

Introduction

Money is the instrument and measure of commerce.

— Nicholas Barbon in *A Discourse Concerning
Coining the New Money Lighter* (1696)

HERE'S A STORY I came across. It has a 'guy falls asleep under hypnosis and awakes a century later to find a model society, then finds it's all a dream' narrative arc that is hard to read with modern eyes, because the perfect society that the author imagines is a communist superstate that looks like Disneyland run by Stalin. Everyone works for the government, and since government planners can optimize production, the 'inefficiency' of the free market is gone.

The time traveller at the centre of the narrative is told by his host in the modern era, the good Doctor Leete, that cash no longer exists. Instead, the populace use 'credit cards'.^{*} This strikes me as rather unusual for a utopian vision since, as Nigel Dodd observes (Dodd 2014), utopias from Plato to *Star Trek* don't seem to include money at all, never mind chip and PIN.

While the author does not talk about phones, the internet, aeroplanes or the knowledge economy, he does make a couple more insightful predictions about the evolution of money. When talking about an American going to visit Berlin, the good doctor notes how convenient it is to use cards instead of foreign currency:

'An American credit card', replied Dr Lette, 'is just as good as American gold used to be'.

^{*} He then goes on to describe what are in fact offline pre-authorized debit cards, but that is by-the-by.

What an excellent description of the world after the end of the gold standard. However, I think that the most fascinating insight into the future of money comes later in the book, when the time traveller asks his twenty-first-century host ‘Are credit cards issued to the women just as to the men?’, the answer comes back: ‘Certainly’.

The answer might alert you to the age of the text, which contains the first mention of a credit card that I have found as part of a fictional narrative. The book is by Edward Bellamy and is called *Looking Backward, 2000–1887*. It was written in 1886, a century before the credit card became the iconic representation of money, and it was one of the best-selling books of its day. I have a 1940s edition in front of me as I write (Bellamy 1946), so it was still being reprinted sixty years later!

The discourse on money in that book is a wonderful example of how science fiction is not about the future but about the present: the retort ‘*certainly*’ is clearly intended to surprise the Victorian reader as much as the prediction of glass tunnels that surround pavements when it rains. In this book I hope to develop a narrative just as surprising to contemporary audiences and I intend to do so (while using technology as the driver of and infrastructure for change) by following Bellamy’s example and looking to the social sciences to make my predictions.

Looking for narrative

At the heart of this narrative there are two relationships: that between the technology of money and wider technological evolution, and that between the technology of money and the way that society thinks about money. To use a famous illustration of this, scientists would have found it hard to imagine a clockwork universe if they hadn’t first seen a clock.

You can’t invent coins unless someone has already invented smelting, you can’t invent banknotes without printing, you can’t have Western Union without the telegraph, and so, rather obviously, on. But what is the technology of the *present* that will help us to think about the money of the *future*? Most people, I imagine, think about money as \$100 bills and gold in Fort Knox, €500 notes and plastic cards, £50 notes

and the Bank of England. This is the present paradigm, so far as the public and the politicians are concerned. I think they are wrong. We are already living in the future, because the future of money began back in 1971 when the US government severed the link between the world's reserve currency and anything physical at all (in that case, gold).

We need to adjust our mental models of money and start exploring the future paradigm, both to shape it and to see where it might take us. Money existed before records began in ancient Babylon and money will continue to exist when Bitcoin is long forgotten. But the money that the Babylonians used, the money that we use today and the money that we will use in the future are all different. The way money works now is the result of particular arrangements and institutional structures, not a law of nature.

The answer is 42

A while back, *The Atlantic* magazine published a list of the fifty greatest breakthroughs since the wheel (Fallows 2013). They asked a variety of eminent scientists, historians and technologists to rank a list of innovations and then put them together into a feature. Number 1 was the printing press, but what caught my attention was the appearance of paper money at number 42. It made me think that in the great sweep of things the replacement of stuff of some kind by records of some kind goes back a lot further – to the grain banks of ancient Babylonia and to the marks made on cuneiform clay tablets – and extends right up to the present day, where there are fascinating discussions going on around the use of cryptography to manage distributed ledgers. Was paper money as big a technological breakthrough as the clay tablet was to ancient Babylon or the blockchain may be to the pervasive Internet?

The interaction between money and the technology of money is more complex and less well understood than you might think, given just how long both have been around. As Jevons wrote, back in Victorian times (Jevons 1884):

It is a misfortune of what may be called the science of monetary technology, that its study is almost of necessity confined to the few officers employed in government mints. Hence we can hardly expect the same advances to be made in the production of money as in other branches of manufacture, where there is wide and free competition.

Well, that was then and this is now. The ‘science of monetary technology’ is becoming more widely studied, and with the arrival of smart cards, mobile phones and Bitcoin it has become easier than ever to create your own money and experiment with it. Years ago my son was already trading World of Warcraft Gold via his iPhone with insight and dexterity to match the best of Wall Street’s high-frequency traders. Now you can download an app for the Brixton Pound on your smartphone and, even as I write, there are kids in basements dreaming up the next DogeCoin and Drachma.

Money eras

It is difficult to see the trajectory of money when technologies that were invented in the 1960s (like the magnetic stripe) or indeed the 1860s (like uniformly valued, nationally based paper US dollars) exist alongside technologies that haven’t yet been fully invented (Maurer and Swartz 2014). It seems to me that the credit crunch, the recession, the collapse of 2008 and a variety of debt and currency crises are forcing many people to think about money, banking and the economy in a way that they had not before. This in turn means that people are beginning to think about using the technology of money to create new kinds of money, rather than using it to implement digital versions of the money we have had for a generation.

When the economy is pottering along nicely, no one (least of all the politicians who are ‘in charge of’ the economy) stops to wonder what money is, what banks do or what the disruptive impact of technological change might be. I spend much of my working life looking at ways for banks, payments companies and governments to exploit new technologies, and I often therefore have to think about how the digital

economy will evolve. Money is an essential part of that economy, yet the essential assumption seems to be that it will carry on at it is now, as if the post-Bretton Woods fiat currency is a natural phenomenon or the final stage of a directed evolutionary process.

Christine Desan, Leo Gottlieb Professor at the Harvard Law School, asks why, if industrial-age capitalism was the result of the seventeenth-century ‘redesign’ of money, we do not debate the design of money more, and I agree with her wholeheartedly (Desan 2014a). We should. The structure of central banks, commercial banks and international institutions that we have in the present comes from another age and must change. We did not have them in the past and we will not have them in the future.

The past: Money 1.0

The first great innovation in the world of finance – banking – predates money by some considerable time, having its origin in the grain banks of the ancient Assyrian and Mesopotamian kingdoms. Five-thousand-year-old cuneiform tablets refer to banking and foreign exchange, as well as secured and unsecured lending. I imagine there are more, presumably lost to history, that refer to the Ishtar Bank being bailed out after unwise speculation on bronze futures at the dawn of the Iron Age. Some 4,000 years ago the temples of Babylon were taking deposits and making loans, and by 750 BCE there was a sort of ‘Basle –1’ in *The Code of Hammurabi*.

Money by that time was entries in a not-at-all-shared ledger, recorded on clay tablets. Money as a commodity itself is a more recent innovation. The first recognizable coins date from Lydia (in modern Turkey) more than 2,500 years ago.* These were made from electrum, an alloy of gold and silver, and their central features (standardized weights for specie and some form of maker’s mark) spread rapidly from there. King Alfred had a working system of mints up and running in ninth-century England.

* One of the only twelve of these coins known to still exist was acquired by a Texan collector in August 2016 for an undisclosed sum.

The next revolution – paper money – came from China. Noted financial visionary Kublai Khan created a paper money system through the simple expedient of capital punishment, instituting the death penalty for anyone who tried to use gold or silver instead of accepting his paper money. As Marco Polo noted in *The Travels of Marco Polo*,

Furthermore all merchants arriving from India or other countries, and bringing with them gold or silver or gems and pearls, are prohibited from selling to any one but the emperor [who] pays a liberal price for them in those pieces of paper... And with this paper money they can buy what they like anywhere over the empire.

Subsequent Chinese rulers, unburdened by Kublai's fiscal rectitude, were responsible for the most dangerous implementation of the technology of paper money: the fractional reserve. They calculated that so long as the merchants believed in the paper money, it didn't actually matter if there was any gold or silver or gems or pearls in the imperial strongroom. They therefore succumbed to the inevitable temptation of quantitative easing and began to print money willy, and very probably, nilly. Their paper currency system eventually collapsed in hyperinflation (as I suppose they all do in the end) in the fourteenth century and was not independently rediscovered by the next great crucible for monetary experiment – the New World – until the Massachusetts Bay Colony began to issue fiat paper in 1698.

Around the same time as the technology of paper money was rebooted, the last great monetary innovation of the pre-modern age, central banking, arose around the coffee houses of Amsterdam. What were they smoking? But the idea spread, and in 1692 the Bank of England was created for the admirable purpose of financing wars against France. France, incidentally, went on to become the source of all sorts of crazy money experiments that ended in disaster: the assignats, John Law's land bank, the Latin Monetary Union and ... the euro.

The past begins with money as debt in commodities and then a commodity (anything from grain to seashells to gold) or a claim on such. The agricultural revolution led to the rise of cities and the dawn of banking and, eventually, to coins. Stretching from antiquity to early modern times, the technological implementations went from cuneiform to

banknotes to printed cheques. The Industrial Revolution then allowed these claims to move faster, by steam train rather than by horse, until technology freed them from the constraints of physicality. The past is about *money as atoms*.

The present: Money 2.0

The present era began in 1871, when Western Union started formal electronic funds transfer (EFT) by telegraph and thus helped us to distinguish properly between invention and innovation. At the time, Western Union's management team turned down the invention of the telephone, rather famously commenting:

The 'telephone' has too many short-comings to be seriously considered as a means of communication. The device is inherently of no value to us.

That's management for you, you might say, but there was no more reason for a telegraph company to catch the telephone wave than there was for Microsoft to invent Google or, for that matter, for a bank to invent the successor to the payment card. But were they crazy? It took twenty-five years for the telephone to make any serious dent in their telegraph business (a business that peaked in 1929), and while Western Union sent their last telegram a few years ago they still make serious money from EFT. Incidentally, just to reinforce the point that money innovation can come from communications companies, rather than banks, in 1914 Western Union gave some of their best customers a charge card for deferring payment (without interest). I have a suspicion – although googling has failed to either confirm or deny it – that the reason that payment cards are the size and shape they are today can be traced back to that Western Union 'metal money'.

Innovation in banking is about sustained business change. It is not delivering the same business using new technology (Gardner 2009). Throughout this period, the business of finance and payments and investment changed utterly, yet money remained the same, however loosely tethered to the physical by the bonds of Bretton Woods. Personal wealth shifted from bank deposits to mutual funds. Cash shifted

from bank branches to ATMs. Payments went from cheques to credit cards. But the money stayed the same.

This period I classify as the *present*. It arrived with electronic communications – when even paper became too substantial and too slow for society, and the invention of the telegraph spurred the innovation of electronic money – and it still dominates the way that the man in the street thinks about money. It is the prevailing paradigm, but it is not the truth (a paradigm is a model, remember, not reality). The present, therefore, is about money as information about physical things (paper that represents gold), or, to put it another way, *bits about atoms*.

The future: Money 3.0

The steps to dematerialize money for consumers – those major post-war innovations of payment cards and money market accounts – began to separate payments and banking, just as money separated from value starting with the end of the gold standard in the 1930s and finishing in 1971 when Nixon ended the US dollar's convertibility. These processes will be completed soon and the final step will come with the transition to the mobile phone as the basic platform for financial services, for the simple reason that mobile phones can accept payments as well as make them, thus ending the need for cash to pay individuals. What kinds of innovation will this invention trigger? When money is completely dematerialized, the cost of introducing new currencies will fall to zero: who will stick with sterling when Facebook credits, electronic gold and the Brixton Pound are only a click away?

Thus, I claim that the *future* began back in 1971, when money became a claim backed by reputation rather than by commodities of any kind. At this point, *money became bits*. The atoms have gone. The only bodies able to provide reputational currencies to implement all the functions of money (especially as a mechanism for deferred payments) were nation states, so the idea of national fiat currencies as the only form of money became embedded. This kind of money is now middle aged and its midlife crisis is just beginning. Its central dynamic is no longer connectivity (since everything is connected to everything else) but community. We can see a glimmer of the future in Facebook and

eBay, Zopa and Zcash, Paypal and Craigslist. It is the age of Reed's Law, disconnection technology and the decoupling of currency from the nation state.

The pace of change

You might well wonder why, if that future began a generation ago and we are shifting to a cashless world where reputation is the prerequisite for transactions, we are still using SWIFT to send US dollars from one bank account to another. Well, people have always overestimated the speed of impact of new technology in money. More than fifty years ago, in April 1965, an article in *New Scientist* magazine about the automation of cheque clearing predicted that in a generation the transfer of money would be completely automatic and 'the payment of a birthday fiver from an uncle to a favourite nephew merely a matter of direction and timing of electronic impulses' (Sayers 1965). Within a year of this, the first British credit cards were in customers' hands, and a year after that Barclays launched Britain's first ATM (in Enfield, North London). A year later, in 1968, the precursor to the Bankers' Automated Clearing System (BACS) was formed and direct debits were launched. Yet that birthday fiver was still sent by post. As it still was in 1975. And 1985. And 1995. Perhaps, just perhaps, it went by PayPal in 2005, by which time BACS was processing two billion direct credits per annum. But today? Today it could well be sent by PayM or internet transfer, WeChat or Venmo, Facebook or M-Pesa. So how will that birthday £500 (adjusted for inflation) wend its way in 2025 to celebrate the diamond anniversary of that *New Scientist* prediction?

Futurology

How can we begin to think about this redesign of money for a post-industrial age? Well, we can begin with a modest step and then try to work forwards. While sketching the outlines for this book in 2015 I was challenged to envisage the payments landscape in 2025. I thought this

challenge would be a good platform to stand on to try to see what impact the new technology of payments might have on money itself.

The first question to tackle was what approach to take, just to reach that more limited goal of trying to picture payments at the modest distance of a decade from now, when we can see that so much is going to change on the technological, social, business and, most importantly of all, regulatory fronts? Well, one of the techniques of futurologists trying to assess the magnitude and direction of technology-induced change is to find an appropriate point in the past to compare with. If you want to imagine the changes coming a generation from now, they would argue, you must look back two generations into the past to correct for the accelerating pace of change.

That line of thinking suggests that if we want to imagine digital money a decade from now, we need to look back two decades into the past and understand the landscape and dynamics of change. A simple way of doing this (see figure 1) is to look at the technologies that support products in the marketplace and, particularly, at the security needed to make them useful.

Cheque clearing	Credit card	MOTO	ATM	Debit card	CNP	Paypal	Mobile money	Instant payments	???
1965	1975		1985	1995		2005	2015	2025	
Mainframe	Telecommunications		Magnetic stripe	PC	Smart card	Internet	Mobile phone	Wearable	
	Online authorization	Hologram	EMV	One-time passwords		Biometrics	Analytics		

Figure 1. A payments timeline: products, technologies, security.

This perspective-led approach makes good sense for the topic at hand because the mid 1990s were a cusp in the co-evolution of payments, technology and security. Twenty years ago, the world was experimenting with different kinds of debit proposition, smart card technology, offline operation and ‘electronification’ in the mass-market (salaries, benefits, bill payments and so on). Some debit systems failed and some succeeded, but the experimentation began a period of growth that saw the debit card rise to become the consumer’s instrument of choice while prepaid solutions began to spread in the mass market. The march of electrification means that the direct debit has

become the way that most consumers pay most regular bills (eight out of ten UK adults have at least one). The rise of the web led consumers and businesses to want new solutions, yet it was another decade before the United Kingdom led the world in introducing instant payments (i.e. real-time transfers between payment accounts held by regulated institutions). Despite ‘typically British’ scepticism, the Faster Payment Service (FPS) has been an outstanding success (IBSintelligence 2013), bringing us to the point where British consumers expect to be able to use their mobile phones to send money from one account to another, instantly and reliably. Around the world countries are following in these footsteps and evolving that infrastructure still further by bringing in more sophisticated data representation and management to add the ability to carry value-adding data along with the payment.

Technology and timeline

The timeline in figure 1 also provides a useful lesson about the interaction between payments and technology that we should keep in mind as we attempt to look forward: in 1995 the financial sector was focusing on making the most effective offline payment system possible (which led to the Europay–MasterCard–Visa (EMV) standard that is used in all ‘chip and PIN’ cards) and using it to displace cash. It was doing this just as the whole world went online, with the mobile phone already in use and the web around the corner.

In Europe, the smart card was used in a variety of electronic purse schemes with the intention of displacing cash at retail point of sale. Most failed and had no impact on the world of retail. In the United States, by comparison, we saw myriad efforts to create Internet alternatives to cash and cheques, and while most of those also fell by the wayside, one of them did not: PayPal. PayPal rode the existing rails to deliver a more convenient service to consumers, something that the established players could have done, but didn’t. Speaking simplistically, online won! But note that while the electronic purse failed, the technology that was being used to deliver it to the mass market (the smart card) became so widespread it is now unremarkable.

It is very tempting when looking at the current landscape – in fact it is irresistible – to see the current flurry of experimentation around Bitcoin through this lens. It may well be that the new payment mechanism never obtains traction, any more than Mondex or DigiCash did, and we will never use Bitcoins at the corner shop, but that the evolution of the underlying technology, the shared ledger, turns into an infrastructure so pervasive that it becomes as unremarkable as the smart card did. The World Economic Forum certainly sees things this way: it says that new financial services infrastructure built on shared ledger technology will ‘redraw processes and call into question orthodoxies that are foundational to today’s business models’ (Bruno and McWaters 2016).

We know where not to look, and that’s on our desks. We are already past that inflection point. The installed base of smartphones and tablets is already bigger than the installed base of desktop and laptop PCs. The installed base of iOS devices alone will soon exceed the installed base of all PCs. By 2020, global shipments of PCs will be lower than global shipments of tablets (according to a Statista prediction made in July 2015). But perhaps we should be looking beyond smartphones? Just as the designers of 1995 set about building for an offline world just as it went online, we should be thinking about the next infrastructure, not the current one. And this, I strongly suspect, is the ‘Internet of Things’. The Thingtnet (as I cannot resist calling it) will naturally stimulate entirely different business models. As figure 2 shows, we can already see these growing around us.

	Internet	Thingtnetnet	What does it mean?
Value creation			
Customer needs	React to existing needs	React to emergent needs	<i>Payments become a constant flow between devices and the data around payments becomes more valuable than the fees earned from the payments</i>
Offering	Stand-alone products; obsolescence	Products always-on and refreshed	
Role of data	Single point data used for future product requirements	Information convergence creates services	
Value capture			
Path to profit	Sell the next product	Enable recurring revenue	<i>Payments are no longer a product managed by banks but part of multiple overlapping ecosystems that transfer many kinds of value</i>
Control points	IP and brand	Network effects between products	
Capability development	Leverage core competencies and existing resources	Create platforms to help partners to build their businesses	

Figure 2. The Thingtnetnet mindset.
(With acknowledgement to Smart Design/
Harvard Business Review, July 2015.)

The impact of these changes will of course extend to retail. The US Food Marketing Institute predicted that by 2025 customers would no longer wait in lines to check out at grocery stores but would walk out of the door while a ‘frictionless checkout’ would automatically account for products in their carts – and this prediction was even made before AmazonGo’s pilot store was unveiled. This is certain to impact the payments business and not only drives us on towards cashlessness but also drives payments further ‘underground’ in retail environments.

These trends pivot on the mobile phone of course, shifting to an app-centric model, in which mobile devices coordinate fast, safe and transparent solutions. As I write, one in five payments in Starbucks is already mobile, so this is hardly a radical view. Now we have Android Pay and Ford Pay, Walmart Pay and CVS Pay, Tesco Pay and Chase Pay. The trend is clear, payments are vanishing from retail, and this means that retail transaction flows will be reconfigured.

Using money in shops, over the phone, on the web and to pay a friend will all become the same experience. Connected devices, instant payments, strong authentication to a token held in tamper-resistant

memory will be the converged infrastructure for the invisible payment and will form a platform for the next money.

Where next?

Think for a moment about the *Cutty Sark*. It was a vessel known as a ‘tea clipper’, built for speed, and at one time it was the fastest ship of its size afloat, famously beating the fastest steamship of its time and doing the Australia-to-United Kingdom run in sixty-seven days. (Yes, I know there’s no tea in Australia but the Suez Canal meant that she only carried tea for a few years and was then set to work bringing wool up from down under.) When she was built, high speed was economically important and there was considerable pressure from the tea companies to get the fastest ships: they weren’t built just for the fun of it, or to show off technology, but because of economic imperative.

She was commissioned in 1869. Note the timing: the fastest sailing ship was built well *after* the first steamships arrived. The first iron-hulled steamship, the *Aaron Manby*, had crossed the English Channel in 1822. The first steamship with a screw propeller, the *Archimedes*, had been built in Britain in 1839. Brunel’s iron-hulled, screw-driven *SS Great Britain* had crossed the Atlantic in 1847. Christopher Freeman and Francisco Louca (2001) summarize this crossover well:

However, it had taken a fairly long time for the steamship to defeat competition from sailing ships, which also began to use iron hulls. The competitive innovations in sailing ships are sometimes described to this day as the ‘sailing ship effect’, to indicate this possibility in technological competition for a threatened industry.

In the long run, the sailing ships vanished, except for leisure, and the steamships took over. But when the steamships first came onto the scene they stimulated a final burst of innovation from the sailing ship world, which then stimulated the building of some great ships as a kind of last hurrah.

Perhaps this ‘sailing ship effect’ can be applied to money. The Bitcoin blockchain is one kind of shared ledger: one of the first steamships, the

equivalent of the *Archimedes*. It isn't the kind of liner that eventually transports passengers across the Atlantic in unparalleled luxury and it isn't the kind of tramp steamer that transported most of the world's goods to global markets and it isn't the kind of dreadnought with which Britannia used to rule the waves. It's the kind of steamship that shows that steamships work and sets off a chain of innovation that triggers a sustainable change in the way that the world works.

Let us imagine for a moment that this tortured analogy holds and that the invention of the shared ledger will, just as the steamship did, trigger one final round of innovation in the 'legacy' financial services infrastructure (push payments exchanging fiat currencies between accounts held at regulated financial institutions). Well, if Money 2.0 is going the way of the tea clipper, what will that Money 3.0 steamship look like?

Many years ago my colleague Neil McEvoy and I argued in *Wired* magazine that while the new technologies for the medium of exchange were being deployed in a reactionary fashion to bring improvements to the current money system of national fiat currencies (i.e. the sailing ship effect, although we did not think of it in those terms at the time), they would in future drive such decentralization and be used to create non-fiat currencies (Birch and McEvoy 1996). Our argument was that emerging technologies – particularly the synthesis of cryptographic software and tamper-resistant chips – would, we said (as did many others), make the cost of entry into the currency 'market' quite small.

Many organizations beyond central banks and commercial banks might then wish to create private money. This could be as a means of supplying credit, as envisaged by the Nobel-winning economist Frederick Hayek in 1970s, or it could be a means of encouraging customer loyalty, as explored by lateral thinker Edward de Bono in the 1990s. There might also be idealistic reasons, as explored by 'Satoshi Nakamoto', the mysterious inventor of the cryptographic asset Bitcoin (Vigna and Casey 2015), and others since 2008. I will explore all these possibilities in my '5Cs' of money creation (central banks, commercial banks, companies, communities and cryptography) in more detail later in this book, before settling on a narrative for the 'next money' that is likely to surprise you.