the manufacture, distribution or sale of (say, a cup of tea).

Money, in essence, fills the void created by a lack of information about a specific individual's need for, and use of, any given product or service. Hence its perceived value – the price that must be paid for an individual to access or use it – is generic and applicable irrespective of each individual's circumstances.

Data is however, by very definition, *information*. It stands to reason that the greater the volume of data there is available, from the greater number of sources, the more focused and individual the information it provides can be. Data isn't particularly useful in raw format – in a digital sense, it just exists as a series of bits and bytes in various sequences. In order to become useful it has to be meaningfully identified, processed, tagged and stored in a way that is cross-referenceable.

The systems required to do this are still developing – we have to remember that the web has only been around for a few decades – so many of these systems that process data tend to do so at the level of segmentation, which can be used at varying degrees of sophistication. What a segment does is indicate potential for an individual to be interested in a certain topic. So if someone buys a ticket for a football game, they are probably interested in football more generally and may be put into a marketing stream for football-related content (it is only probably, as they may actually have no interest but were purchasing the tickets for someone else, which is why segments can only ever be so accurate – they don't make allowances for individual circumstances).

Many of these systems are still evolving to process data at the individual level at some point in the future – it may be aspirational still in many cases, even for the largest tech companies, but that is the clear evolutionary path for DCT. This means that data will not just be providing information about an individual's propensity for being responsive to certain content themes, it will also become possible, theoretically, to understand that individual on an individual basis and across multiple areas of their life.

Data, then, will become increasingly personal in nature, increasingly specific to the very thing it describes, rather than just providing information that is in any way generic or performing the role of common standard.

And this is why economics is facing something a lot more fundamental than its Michael Fish moment. We have reached the point at which humans are no longer able to process and understand what is going on, as the web and DCT have accelerated the pace at which things happen by connecting everything together and created a flow of data that can only be processed by machines, overseen by artificial intelligence (AI) systems, which need to have a reasonable level of autonomy in order to make decisions on what is happening – humans simply cannot process information fast enough or to the required scale enabled by digital connectivity. The human version of this system of governance was measured in *economic* terms, the machine version is measured in *information* – the outputs do not compare according to traditional ways to understand them.

The 2007/08 crash and dire post-Brexit warnings may indicate a failure of forecasting accuracy, but the crisis facing economics today has much deeper roots. There is little point in attempting to restore confidence in economics as it doesn't make a natural or obvious fit with the concepts that define our age – data and DCT – but is being mapped onto them anyway. We've tried to overlay the competitiveness of economics onto something inherently *cooperative* – that relies on data-sharing to function to its optimum level.

Yet the potential – and therefore, rules – are changing in ways that will make economics obsolete. And, while it may seem a form of heresy to call it out, the alternative is blind faith in something that shows no evidence for being appropriate anymore.

And the factors feeding this move toward economic irrelevance are numerous.

Economics will not just vanish. It is too deeply ingrained within the way that everything is managed – and with too many interested stakeholders in its continuation – for it to be rapidly deconstructed just because it got a few forecasts wrong and there are lingering questions over its relevance to the way online services function.

In the part following this chapter I will look at how current definitions of the primary pillars of economics – business, jobs, money and consumers – are on the way to being invalidated as concepts by DCT.

Before explaining how that can be possible, a bit of background information is required, as it's important to understand that technology has already changed the way that things work in some really fundamental ways – where we are today is very different from where we were a decade or two ago – and what we have seen so far is just the start. This chapter first outlines the four factors that are currently building in significance and will influence this shift in the validity of economics as a governing system.

Some of these factors are quite technical and complex in nature, but they are covered at a high level only. That said, I have assumed a basic level of understanding of digital and web technology.

Some of what I outline in this section may seem fantastical, but in many cases it's not as far away as you might think. It may seem that modern technology has established some defined parameters and settled into a pattern, but again it's worth keeping in mind that we are actually still at an incredibly early phase of the web – consider how far it has advanced in the quarter-century since the world-wide-web protocol was developed, and where we could find ourselves after another quarter-century of technological progress.

The four influencing factors

1. *From 'always connected' to 'total connectivity'*

Google employees frequently present at industry events and conferences. That's not as exciting as it sounds; Google are an extremely corporate organisation and everything they say is carefully PR-controlled. Around 2014, these presentations started including a line stating that '*nothing has ever happened as quickly as mobile before, and nothing will ever happen that slowly again'*. What they were getting at of course is that, due to digital technology and the ubiquity of the incredibly smart devices that people have access to, the pace of change is rapid and accelerating, with a penetration and scale that was unimaginable before the web. So while it might have taken a few years for smartphones to really become influential, digital is becoming ever-more pervasive across all areas of our lives, meaning its capacity to effect change is augmented accordingly.

The real driver behind statements such as Google's is that more and more things are either becoming internet-connected themselves (meaning they can track data) or are able to be *tracked as data* by these internet-connected things. This is an important distinction – not everything has to be specifically designed as web-ready in order to be trackable. They just need to be identifiable in some way by the things that are.

The difference between how things work now and how they will in the near-future relates to our level of connectedness:

- **Now** we are *always connected* – due to having a large number of devices for accessing the web; and
- **In the near-future** we will enter an environment that is closer to *total connectivity*, where practically everything we do has the potential to be tracked and cross-referenced in real-time, with little opportunity for 'switching it off'.

That may appear a bold statement, but it's not excessive when we look at the evidence. It represents a major shift in how things work and are able to work. It is basically the difference between having an element of control over when we are engaging with devices and systems that can track data on us (because we have clicked on something on a website, for example), and having it happen in a far more automated sense less requiring of someone to manually set that activation procedure in process.

The level of connectedness is contingent on the number and range of these devices and systems that are able to track data, combined with the coverage they are able to achieve. Web access is not yet universal either. In 2017, only 51% of people globally had access to it, with some sharp regional differences – while in Europe penetration was almost 80%, in Africa it was just 30%[xiii]. Even where web access is widely available, the idea of 'total' connectivity may be something that isn't possible to guarantee at all times – there will always be black spots, we may also see legal requirements introduced around 'kill switches' for digital so people have the option to turn it off entirely (albeit temporarily). Cities, particularly major ones in developed countries, will logically feature a wider and more complete spread of connected technology, both through the greater number of cameras and sensors on the various infrastructure there as well as the tendency for new technology to be trialled in those locations first. This suggests an urban / rural divide in terms of how 'total' total can be, with general internet coverage another long-standing issue. According to the UN, only just over half (54.5%) of the world's population lived in urban settlements in 2016. This is projected to rise to 60% by 2030[xiv], but it still leaves a huge number of people in non-urban environments where external digital technology and connectivity is likely to be relatively less advanced and pervasive. Or, less 'total'.

Be that as it may, the technology to enable connectivity is always evolving and getting the entire world connected is a focus for many governments, not to mention the major tech firms (the usual suspects such as Facebook and Google – but also SpaceX, whose Falcon Heavy rocket, which has the capability to deliver very heavy loads into orbit, may provide the realistic potential for increasing satellite coverage in hard-to-reach places around the globe), who boast huge resource and want to ensure they can secure new customers – not to mention their time and attention – before a competitor finds a clever alternative way to do it. Some of the ideas may be a little crackpot – Google's Project Loon initiative to send connectivity balloons over Africa, for example – but it's such an obvious stumbling block for so many digital initiatives that it will have to get solved somehow. Some even call for internet access to be regarded as a human right. Connectivity is also not a linear process – so while in the UK web infrastructure was built around dial-up connections, then broadband and now wireless as we use multiple (often mobile) devices to access the web, this doesn't mean that developing countries need to follow the exact same

sequence. In many countries in Africa and Asia they haven't necessarily got the historical dial-up and broadband infrastructure in place, nor widespread access to desktops, so have skipped that step entirely and gone straight over to networks that support smartphone usage, as this is how everyone accesses the web there. Consequently, some mobile-based apps have become hugely dominant in certain countries there (such as in China, where people can use WeChat for almost anything from messaging to gaming and payments, while the M-Pesa mobile service has become the de facto method for making payments in Kenya).

So there will always be some reservations about how 'total' total can be, but the important thing to understand here is that we are moving toward a phase in which more or less everything that you do *can* be tracked, measured and analysed in some way by *some* external agency. Not just what websites you visited and pages you viewed, but every action you perform. Then shared with other agencies that enable them to add additional insight and context to the data they are able to track on you.

You may think that sounds unlikely, or that we would never allow that level of intrusiveness to happen – this is using our personal data after all, surely an individual's most precious asset. The truth however, perhaps surprisingly, is that far from resisting this we have shown ourselves only too willing to play our part in enabling it.

We have already entered the age of being 'always connected', which started in a modern public sense with people being able to access the web on their computers through dial-up modems (in the UK at least), which were clunky, slow and unreliable. As the supporting networks became capable of carrying data faster – through broadband, 3G and 4G (with 5G to come in the near future, where you'll be able to download a full-length movie in a second) – people started to spend more time online as they were able to do more things on there – view higher resolution images, complete transactions, download videos. And the range of sites and services available to support activity in these areas (and, of course, many more besides) has expanded accordingly, increasing what marketers refer to as 'stickiness' from the overall perspective of the web – which is to say the greater the variety, convenience, entertainment value and usefulness of things available digitally, the greater the reasons for people to spend more time exploring and using them. We have, in effect, become dependent on the web.

This was a major development in itself, but having a network with limited means of accessing it greatly reduces its potential. Evolution in the kinds of hardware capable of providing this access in far more places and situations has kept pace – and how this happens is now set to multiply and fragment massively.

There are a wide range of digital connected devices that people may have access to (such as TVs, consoles, e-book readers etc) but by far the most important devices in driving us toward being always connected have been tablets and smartphones.

The impact of tablets was to greatly extend the *times and contexts* in which people could access online content. They switch on quickly and, because they are primarily hand-held devices, are very convenient to use in conjunction with other activities – such as when watching TV, known in retail jargon as 'second-screening'. For the retail industry specifically, a notable result was that it created a new peak time for traffic to online retail sites. Traditionally peak times had been midday and early evening; tablets also added late

evening. Note that is an *addition* of a peak, as opposed to a replacement – its effect was to extend, rather than shift.

This was key to enabling people to spend more time engaging with online content, but the real game-changer has unquestionably been smartphones.

It took a few years for smartphone models to be released that were affordable on a wide scale, but 81% of adults in the UK owned one in 2016 according to research by Deloitte[xv]. Broadly speaking, a 'smart' phone is one that does far more than just allow the user to make calls and send texts; it has other built-in technology (such as a camera), can connect to data networks and offers access to various functions, largely through apps. And the thing with smartphones is that they truly do enable people to be 'always' connected, rather than just extending it onto the sofa. Barring mountain ranges, tunnels and deserts (though these will also probably be covered eventually), networks can be accessed almost anywhere using these devices; hence 'always'.

And we do use them anywhere. Look around you at any given time and you'll see people's faces glued to their screens. Walking a dog, waiting for a bus, crossing a road – anytime, anywhere, *always* connected.

A general way to understand the difference between always connected and total connectivity is that the former usually requires the user to request that the flow of data begins – by typing in a URL for example, clicking on a button or opening an app – while the latter will be a far more continual process of data flows in both directions at once due to a growing capacity for connected things to 'recognise' people (more on this shortly).

We might identify three stages for how connectivity will come to resemble something approaching total. Using diet tracking as an example, the first stage of tracking is generally where we are now – with apps available that prompt the user to manually enter food they have consumed into them. This produces a handy record of how many calories that individual is ingesting on a daily basis for personal reference (though, of course, this can also be stored in a central database for benchmarking purposes). Some of these apps even allow users to match the exact brand by scanning a barcode ('Heinz beans, 415g') so it can pull in the nutrition information directly from a digital product label. Useful, but still rather manual. The second stage would involve estimations, based on intelligently cross-referencing information from different datasets. This may be matching up products purchased at the supermarket with what is scanned by connected devices in the kitchen to approximate what has been used – it might also look at items on a restaurant bill to get a fuller view of what that individual has consumed. This is a far less manual process, but still has room for error – just because someone has ordered something from a menu, it doesn't necessarily follow that they ate all or any of it. The final stage is when we arrive at a method for having fully automated tracking, making full use of external recognition technology to cross-reference datasets, which happens without the user needing to do anything but is able to be highly accurate with little need for relying on rough estimations to cover any 'data black spots' that might exist.

This is not to say that these steps are not blurred in some way, or that fully automated tracking doesn't already happen to an extent – we don't always have control over when we want to start engaging with digital services by clicking a button. No-one has ever said to the mobile networks '*please track my every move*' but they can and do – not because they are evil or voyeuristic, neither does it suggest that they are using it in any meaningful way

at present, but because it is the nature of how the technology works. Mobile phones function by emitting a signal into the phone network, which means that it is possible to track their location at all times (again, barring mountains and tunnels currently). Any request sent up into the mobile network (such as typing in a URL in a browser on a smartphone) also provides the networks with data, so you can see how some companies are already capable of building up a pretty good understanding of your life without even needing to cross-reference with that of other companies. Many apps make use of this 'in motion' functionality to provide information that is specific to an individual's circumstances (health apps that track how many steps you've taken, for example) – and they can sit there quietly tracking data too (again not many people said '*please track my steps*' but their devices still do). What's more, apps sometimes use 'passive tracking', which people accept in the terms and conditions (because they don't read them[xvi]) – this enables apps that are not being actively accessed and used to monitor certain other data being streamed from the smartphone, such as the user's location.

So even today, based on that information alone, we are already very well mapped by technology (and note, that's without even mentioning companies like Facebook or Google there) – it's just that the supporting infrastructure hasn't yet developed in such a way as to take full advantage of that fact and create comprehensive understandings of individuals on an individual basis.

How the smartphone has evolved gives us an interesting clue as to where it may be going. People still refer to them as 'phones' but these are now bona-fide multimedia devices that also serve as photo galleries, email inboxes, stereos, GPS trackers, video streamers, personal diaries, personal assistants, health trackers, book libraries, wallets, banks and gaming consoles. Nor is that an exhaustive list by any means. In fact, the low average percentage of time that is likely spent using the phone function on a smartphone would mark that name out as something of a misnomer – it may have started out as primarily being a phone, but it's debateable whether that is an accurate description anymore. Whether smartphones have a long future ahead of them as the popular web-access devices of choice is hard to forecast but, whatever the future device of mass choice happens to be, it's easy to imagine that it will serve the role of singular access point for managing multiple areas of our lives.

On top of the above, consider how we play our part in all this by allowing our likes, friendships and opinions to be tracked through social networks, as well as deeply personal conversations through instant messaging (these messages do not just exist between the sender and recipient; the sender basically creates an entry in the enabling platform's database, a copy of which is pushed out to the recipient. Yet most people probably don't realise that or think about it in that way) – and the reality is that most people have almost no idea what happens to this data behind the scenes, or just how much can be known about their behaviour and character from such seemingly innocuous activities. Now imagine if tech companies such as Apple, Facebook and Google were not bitter competitors and openly shared everything they know about individuals between them – this would likely already be frighteningly comprehensive in the eyes of an unsuspecting public.

This is absolutely not just about smartphones and social networks, however. Another important enabler of total connectivity is the extension of digital capabilities into so many

other types of what we might still term 'hardware', but that aren't reliant on an individual actively clicking on buttons or tapping a screen to activate.

Fitness trackers are a major growth area in technology. These typically take the form of wristbands or something similarly wearable (it's also known as 'wearable tech' – a sector forecast, in an economic sense, to be worth $29bn globally by 2022[xvii]) which then track our 'health data' – our sleeping patterns, heart rate, steps taken in a day and numerous other physical activities. Again, things that were not data before but very much are now.

Then we get into the 'Internet of Things' (IoT) – which is a fairly loose term used to describe the connectivity of a wide range of formerly static objects, which are often referred to as being 'smart' once connected (though some, while being smart, are undoubtedly dumb as ideas – smart socks, for example). This is everything from traffic lights to kettles, blinds, light switches, cameras, TVs, ovens and even paving slabs (seriously[xviii]).

The 'smart home' is a keen area of focus for technology companies. A smart home is one that is fitted with a number of sensors and monitors that can track data in a specific area and use it to provide some kind of useful, contextually-relevant function. An already common example of this is digital thermometers, which automatically switch the heating on (and can track when, where and for how long) should the temperature drop below a pre-defined measurement in rooms throughout the house. They can also be switched on and off remotely using an app – and everything that it does produces data.

Thermometers are just the tip of the iceberg – our homes could soon become hives of data, particularly once smart kitchen equipment becomes affordable on a wide scale. This introduces a raft of automated possibilities – monitoring items in fridges and cupboards and ordering replacements when running low, suggesting and assisting with recipes, warming up the oven, testing whether items are edible.

This means that everything we eat, when we ate it, how long we spend in each room, who we are with, how warm we like it to be – and much, much more – suddenly becomes knowable and, as it exists in data form, can be processed and acted upon. This may seem too intrusive for people to be comfortable with and support on a wide scale, but the convenience and usefulness of some of these implementations counterbalance that anxiety. For example, radio frequency technology is being used in scanners that can sit in the corner of a room and allow for anonymous scanning of people to see where they physically are in that room. That might seem far too intrusive to ever reach acceptance among the public, but when you consider how it could give family members a tool for ensuring an elderly relative hasn't had a fall in their home, its appeal becomes a lot clearer. It's potentially intrusive, but its use-case is probably strong enough to outweigh the anxiety that may cause.

The numbers that consultancies in the technology space are putting out are eye-watering. According to Gartner, the average home will have 500 connected devices by 2022[xix] – with 6.4 billion connected 'things' in use in 2016, rising to 20.8 billion by 2020. Samsung, the world's largest producer of electronics, has announced that all its devices will be connected (and intelligent) by 2020[xx]. To be clear, this means that, from now on, no electronic equipment is being designed as standalone, unconnected to the web. That's not some distant future, at the time of writing these forecasts are three-to-five years away. Neither is this simply the preserve of commercial marketers looking to get better results

from better-targeted campaigns – the potential benefits of connecting things together and monitoring data on all our activities is too great to ignore, and academia are equally focused on developing this area. One example of this is a joint initiative between the universities of Bristol, Reading and Southampton called 'SPHERE' (Sensor Platform for Healthcare in a Residential Environment)[xxi]. This concept actually refers to a series of sensors that monitor people over an extended period to help build up a picture of their diet and activity – including adjustments in posture and sleep patterns – and identify indications of medical or well-being issues. One of the key tenets of their research is that they want the technology to be 'acceptable in people's homes' and have a test house fully set up to track volunteers. It's early days, but this is fundamentally the way the world is going. With academia and its limited budgets, progress is likely to be steady – with technology companies and their huge capital investment in understanding more and more about us, it could be anything but.

Note that this is all far from saying that absolutely every object will need to become web-connected, and there are already many inventions that seem unnecessary – such as smart umbrellas and toilet roll – so we don't need to make everything smart, it's far more efficient to focus on ensuring that everything important can be tracked and measured in some way by these smart devices.

One possible efficient solution would be to simply roll-out an unobtrusive infrastructure of external sensors and monitors (situated throughout 'smart cities'[xxii], another term for a city that uses connected technology, something all cities have an aspiration to get toward, on things like lampposts and bridges) that are able to measure data, cross-reference it in real-time with other datasets and draw logical conclusions based upon how they interrelate. Again, the idea of smart cities may sound futuristic, but most major cities have already made some strides in this direction, while others have attracted significant investment to be completely transformed by it. Sidewalk Labs, which is the urban innovation unit of Google's parent company Alphabet, have a deal in place with the city of Toronto to develop 332 hectares of waterfront land into what it calls a 'connected district' – it claims to be '*building a city from the internet up*', which very clearly indicates that it will be more or less impossible to avoid digital there. Life will be entirely based around connectedness, presumably. Yet this is, of course, only so useful if this infrastructure is not ultimately also connecting with people (or *recognising* them, to be more precise).

Then there is the transport infrastructure. Driverless cars can still seem rather futuristic and frightening but, as alarming as they might seem for many people, this technology arriving on public roads may not be far away and these will massively increase the capacity for areas to be scanned by a huge network of cameras. In fact, it's difficult to imagine a manual car being legal in a smart city. There are actually five levels of driverless car, as set out by the Society of Automotive Engineers. The first four require a human still to be involved in varying degrees – from hands on the wheel at all times to being ready to take over control if anything goes wrong. Level five is fully autonomous, which has not been successfully achieved yet but is anticipated in the next year or two.

As soon as they satisfy all the safety concerns and pass the legal hurdles, the potential benefits on offer could result in them quickly becoming commonplace and they will be entirely dependent on data in order to function – tracking every journey undertaken by each individual as standard, as they are covered in cameras to enable them to 'see' all around them (this is not just restricted to cars, many robots have multiple cameras on

them – the world will soon start being 'filmed' in so many new ways that were not practical before and this will all produce useable and cross-referenceable data). Again, that may seem a little overly optimistic, but their introduction may be very timely. There has recently been a lot of focus on pollution in cities[xxiii], a large part of which gets blamed on vehicles, particularly those with diesel engines. A system of shared-access, automated vehicles could significantly reduce the number of vehicles on city roads, but would also probably be electric by default, hence they may receive considerable legislative support from governments under pressure to reduce the kind of pollution generated by vehicles.

Singapore may be the first city to mass-roll them out publicly, with plans for nuTonomy and Delphi Automotive to introduce a small fleet of autonomous vehicles to a business district in 2019[xxiv]. Major car manufacturers have also invested heavily in this, with notable tie-ups between Volvo and Uber as well as General Motors and Lyft[xxv]. Google and Tesla have been testing driverless cars on public roads for years, but 2021 is currently being signalled as the year during which fully automated rides in cars without steering wheels or pilots may become a reality on public roads.

Again, it's important to understand the difference between actively engaging with something in the digital world – typing a URL into a browser, liking a social media post, clicking on a link – and surrounding ourselves with these various types of sensors and monitors that can stream data on an individual's activities in real-time and without needing prompting actions to begin doing so. The volume and variety of data that could generate in the background without most people even noticing would be both comprehensive and staggering.

Of course, the kind of prompting action I've mentioned so far has tended to focus on a physical push, click or swipe – but there are other ways to start streaming data across the web.

One that will likely prove most alarming to people is what we might term 'the trend toward recognition'. One form of this already being widely used in technology is voice activation. You may be aware of examples of this type of service, such as Apple's 'Siri' or 'OK Google' (many smartphone models include the technology as standard). More recently Amazon has started aggressively pushing their Echo speaker, with most of their major tech competitors following suit by issuing similar models. This device is placed in the home and responds to voice to execute a range of commands the user can issue. The point to understand here is that this is a 'listening' technology – which waits for a voice prompt (saying 'Siri' or 'OK Google') then processes what the user says to provide an appropriate response. In a very basic sense, this can be used to issue commands or execute searches ('*where is the nearest shoe shop*'), but quite where the barrier is between listening and not listening is a topic for debate. Some people have become suspicious of adverts they receive on their devices (or TV, as some smart TVs also feature voice activation services) that seem remarkably relevant to something they have discussed out loud but not actually provided information about through other means. It is this distinction between what is acceptable and not acceptable to track that is currently framing debate in this area – on the one hand, people understand that being able to make something happen simply by saying it is highly useful; yet if additional information that they share in the process is also tracked and stored it can seem a bit unnerving (the significance, for our purposes here, of the move toward mass use of voice assistants is covered in detail in part IV).

If that form relates to the audio world, there is another gaining momentum relating to the visual world. Image recognition technology has been talked about for years – it basically means the ability to point a camera at something and find out what it is without needing to add any words to structure that query. At some of the largest tech companies (eg, yes again, Google and Facebook), they have implemented a technology known as 'deep learning' that can identify faces in photos and find a match usually through posts on social media accounts. As smartphones almost always have cameras built-in to them, this technology is also now accessible to people on a mass scale. A notable example of this is Blippar, an app that enables the user to focus the camera in on any object which it then tries to identify. At the moment it is fairly rudimentary – if you point it at a table, it says 'table' – but the concept has been proven to work and they are making progress. In July 2017, Blippar announced that its app can now recognise human faces, with 370,000 'public figures' already on record[xxvi]. If we were to fast-forward a few years, how large could that database already be?

Extending the above example further, in order to be genuinely useful it needs to be able to identify the type of table ('oak' or 'IKEA table' or 'IKEA table, serial XXXX'). Once the technology advances from 'it's a table' to 'it's *this exact* table' (ie doing with objects what they have started to achieve with human faces), an entirely new world of associated datasets can be accessed to provide additional insight and information on it. This prospect would make the network of cameras on cars and robots highly useful in mapping what is going on around them, particularly in relation to whom they see, at any given time.

And this is the real driver for why the trend toward recognition will happen – if something can be identified it can be cross-referenced against other datasets, greatly enhancing the experience someone has in terms of efficiency and relevancy. Consider how this differs from a CCTV network, where cameras are installed on lampposts and all over population centres. These are only checked if there is an incident (robbery, murder etc), as trawling through the footage is a highly manual and labour-intensive process. If this was replaced with a network of advanced image recognition cameras, they wouldn't need to request permission before they could track people, they just would – they would be everywhere as they form the 'eyes' of robots and automated vehicles and, what's more, the network could actively share that information with other data sources so that an individual's every move could be better understood, without the need for manual intervention as intelligent algorithms could pick out the useful information to process autonomously.

It's easy to see how the trend toward recognition could apply to other senses too, such as touch. Already there exists a pretty large record of fingerprints by virtue of the iPhone unlocking mechanism. It's not unreasonable to imagine that this could end up paving the way for growth in the kind of technology that operates by touch, identifying the individual in the process and opening up the potential for accessing associated datasets. Many payment companies are interested in using parts of the body for identification. MasterCard, for example, have launched a 'pay by selfie' service (officially known as 'Identity Check Mobile' – not the only example by any means) which uses biometric technology like fingerprints and facial recognition to verify a user's identity.

So a remarkable store of information is already being built up, due to the ways in which we interact with things, sometimes perhaps without even realising how much (and what variety of) data is being shared in the process – and not just by businesses either. The French government, massively under pressure due to a raft of terrorist attacks, wants to

launch a database called 'Secure Electronic Documents' (TES), which would be used to collect and store name, address, marital status, eye colour, weight, photograph and fingerprints for every citizen over 12 years old. We might expect other governments, equally under pressure to prevent terrorism, to follow suit. Indeed, in the UK the Investigatory Powers Bill (also known as the 'snoopers charter') came into force in early 2017. This requires internet service providers (ISPs) to record which services (sites, apps etc) their users' devices are connecting to. This isn't just a functional nice-to-have; it's a legal requirement to track people.

In some countries, this ability to track and understand to such an individual depth is already leading to the roll-out of systems that can 'score' people based on certain behaviours that they exhibit, measured against what the government deems desirable in its citizens. In China, for example, a trial of 'citizen scores' is underway that is due for full mandatory participation in 2020. This is calculated by algorithms that collect data from a huge range of sources, including some of the most popular online services such as WeChat and Alibaba. These algorithms can then 'nudge' an individual away from seeing or accessing certain things the government doesn't want them to have if they are adjudged to be lazy or untrustworthy in some other way. Those with a low score may find that their internet connection is slow, and that they find it difficult to access loans or get a reservation at a good restaurant. Conversely, those with a good score (which is tantamount to them being assessed as 'trustworthy' according to government criteria) can find that they have a very good internet connection as well as greater prominence on diverse services, even going as far as their profile on dating apps.

To the western mind, this tends to sound very negative – although proponents of the system point out that it is actually just an extension of credit rating systems that have been in common operation for decades in the west and haven't been available in China. For the purposes of this text, the Chinese model actually represents a kind of post-economic system which is interesting in principle, but poorly executed as it doesn't use the data available to recognise the individual and present them with experiences that are relevant, appropriate and personalised to them (the core evolution made possible by DCT). Instead, it feels more like heavy-handed government intrusion into an individual's privacy, punishing or rewarding them based on whether they adhere to rigid standards that the government sets out, rather than using the information to create a more symbiotic relationship that works in the best interests of both sides (which is the crux of the post-economic argument set out in this text, and on which much more later).

The infrastructure of the web has been built up by countless independent individuals and businesses, many of whom require the user to create a dedicated login for their specific site or app. Given how much of a barrier and annoyance it is to have multiple logins specific to each site on the web (each with a different password if we want to avoid being too easy a target for cybercriminals), it does seem inevitable that we will have to move over to a model of single, universal online identities at some point – a kind of online passport – that work across everything and store information centrally. This would be a huge boost for the trend toward recognition, as people could then be uniquely and unambiguously recognised at each point of digital interaction without that site, app or service needing to go through the process of identifying them from scratch every time (how important this is to businesses – and the level of interest they have in being able to do that – is covered in more detail in part III).

Other examples of digital technology that are driving the move toward total connectivity include what's known as iBeacons, which work by detecting someone within a specific radius (who has opted into a service) and sending them contextually-relevant information – which might be a retailer sending a customised offer to entice a passer-by in-store. Should 3D printing reach mass market appeal, with costs kept low enough to reach the homes of both rich and poor, it would grant people the ability to print many things they want and need from home – but this would all have its origin in digital format, so everything they create could generate a full and comprehensive data record. It's just not the same as what happens when we print things in the traditional manner at all.

There are other, slightly more fanciful technological possibilities for which it would seem unlikely that they could reach mass acceptance among the general public, but which equally could not be ruled out should circumstances dictate. There are already small groups of people who have sown near field communication (NFC – the kind of tap technology that makes the Oyster card work on London Underground) chips into their skin, so they can carry readable information within their body that can be scanned. It's hard to imagine a situation in which significant volumes of people would do this willingly, but that's not to say it couldn't be mandated by governments – either due to a draconian response to the threat of terrorism or to embed their medical records within them so they can always be accessed quickly. As I say unlikely, but it certainly couldn't be ruled out entirely.

Other parts of this may seem a bit farfetched too, but the unstoppable march toward total, or at least something approaching total, connectivity is well and truly in motion. The potential for having a record of everyone so they can be identified digitally and in real-time is clearly very attractive to governments increasingly under pressure to prevent terrorist attacks from happening, as well as resource-rich tech companies who can make more money from their users if they understand them better. All the parts are there, the only doubt is over how they will be put together. It would be inefficient madness to ignore information that it is possible to know, as someone else will always find a way to gain access to it eventually and leave everyone else at a disadvantage.

There are further examples that I could provide (from a number of different sectors, as they all feature innovative companies and individuals who are looking at how to make things more efficient using DCT), but this short(ish) overview is not intended to be a comprehensive list of everything that is connected everywhere – instead, it serves to indicate evidence for a landmark shift in how the many things around us that are currently standalone will actually form part of a vibrant network that is continuously tracking, processing and cross-referencing information on *people*, on an individual basis.

All you need to do is talk, type or move somewhere and a digital record of it can exist. And, as a final example in this section, use cases for this already exist in ways that can seem like magic. Amazon have launched a concept store (officially called Amazon Go, which was only accessible to Amazon employees initially but is now open to the public in Seattle) that features no checkout or lines; the store visitor simply walks around, taking items of shelves, then leaves without having to pay physically, use a device or scan anything. The whole tracking process is managed through sensors that monitor what is taken and send an invoice to the customer afterwards. This is representative of a post-device internet, one in which people are not required to do anything in order to participate digitally – it just happens as far as the user in concerned, producing data on every step

and action taken. This probably serves as the truest expression of total connectivity yet achieved – a bit like actually being inside the internet in many ways.

Obviously some of the devices, products and techniques that are being brought to market will fall by the wayside and never be heard of again, but many of the central concepts covered here, such as image recognition, are general purpose technologies that can be implemented in any sector, through any range of devices and products, so they will find expression somehow in a way that works on a mass scale for people.

We may quibble over how total 'total' can be, but this point is what characterises the shift from always connected to total connectivity – everything around us and everything we do becoming data, specific to people at the individual level, without any kind of start or end to it anywhere[xxvii].

2. Artificial intelligence (AI)

Everything (people and things) becoming far more trackable as data doesn't actually achieve anything on its own – this seemingly bottomless source of information is what is often referred to as 'big data', but it only becomes significant when the data is tagged, analysed and cross-referenced. This data processing provides the ability to measure, which means what is happening can not only be recorded but considered against various criteria. Until then it is just a raw dump of meaningless (from a human perspective at least) bits and bytes, or at best characters and numerals, which in many cases probably isn't even effectively captured or processed at all.

When it is though, it enables the building of connections and relationships between things that were previously isolated from each other.

Once this reaches a certain saturation level (something like total connectivity), we theoretically gain the ability to measure the impact of all actions and activities in real-time and on an ongoing basis – digital works by processing, storing and referencing data which, due to the sheer range of activities it can cover, raises the prospect of levels of understanding far beyond what has ever been possible before. But it needs something capable to oversee it – and that entity is artificial intelligence, or AI.

At the moment, if someone went out for the day without their mobile phone and just walked around they wouldn't be creating much data. If someone asked them where they'd been and they replied, somewhat sullenly perhaps, 'nowhere', the exact details could remain a secret indefinitely. If we consider all the different kinds of technology driving the move toward total connectivity, this idea that things can happen without the infrastructure that surrounds us knowing about it will become far less likely as this technology is implemented. If that person walked around a smart city, with the huge range of sensors and monitors that will be in place to track various activities (particularly if image recognition technology is built into it, or some other kind of recognition technology), their exact movements could be understood and matched up to that individual without them needing to do anything to enable it and, most likely, without them even realising it's happening.

Tracking the data isn't the hard bit – even today we can be pretty well known given all the data we stream, consciously or unconsciously – it's gaining access to it and actually doing something meaningful with it that presents the challenge. As data is being created in real-time and at large scale, humans are inadequate at being able to process that information –

it is just too large, too fast and too complex for us to do. To illustrate how vast this scale is, the platform Domo publishes research every year looking at how much data is generated in a day, based on activity on all the major networks. In 2017 it put it at 2.5 quintillion bytes; a figure so vast that most people will have no idea what quantity the term 'quintillion' even refers to (it's a fifth power of a million or 1 followed by 30 zeroes, incidentally; and that dataset is just specific to a sample of major networks, it is not the entire internet). Even focusing on a single content format produces eye-watering figures – Deloitte research estimated that 60,000 photos would be shared *every second* in 2016[xxviii].

Working with these data streams requires a huge amount of processing power and some highly intelligent algorithms that are able to respond within an appropriate timeframe and make decisions based on what the information tracked is saying. But an algorithm isn't necessarily the same as AI.

An algorithm is basically a rule, or set of rules, that says 'if this happens, do this' or 'in this situation, do that'. The term algorithm has become tightly interwoven with web technology. Google, for example, sorts results to search queries based on its PageRank algorithm – which assesses a number of criteria to decide on how good and relevant a page is to that query. At its most fundamental level, Google looks at links to and from a page, as well as the popularity of it (number of unique visitors), although over time it has come to factor in other elements such as mobile responsiveness, page structure, use of rich media and social sharing. It's such a primary tool for how people access resources on the web (consider the common phrase '*I'll Google it*') yet, relatively speaking, Google actually has precious little content itself – its algorithm indexes pages from other content-providers and serves them up accordingly. It sits between user and web content as perhaps the most commonly-used algorithm in use today.

There is nothing new about algorithms at all and they are certainly not unique to digital; they have been around since Euclid and underpin much of what happens – from traffic light sequences to higher education application processes to matching people up on dating sites. Yet we need to be able to distinguish what constitutes an automating algorithm and when this can be technically regarded as AI. We would not, for example, regard Euclid's algorithms as being AI, nor would it seem appropriate to label traffic lights as such – it requires something a bit more advanced to earn the title of AI. While these algorithms have traditionally tended to function in isolation (ie perform a specific role for a specific purpose and to generate a specific outcome), their role has been to automate activities or standardise results in accordance with the rules that underpin them. The web is different as it makes it possible to connect so many disparate data streams together that these algorithms (so the theory goes) become so smart and advanced that they start to update themselves and find more efficient ways to do things without constant need of manual intervention or human consent. *That* is what constitutes genuine AI.

Many software companies market themselves as being engaged in AI, but it would often be more accurate to state that they are engaged in advanced automation. Commercial passenger aircraft tend to have autopilot functionality, so in theory the planes are 'flying themselves'. Some would call this AI, but it's not – they are following specific rules and wouldn't have sufficient agency to break those rules. It also wouldn't currently have access to external datasets on a wide enough scale to help inform decision-making. We are still in the phase of automation, despite what companies might be telling us, though the capability to create genuine AI is coming.

AI has often found expression in popular culture – largely driven by a slew of dystopian novels and films on the subject – as being about the creation of androids that are, to the unsuspecting eye at least, human. This is not surprising of course, as AI really refers to a more advanced 'interface' between human and machine – the establishment of a relationship in which we both learn from each other. But this doesn't mean that AI has to be represented quite literally as an exact physical copy of a human – this is a misleading example of what AI is all about. Its strengths are heavily concentrated around *processing data* rather than any kind of physical activity; everything it is capable of achieving starts from that point.

In order for them to learn anything, machines are entirely dependent on data – it is the process through which they interpret the world around them, in the same way that we do using sensory data. In the near future, their capacity to learn through data will receive a considerable theoretical boost due to the continued move toward total connectivity – as so many activities that individuals undertake will produce data that can be tracked, analysed and combined with other datasets to present deep understandings of them. At that speed and scale, AI is required to make sense of what is happening, as it is far more capable of making decisions that produce logical and relevant outcomes than humans are.

The way DCT is developing is leading to a blurring of the physical and virtual worlds, creating endless streams of data, where its very nature will be for systems to constantly adapt and update their behaviour based on changes and developments tracked elsewhere in the overall 'network' (which doesn't really have a start or end point).

It is this concept of vast and varying data streams being continually processed by highly intelligent systems that really represents what AI is and how it will work – interconnected, constantly tracking, learning about the activities of individuals at a highly detailed level and cross-referencing the information streams produced by each unique individual to inform decision-making. Standard automation at that point will not be particularly useful anymore; due to the pace and scale of activity, AI needs to be able to circumvent existing rules and create new ones. And intelligent machines can process information at a rate that far exceeds the capacity of even the most capable human. So, in reality, AI is a lot more abstract than science fiction would have us believe. We shouldn't think of AI as physical androids / humanoids / cyborgs etc, but as a far more intangible, cloud-based (or whatever future concept replaces the 'cloud') system of data-processing algorithms, functioning behind the scenes and far out of view for (and beyond the understanding of) most people. While some AI systems have demonstrated a remarkable ability for solving puzzles that had presented serious challenges to the human mind, due to their capacity for processing enormous amounts of data quickly, androids have tended to suffer in accordance with the Moravec paradox, which has it that hard tasks (such as resolving complex equations) are relatively easy for AI systems but easy tasks, from the human perspective at least (such as making a cup of tea or walking down some stairs), can pose serious difficulties. As useful as it would undoubtedly be to have a robot make you a cup of tea, this kind of human, physical task is not what's important for AI – its usefulness grows in tandem with the volume and variety of data it is able to process. The form it takes overall, whether human or not, is largely irrelevant to that primary function.

Whereas algorithms have tended to be used previously for problem-solving (how can the space in a given area be optimised, what is the best sequence for these actions to be

performed etc), in the digital age their most interesting function is how they enable the creation of matches between disparate information streams to produce useable insight.

We already interact with low-level AI regularly in our day-to-day lives, we just don't realise it in many cases. The way that our inboxes are sorted, with emails suspected to be of low importance or unsolicited moved to the junk folder is arguably a form of AI in motion – it's making decisions without requiring our sign-off for every one made. When we make a payment for something using a card or digital means (ie non-cash), banks carry out fraud screening checks that are run by autonomous programmes. When we search for something on Google, a social network, retail site or any other kind of site that has large volumes of content, the site may be learning about your preferences based on your search behaviour and structuring the content that is shown to you accordingly to increase the inferred relevance of the experience (though largely in accordance with set rules). This early expression of AI is built into the fabric of how digital systems work; the next phase – the ability to make decisions without the constant need for manual human intervention at every step – is necessary for them to operate to a standard that people will increasingly expect.

There is however a contradiction in having highly personalised experiences decided and provided by something impersonal, remote and abstract – the reasons behind what an individual is shown and what they are encouraged to do (which is to say, the decisions made by AI systems based on the data it has processed on that individual) requires a degree of humanity for the individual to be able to understand it. There is no reason why this has to go as far as expensive, clunky androids – it is more likely that a virtual digital assistant of some kind would perform this role just as well.

There are a number of precedents for this type of 'interface' entity – from Microsoft's paperclip helper right through to Apple's aforementioned voice-activated Siri – although historically these have been passive; used to execute commands, access help files and find out information. More recently this digital assistant technology has evolved far enough for chatbots to come into public-facing service. This is a bit different as they are typically playing a customer service role – responding to queries and designed to seem as 'normal' and 'human' as possible. The whole time of course, every single interaction with them provides information in a digital format that can be processed and help it learn for future engagements. We are all playing our part in making genuine AI possible, we just don't all realise it.

The digital assistant in a world of total connectivity would be a far more active type than any that have existed thus far, providing the interface for explaining what individuals are seeing and why, plus rationale for decisions they are making.

The trade-off, on the part of the individual, for being completely connected and having so much about themselves known – is getting experiences that are entirely personalised to them. It represents the phasing out of irrelevant communication, which AI systems can eradicate through providing information and experiences that are specific to an individual and their unique circumstances – that is realistic, tailored and based on the enormous amounts of information they can know about them. This is different from being sold to or shown things for commercial purposes; it is a relationship of openness by its very nature. Debates about digital often posit the issue of privacy centrally and this is not to suggest that everything should just be unencrypted and freely available to all and sundry to access

where and when they please – people are unlikely to ever be comfortable with the idea of their neighbours knowing everything about them and their activities, but AI *does* need to be able to access that data if it is to make relevant, appropriate and accurate decisions about how individuals' data is used and the kind of experiences it provides.

If total connectivity is the enabler for data to be tracked on a mass and continual scale, AI is the element that defines the *nature* of the relationships and connections that exist between people, things, businesses and other entities. Total connectivity is the *enabler*, AI is the *determiner*.

3. Automation of labour

Technological progress is concerned with one thing primarily – making something function more efficiently. AI is just a natural extension of that process, albeit one that will supercharge the pace at which change becomes possible.

Whenever there is significant technological progress made that impacts on a sector, it tends to have a massively disruptive influence on the people working in that area – with those performing the manual roles associated with the less efficient processes that were previously used typically finding their jobs at risk of obsolescence.

There have been some notable periods in history when technological progress hit a peak and disrupted existing industry. During the Industrial Revolution, machines began to proliferate in all kinds of manufacturing industries that were capable of performing the roles of several people. When cars became affordable it completely displaced a centuries-long industry and infrastructure built up around livestock pulling vehicles (things like stables and coaching inns). People working on the docks unloading goods from ships thought their roles would be eternally necessary – until containerisation replaced them.

We are unquestionably living through one of these periods now due to the evolution of AI, and it is all part of a perfect storm forming that is expected to impact deeply upon what we currently think of as employment. As the examples in the previous paragraph suggest, we've been here before and yet jobs still form a central pillar of how economics works. Industries get disrupted by technological progress, but new job opportunities have tended to be created in the process during these previous periods. There are two reasons why it may be different this time. The first is scale – AI (and the web more generally) is a general purpose technology that doesn't just affect a sector or two, it is multi-sector (omni-sector even, if you'll excuse the term) – manufacturing, design, finance, banking, travel, entertainment, retail; hardly any are expected to be free from significant impact. The second reason relates to what it does to the idea of business, as it will come to determine the nature of connections between everything, but also everyone. This necessarily brings with it a depth of understanding on individuals that will make the relationship of business to individual highly personal and, when it reaches a certain point, will force existing business propositions and the ways that they operate to undergo a seismic overhaul (more on this in part II).

There are other issues too. On the one hand, the global population is continuing to increase and is forecast to rise from the current 7 billion to somewhere between 8.9 billion and 10.6 billion by 2050[xxix], depending on certain scenarios. It has previously been suggested that it could reach 12 billion by 2100, but long-range forecasts like that are notoriously difficult to get right. Whichever (if any) of these forecasts turns out to be

accurate, in a very basic sense it means that there will be more people needing to find ways to earn a living. This issue will be amplified by the trend for countries with high populations (India, China etc) growing in economic competency – leading to more aspirational societies there where people expect to have opportunities to find gainful, desirable employment.

And then there is the move toward robotics, controlled by AI systems, with some factories already using them heavily and thus reducing the need for human workers. Machines offer a number of advantages over a human worker in that they can work almost indefinitely – only requiring maintenance, supervision and programming to ensure they are carrying out the right tasks – as well as being immeasurably more efficient at carrying out these tasks. It's worth bearing in mind that not all automation is as straightforward as reducing the need for human employment entirely. McDonald's, for example, claim that bringing in self-service screens that enable customers to place their orders themselves (as opposed to through till staff) hasn't led to a decrease in staffing costs; the excess till staff that had been technically replaced have actually ended up being redeployed in the restaurants performing a role more focused on hospitality.

Be that as it may, in many cases humans can't really compete with the functional capabilities of AI systems. It's not just that they can replace a role (as in, a machine automating the exact same task that a human worker carried out manually); AI systems have the potential to offer the full suite of associated functions – performing whatever the task may be, but also monitoring, analysing, managing and optimising it. It's different from previous periods, such as the Industrial Revolution, specifically because of this ability for machines to become so comprehensively multifunctional.

The impact of this will be felt profoundly in supply chains which, in principle, could become almost entirely automated – from the manufacture of goods by robots in factories, which are then transported via driverless vans or drones, before being presented or fulfilled to people through largely automated means (consider the Amazon Go example cited earlier).

In fact, if sufficient focus (and investment) is put on any area currently requiring manual labour to fulfil – the farming, cleaning and service sectors for example – these could also become in theory almost entirely automated.

And this is without mentioning 3D printing, which has the potential to more or less replace large areas of manufacturing.

But this is not just limited to 'blue-collar' jobs – almost no sector is entirely safe from the roll-out of AI systems, that can perform and manage what we might have thought were fairly safe human roles too; the production of works of art, customer service, even medical diagnosis and carrying out operations. The reality at the moment is that it tends to be jobs that are routine or repetitive in nature that are most straightforward for AI systems to undertake – they are dependent on data to understand what to do in any given situation; it presents more of a challenge where they are required to deal with unique situations where there is no obvious data reference they can access to enable them to make a coherent decision (cutting someone's hair is one example – simple enough for a human with the necessary skills, but to a machine every job has slightly different requirements).

The key point to bear in mind for the purposes of this text is that robots performing 'white collar' roles cannot help but create data in absolutely everything they do – unlike the people previously doing them.

One area where we can glimpse this process in motion is in the roll-out of chatbots, mentioned previously, which serve as automated bits of software performing the role of a customer service operator – continually learning how to respond in certain situations based on the engagements it has with individuals. Humans wouldn't be able to remember and categorise every single word said, but a chatbot could.

Consider also the impact algorithms are already having in areas such as recruitment (as they can scan hundreds of CVs in seconds for the right candidates) or the stock exchange (where they can process huge streams of information far faster than a human) to name just a few.

This may all sound exciting or terrifying depending on your viewpoint – most likely a combination of the two – but whatever your take, there's a fundamental problem with where it's all heading.

It may be that as the number of what we understand to be traditional job roles falls massively, it creates new types of associated roles to oversee the automated activity – but it seems likely that, in the short term at least, if we maintain the idea that jobs are economic in nature rather than updating their definition to be better suited to the digital age, there will be more people vying for fewer, skilled opportunities, with everyone who is less skilled / capable / educated having to take on multiple 'zero-hours'-style contracts and a huge reliance on welfare. To put a figure on it, in a December 2016 speech at Liverpool John Moores University, Bank of England governor Mark Carney estimated that 15 million UK jobs (of a workforce 31.8 million strong) were under threat of automation – that's almost 50%[xxx] (presumably he was basing this estimate on research in this area by Deloitte[xxxi]; another much-referenced source is a study by Oxford Martin School[xxxii] which estimated 47% of all jobs could be automated within a 20-year timeframe).

Of course, in the future, jobs may end up being created in ways that would seem impossible today. Estimates vary for how many gamers there are globally, but the consensus range tends to be somewhere between 1 and 1.5 billion. While some gamers have found success posting videos of themselves playing on YouTube, the interesting potential here isn't just restricted to those capable of securing a large audience. There has been some speculation that this kind of activity could evolve to be so comprehensive and immersive (particularly where augmented reality is incorporated into the games) that we could eventually come to have multiple existences – a self in the real world, as well as one (or multiple, indeed) in the virtual world. Obviously this doesn't just mean doing well at *Call of Duty*, it refers specifically to people doing things in games that actually correspond with work and achievement – building worlds, designing things, working on complex problems with others. If that seems a little fanciful, bear in mind that *Minecraft* has already enabled people to do things along those lines, just without the work-like structure and outcomes defined.

So it isn't all doom and gloom necessarily, but having access to virtual work to the extent that it would provide someone with the means for subsistence (as well as considerably more in line with expectation – such as promotions, higher rewards etc) is probably a way

off yet and the interim period is likely to be a bit less optimistic, not to mention considerably more turbulent.

Jobs have traditionally provided the main route through which people accrue money to spend and build the economy. How this will balance out remains to be seen, but one thing seems apparent – what we think of as employment and earning a living, how we actually define and measure those concepts, has to go through a pretty fundamental degree of change.

4. Total personalisation

If total connectivity is the *enabler* and AI is the *determiner*, the logical result is what we might term '*total personalisation*'.

As a concept, personalisation is already in common parlance and hardly represents a revolutionary new buzz-term on the surface. But, while it cannot be regarded as being brand new, the extent to which personalisation will extend into every area of our lives over the coming years marks it out as a highly significant – and vastly underestimated – one. Up until now, the development of digital technology has arguably been characterised primarily by connectivity – by positioning digital technology centrally within various areas of our lives and improving efficiency and convenience for users of the enabling services. The next phase will elevate personalisation to be the central element in its evolution. So significant, in fact, is the potential of this concept that its rise correlates directly with the fall of economics. As I will argue throughout this text, total personalisation makes the very idea of money being something that people own, save, give or use in any kind of transactional capacity no longer valid.

To begin to even understand its potential, we need to consider how personalisation could evolve into *total* personalisation.

The difference can best be characterised as thus: if *personalisation* is enabled by a single entity having information on engagements an individual has made with it, *total personalisation* becomes possible when all entities have all information on all engagements individuals have had with all of them.

Economics is a functional system for a world focused on, and determined by, *isolated, unconnected things* – everything has its value and people strive to get themselves into a position whereby they can access a higher quality of thing, irrespective of whether they either need it, or it is appropriate for their needs. That information is seldom part of the equation. But personalisation is all about people, more specifically *completely connected but unique individuals*, who make the greatest contribution to relationships with external entities by allowing data on all their activities to be known. Economics doesn't provide a natural fit for relationships like this that are built on in-depth information on everything that happens. Economics – money, to be exact – is what we use to fill gaps in information because the purpose for which something may need to be accessed isn't generally considered as part of the transaction under that system, nor its subsequent use after purchase. Transactions are completed at the point of purchase, but information on it doesn't stop there, or ever, technically. The idea that money is inevitable and unavoidable – that it makes the world go round indeed, as the common-sense axiom has it – persists. But it's not a glue that binds all our activities together; it was never designed with that purpose in mind. Economics is a system that functions by determining an individual's

capacity to access things, for which money provides the means – but a system based on personalisation removes that need through generating incredibly detailed understandings of each individual at the individual level. People don't need money to be able to access things, as total personalisation makes it possible to know which things need to be accessed by each specific individual at a specific time and for a specific purpose, or which people can have access to these things based upon what is known about them. Processing all that information so that it can be acted upon in something like real-time is obviously very complex – and humans cannot hope to be able to manage it in anything like an efficient manner. But this is the exact strength that AI systems have – they make it not only possible, but logical.

At a basic level, we all have a sense of what personalisation means – it suggests that something has been tailored for you individually, rather than as part of a wider group of people. And over the past few years it has become common currency in the marketing language used by almost any type of business.

In essence, personalised experiences are specific to you. If you walk into a pub and the bartender pours the drink you want and puts it where you want to sit without needing to ask, that's a personal experience. If s/he also places the section of the newspaper you like there and puts your favourite music on, that's personal too.

In the digital world this is different, as a machine does it instead. But machines are able to learn and the more data they have to access on you – and the more intelligent they are at processing it – the greater the potential for providing really relevant experiences for you. The bartender is unlikely to know, for example, where you've been, how many steps you took from there, who you were with, what you said and what kind of day you are having generally until you explicitly tell her / him; but as this can exist as digital data, AI systems are able to know information such as this to an incredibly personal level, in advance, without even needing to ask.

Extending the above example but with an AI system providing the personalised experiences in a world of total connectivity, it's clear to see how different the experience could be – how it would be far closer to total personalisation. Instead of pouring you your favourite drink, it might consider the fact you've just walked three miles, have a slight hangover from last night and are recovering from a cold – offering a glass of water to start instead. It might know you've already read that section of the paper, and offer a catalogue featuring your aunt's favourite products in its place, given it knows she has a birthday coming up. And on the music front, given you've just received some bad news, something less jaunty than your usual favourite might be appropriate.

Total connectivity means we are going to be far more accessible and far better known by everything around us – and the way that everything interacts with us will evolve accordingly. As we will be (indeed, are) indirectly making everything about us known and available, a personal line will have been crossed and it is therefore logical to expect that this information would need to be used to recognise the uniqueness of every individual – and provide experiences that are tailored to function in each individual's best interests. Anything less than that can only be regarded as intrusive by the user streaming that information.

That, as a concept, is getting somewhere close to total personalisation, which results from being able to identify every individual as an individual in everything (conceivably, at least;

in reality it would not be necessary to know *absolutely* everything) they do, and providing them with experiences and information completely specific to them and their situation. This changes everything about how we are able to understand ourselves in an unconnected sense. The move toward total personalisation is the logical driver for phasing out the idea of anything being generic in the experiences individuals receive from the infrastructure around them.

Again, there will be some question around how total 'total' can be. By extension, the extent to which personalisation can be considered total is directly dependent on how connected people are (ie how close to total connectivity we get) and how accessible that information is to AI systems.

This section has sought to introduce total personalisation as a concept, which we will return to later (and throughout). Now that the factors influencing the obsolescence of economics have been identified, the next part looks at the main elements that are required for a system of economics to make sense, analysing why they are no longer relevant and how they could be redefined to be appropriate for the digital age.

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