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**Article (Accepted version)
(Refereed)**

Original citation:

Dodd, Nigel (2017) *The social life of Bitcoin*. Theory, Culture & Society . ISSN 0263-2764

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Available in LSE Research Online: February 2017

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The Social Life of Bitcoin

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Abstract

This paper challenges the notion that Bitcoin is ‘trust-free’ money by highlighting the social practices, organizational structures and utopian ambitions that sustain it. At the paper’s heart is the paradox that if Bitcoin succeeds in its own terms as an *ideology*, it will fail in practical terms as a form of *money*. The main reason for this is that the new currency is premised on the idea of money as a ‘thing’ that must be abstracted from social life in order for to be protected from manipulation by bank intermediaries and political authorities. The image is of a fully mechanized currency that operates over and above social life. In practice, however, the currency has generated a thriving community around its political ideals, relies on a high degree of social organization in order to be produced, has a discernible social structure, and is characterized by asymmetries of wealth and power that not dissimilar from the mainstream financial system. Unwittingly, then, Bitcoin serves as a powerful demonstration of the relational character of money.

On 13 August 2014, a five-minute video was posted on YouTube called “The Declaration of Bitcoin’s Independence”.¹ “When we say Bitcoin”, the accompanying note explained, “we mean the idea: the birth of cryptocurrency”. The note continued: “We know it’s not perfect. But we’re not after perfection, we’re after progression. We’re after a way out. And we will not stop”. The video consisted of a series of talking heads from varied Bitcoin evangelists and luminaries such as Roger Ver, Jeff Berwick, Kristov Atlas and Trace Meyer, all reading segments from a single text.² Bitcoin is more than a currency, was the central message: it is an “animal of anonymity” that “basks in shadow”. “Bitcoin is sovereignty. Bitcoin is renaissance. Bitcoin is ours. Bitcoin is.” Bitcoin was trading at US\$544³ on the day that video was posted. Five months later, on 14 January 2015, with the price at US\$177, *Bloomberg Business* carried the headline “Bitcoin Has Been Getting Obliterated,”⁴ while *Business Insider* opted for “Bitcoin is Getting Annihilated”.⁵ Both articles, along with countless others published at the time, expressed Bitcoin-related *schadenfreude* by recounting a customary list of Bitcoin flaws: the system’s alleged vulnerability to hacking and fraud, its associations with criminality, and the uncertainties generated by price volatility. Finally, on 29 May 2015, Ross Ulbricht, the erstwhile ‘pirate king’ of Silk Road, was sentenced to life imprisonment without parole, having been convicted four months earlier for crimes ranging from selling narcotics, through money laundering, to maintaining an “ongoing criminal enterprise”.

These three events seem to be part of a single underlying narrative about Bitcoin: a story of the currency’s downfall, a cautionary tale of political hubris, financial ineptitude and underlying criminality. The Bitcoin game is finally up, it seems, and the assorted libertarians, anarchists, investors, monetary activists, techno-geeks and criminals who were celebrating the benefits to personal freedom and empowerment that would inevitably accrue from Bitcoin’s mere existence – “Bitcoin is” – just a few months earlier can now be safely ignored. But in their very juxtaposition, these three events demonstrate something interesting and significant about Bitcoin. While the Declaration of Bitcoin Independence focused mainly on the new currency’s political significance – “Bitcoin is inherently anti-establishment, anti-system, and anti-state” – the annihilation story homed in principally on Bitcoin’s potential as a financial asset: “Some people are beginning to worry that bitcoin is stuck in a self-reinforcing negative price cycle”, warned *Business Insider*. Ulbricht’s conviction and imprisonment, on the other hand, seemed to many to be a reflection of how much of a threat to the state’s legitimacy, and the efficacy of its

monetary infrastructure, that Bitcoin itself had arguably come to pose. In one sense the events appear to belong to independent narratives: the Declaration had nothing to say about price and investment; the obliteration articles made no reference to politics, sovereignty and the state; and the Silk Road conviction focused on outright criminality. But Bitcoin is fascinating precisely because it demonstrates many of the contradictions and confusions that characterize money, and its relationship to law and the state, in general. Bitcoin is both a symptom of increasing monetary pluralism in the advanced capitalist societies, and an embodiment of monetary diversity in its own right. Like money itself, Bitcoin is multi-faceted, politically contested and sociologically rich in its functions and meanings. There is not one Bitcoin, but several (a point which, as I argue below, is all the more noteworthy given the theory behind it). My aim in this paper is to embrace this diversity within Bitcoin (and blockchain technology more generally), and thereby to provide a critical analysis of the Bitcoin phenomenon that reflects these different nuances.

The article contains four sections. In the first section, I argue that Bitcoin expresses two forms of monetary disintermediation that are closely associated with this moment in the history of money, namely, its separation from banks and the state. Both forms of disintermediation underline the political appeal of Bitcoin, but as I explain in the second section, the ideology behind Bitcoin is essentially that it removes politics from money altogether – hence the strong parallels between Bitcoiners and goldbugs, for example. In the third section, I subject this claim to critical scrutiny by exploring the nature of Bitcoin as a social space, showing that the currency has many characteristics that the ideology behind it would seek to deny, such as social organization, political hierarchy and even trust. Building on this critique in the paper's fourth section, I consider some alternatives to Bitcoin that claim to offer solutions to some of the issues already identified. Here, the idea of a 'permissioned' blockchain that operates without money will come to the fore. I conclude by clarifying what Bitcoin really means for our understanding of the social life – and future – of money.

My core thesis is that there is a paradox at the heart of the Bitcoin phenomenon. Bitcoin will succeed as *money* to the extent that it fails as an *ideology*. The currency relies on that which the ideology underpinning it seeks to deny, namely, the dependence of money upon social relations, and upon trust. Insofar as Bitcoin has been successful *qua* money,

it is because of the community that has grown up around it. Ironically, however, this community is sustained by the commonly held belief that Bitcoin has *replaced* social relations – the trust on which all forms of money depend – with machine code. This belief is a fiction. Bitcoin has thrived *despite*, not *because of*, its reliance upon machines. If ever there was a form of money that validates Simmel’s description of money as a claim upon society, it is Bitcoin, the very currency that was set up in denial of that conception.

1 *Bitcoin and the Disintermediation of Money*

Bitcoin was launched in January 2009, using open-source software, as a peer-to-peer payments network. Bitcoins are created within the network, and their creation is strictly controlled without being governed by a central issuing authority. The network is programmed to ensure that the total number of Bitcoins in existence will never exceed 21 million: half of that total supply was generated by 2013. Bitcoins are created through dedicated rigs (PCs), which mine for new coins through a series of tasks that require considerable computational power. The network is designed to produce a fixed number of Bitcoins per unit of time: 25 new Bitcoins will be generated every ten minutes until 2017, and that number will subsequently be halved every four years after that. The more people (or rigs) there are mining for coins, the harder they will be to produce: now, only the most powerful rigs, i.e., several computers working together, are able to create new coins. Bitcoin transactions are rendered both anonymous and secure through the block chain, which is a database of transactions that is shared by all nodes that are participating in the system. So to be clear, the network does two things simultaneously: first, it mines for coins by solving cryptographic problems; and second, it listens for transactions, which are processed and confirmed by being included in a block, which is then added to the blockchain – rather like a rolling spreadsheet that is shared and maintained by the network as a whole. Any discussion about the future of Bitcoin needs to distinguish between these functions, because it is conceivable that a blockchain may be set up that does not involve the production of coins at all (Eris industries has introduced such a system, as I discuss later on).

Since its launch, the Bitcoin network has grown rapidly to become the most widely used alternative money system. Various retailers of material goods, music download websites, game providers, gambling sites, software providers, and high-profile online businesses

such as Expedia, WordPress, Reddit, Namecheap, and Mega, accept Bitcoins. The bitcoinstore.com sells a wide range of consumer goods. There are Bitcoin gift cards, dedicated payment system and debit cards, and a series of exchanges (such as Bitcoin-Central and Bitcoin-24.com) in which Bitcoins can be traded for major currencies in real time. However, much of the public attention that Bitcoin has attracted is connected to a feature that makes it less useful as a means of payment, namely its price volatility. While Bitcoin may be used to buy things, those things are usually priced in a currency such as the US dollar, for the simple reason that the price of Bitcoin has been unstable. Realistically, it seems highly unlikely – almost impossible – to imagine that Bitcoin will ever replace state currency, or even that it will become mainstream. Should it do so, as currently designed the deflationary consequences would be severe. It is also easy to overestimate Bitcoin’s impact outside of our own internet-savvy circles: according to an ongoing survey conducted in the US, popular awareness of Bitcoin remains low: as of April 2015, 65% of those surveyed said they were not familiar with Bitcoin, and only 4.5% had ever used it.⁶

Historically, proposals to reform the monetary system typically involve two kinds of disintermediation of money: from *banks*, and from the *state*. Some aim only for one of these” for example, the idea of ‘100 per cent money’ (echoed more recently by – among others – the Positive Money campaign in the UK,⁷ Gode Penge in Denmark,⁸ Fair Money in Australia,⁹ and Betra Peningakerfi in Iceland¹⁰) followed the Chicago Plan first conceived by Frederick Soddy during the 1920s (Soddy, 1926, 1933, 1943) and subsequently advocated by Irving Fisher (Fischer, 1935, 1936) and Henry Simons (Simons et al, 1933) in the aftermath of the Great Depression sought to take the right to produce money away from banks,¹¹ while Hayek’s (Hayek, 1976) proposals for denationalizing money (echoed more recently by various proposals for ‘monetary freedom’ or ‘free market money’) aimed at disconnecting money’s production from the state. Bitcoin aims at both forms of disintermediation (Karlström, 2014: 28), and it is the promise of both that accounts for a substantial amount of its political appeal. Bitcoin attracts a range of supporters not least because both aspects of monetary disintermediation – separating money from *both* banks *and* the state – resonates with two major axes of political debate about the relationship between finance and the state. It seems obvious that much of Bitcoin’s impact is due to the 2008 financial crisis – although as we shall see, its roots long predate the crisis. Public interest in Bitcoin

resonates with debates about the nature of money and banking that were triggered by the 2008 crisis. For all their political diversity, Bitcoiners seem to unite around the common view that there are major problems with our existing monetary system, which require radical solutions, not piecemeal reform. This is the political conversation that sustains Bitcoin. Bitcoin therefore feeds on the same vein of discontentment as Positive Money in the UK, which argues that banks should be deprived of their right to create money through lending. But there is a crucial issue that sets Bitcoin apart from the arrangements envisaged by advocates of schemes such as the Chicago Plan and Positive Money. Whereas those who support Positive Money argue that money's creation should be placed in the hands of a politically accountable central bank committee (hence we would have something they call "sovereign money"), Bitcoiners believe that only technology can be trusted to do such an important job.¹²

Bitcoin appeals to the political sentiments of those who are troubled by the power and influence of the so-called Wall Street System, and more specifically, are critical of the fractional reserve system that enables high-street banks to create money whenever they make a loan.¹³ From this perspective, the problem with our current monetary system is the way that it ties the production of money systemically to the production of debt. Bitcoin thus appeals to those who regard debt as morally, economically and politically problematic. Bitcoiners are not simply opposed to banks, though. Many of them have major issues with the state, too. Arguably, this is Bitcoin's biggest source of public notoriety, fuelled by Silk Road, the website through which one could buy drugs and pornography, free from state regulation. This, perhaps, explains Bitcoin's in a post-2001 world: it seems to be the antithesis of the state's increasing use, post-9/11, of the mainstream financial system for security purposes (see de Goede, 2012). Bitcoin and other forms of cryptocurrency are particularly attractive to those with libertarian and/or anarchist sympathies who want to see money removed from the control of government. According to David Golumbia, Bitcoin's appeal is indeed *mainly* political, attracting those who sympathize with "the profoundly ideological and overtly conspiratorial anti-Central Bank rhetoric propagated by the extremist right in the U.S. from as far back as the Liberty Lobby and the John Birch Society" (2015: 119).

It would be mistaken, however, to homogenize Bitcoin in political terms. While Golumbia's analysis of Bitcoin as a manifestation of "distributed right-wing extremism"

captures the politics of some of its advocates, this is an unnecessarily one-sided view. For example, one might just as easily view Bitcoin in anarchist terms, as a direct descendent of the Cyberpunks, while its genealogy can also be traced back through the work of David Chaum in the 1980s, Wei Dai's b money and Nick Szabo's idea of bit gold (Dodd, 2014: 363-4). Bitcoin, in other words, can be many things politically. As Maurer et al suggest: "In the world of Bitcoin there are goldbugs, hippies, anarchists, cyberpunks, cryptographers, payment systems experts, currency activists, commodity traders, and the curious" (2013: 2).

Bitcoin is arguably a *social movement* as much as it is a currency – albeit a movement that remains diffuse and ill defined. But whichever political direction one approaches it from, *protest* seems to be a crucial unifying factor in what nurtures and sustains Bitcoin. From a narrower monetary perspective, the reasoning behind most forms of overtly political support for Bitcoin – libertarian as much as anarchist – is that governments cannot be trusted to resist increasing the money supply when political expediency demands, even if it results in high inflation. The prominent Bitcoin investor, Roger Ver, offers a fairly extreme version of this perspective when he argues that "Bitcoin will prevent governments from being able to just print money at will and then use that to buy tanks and guns and bombs to murder people around the world".¹⁴

Bitcoin's connections with arguments about personal privacy and freedom are also important in this context. According to Brett Scott, Bitcoin plays an important symbolic role as a "counterpower" to the Wall Street System – irrespective of the exact political reasons one has for being supportive of or suspicious towards the new currency itself. One significant reason for this, he argues, is that in the UK for example, where around 97% of money in circulation consists of money issued by commercial banks, "every single one of your transactions becomes a potential piece of data to be monitored, incrementally building up a database of your personal characteristics".¹⁵ In such a world, Bitcoin – like cash – offers privacy, and freedom from the clutches of "big data". In these terms, Bitcoin's genealogy can also be traced back, beyond money, towards projects that grew up alongside the Internet itself, which were primarily concerned with responding to the emergence of digital society and its myriad challenges for governance and participation. This was a response to the "datafication of everything" (Clippinger and Bollier, 2014: xii), that is to say, the growth of a new ecology of data in which almost

anything – identities, currencies, contracts, genome, goods and services, etc. – can become a digital asset. In such a world, the capacity of the Internet to transcend extant regulatory boundaries – as defined by national borders, for example – is fraught with risk, as failures of security and privacy are capable of having a direct and serious impact on critical infrastructure. According to Clippinger and Bollier, existing – largely centralized, physical and human-dependent – solutions to such problems no longer seem to work in the face of such risks: “it is not possible, indeed, even necessary, to make such processes digital, algorithmic, autonomous, transparent and self-correcting” (2014: xiii). Bitcoin, and more specifically the distributed ledger that is sustained by the blockchain that underpins it, offers a resilient solution to these problems. In this sense, the broader appeal of Bitcoin is not simply that it takes money away from the control of banks and states, but that it *removes politics from the production and management of money altogether*. As I move on to argue in the next section, it is in this sense, particularly, that I would refer to Bitcoin as utopian.

2 *Bitcoin as Techno-Utopia*

Like many forms of money, from the Brixton Pound to the Euro, Bitcoin is underpinned by a series of assumptions about the organization of society, and the role that money plays within it. Some of these assumptions are about how the monetary form in question might contribute to social reform, or in the case of the Euro, to greater levels of social integration and enhanced forms of social identity. But in one crucial respect, Bitcoin is different from other alternative or complementary currencies;¹⁶ indeed it is different from *any* extant form of money. Unlike those other forms of money, Bitcoin seeks to achieve its aims by technological means. Some of these aims are purely technical, so for example, while it is usually up to institutions like central banks and the IMF – or in the case of a local currency, a board of trustees – to protect the value of money, Bitcoin *delegates the task to machines*. But in addition, Bitcoin is associated with beliefs about the efficacy of technology *per se* as a means of bypassing politics altogether.

According to Satoshi Nakamoto (the anonymous individual or collective from whose paper the Bitcoin project was derived), the root problem with most conventional forms of money is the trust in a central form of authority that’s required to make them work¹⁷ Nakamoto’s proposals sought to get rid of this central authority by using a block chain

(shared by all computers or nodes within the network) through which the transaction history of each coin could be publicly known. Privacy would be maintained, meanwhile, by encrypting the public keys. (Most Bitcoins are not really coins, of course: this is a ledger-based system.) Nakamoto's idea has captured the imagination of a wide range of people. At its heart are four very seductive ideas: first, the Bitcoin network is decentred and flat – with no hierarchy and no single point of authority; second, Bitcoin offers reliable technological solutions to key problems of monetary governance, such as inflation; third, Bitcoin dispenses with the need to trust others, whether they are experts, politicians or ordinary people; and fourth, Bitcoin is debt free money, just like gold.

Public discourse about Bitcoin often focuses on the idea that this is money created out of nothing – virtual rather than real money.¹⁸ But as even a casual glance at the specialist monetary literature will tell you, there is nothing unusual about this – *all* money is 'virtual' in the sense that it relies upon the series of claims and obligations in which it is embedded (see Dodd, 1994, 2014; Hart, 1986, 2001; Ingham, 1996, 2004; Graeber, 2001, 2011; Desan, 2014). Here, though, Bitcoin presents something of a paradox for the theory of money. While Bitcoin is no exception to the argument that all money is virtual – it, too, relies on honoring generalized claims to payment – the theory behind it relies on a form of reasoning derived from the opposing theory of money, i.e. that money gains its value from its material properties as a medium of exchange. Indeed, one key aspect of Bitcoin's appeal to its advocates and supporters *qua* money – and an important reason for its rising price up until recently – is that the currency effectively *mimics the properties of gold in virtual form*. Maurer et al characterize the philosophy behind Bitcoin as a form of "digital metallism" that relies on the semiotics of metallic money, with its language of mining and rigs (Maurer et al, 2013). One of the most interesting things about Bitcoin is the material paraphernalia that supports it, and the materialistic language that justifies it. This speaks to a paradigmatic distinction within the theory of money between credit money (i.e. a claim to future payment; see Orléan, 2014, chapter 5) and species money (i.e. coin or bullion). It does indeed seem that Bitcoins are being dug up from the ground.¹⁹ It is the natural limits of supply that underpins the argument that gold should be money, because governments or banks cannot artificially increase its supply. As Maurer and his colleagues point out, it was this philosophy that led Locke to associate sound money with liberty, because it emancipated money from government control. Thus while the ideology behind Bitcoin is libertarian, the theory of money that informs it

can be traced back to Menger (1892). An image of money as a thing that must be kept scarce – in order for its value to be protected – unites these phenomena. If money is a social process as Simmel suggests, it seems that nothing could be farther from that idea than Bitcoin.

These inconsistencies emerge quite clearly in the talk of Bitcoin users (both miners and traders) themselves, and it is fascinating to see how they are dealt with. When I asked a Bitcoin trader about the theory of money underlying his understanding of cryptocurrency, he compared Bitcoin to gold; indeed he suggested that the currency was *superior* to gold because its supply could be absolutely fixed (at 21 million coins) by the underlying software. At the same time, he conceded that it is possible for the chief scientist at Bitcoin to remove the cap on Bitcoin production, for example by doubling the total number of Bitcoins that will eventually be mined to 42 million. For many observers this might well be a good thing, because it would relieve what look like inherently deflationary pressures within the system, or even because it would enable the system to be “managed” according to prevailing economic conditions, like a conventional monetary system. However, such move would undermine the techno-utopian ideals that are so important to Bitcoin, which hinge on the argument that the supply of Bitcoin can *never* be altered. When I put this point to the trader in a question, he suggested that the *belief* that the total number of Bitcoin would never exceed 21 million that acts like a socially necessary fiction that holds the network together. In other words, while the chief scientist at Bitcoin could indeed raise the cap, he was highly unlikely to do so because such an action would shatter the belief-system that sustains the network itself. In other words, the trader I was speaking to appears to behave like a gold bug, while thinking like a social constructionist. He saw no contradiction in his position.

One cannot help but think of Polanyi here, who argued the only way of realizing the “stark utopia” (Polanyi 1957b: 218, 250) of the self-adjusting market was through the support of a strong interventionist state. He wittily describes this system as planned laissez-faire capitalism: “There was nothing natural about laissez-faire, free markets could never have come into being merely by allowing things to take their course . . . laissez-faire itself was enforced by the state” (Polanyi 1957b: 145). Much the same could be said of the idea of Bitcoin as a monetary space that has built-in scarcity: it is a techno-utopia that must be embedded within a set of social practices that are sustained by strong

beliefs. One could also compare the “socially necessary fiction” of Bitcoin’s finite supply to the fictions that arguably sustain the idea of monetary policy as something largely technical, not political, and of central banks as institutions operating independently of government (see Ingham, 2004). As I move on to argue in the next section, this is a techno-utopia that relies on far more than technology alone.

3 *Bitcoin as a Social Space*

I have suggested that Bitcoin’s appeal to its advocates and users rests partly on its association with two kinds of monetary disintermediation: from banks on the one hand, and from states on the other. In this section, I want to argue that there is a fundamental and widespread confusion in relation to Bitcoin concerning a third form of disintermediation of money, namely, from hierarchical modes of *society* and *social organization*. As noted above, Bitcoin appeals to many users as a techno-utopia that is free from politics altogether. In purely technical terms, this suggests that Bitcoin is a currency whose supply is governed by technology, and which therefore has similar properties – *qua* money – to gold. But there is also a strong sociological thesis running through Bitcoin, which holds that Bitcoin is characterized by a horizontal – decentered, or distributed – mode of organization. Arguably, it is the notion of *distributing* power throughout the network of computers – and, just as importantly, distributing the record of transactions throughout the network by means of the blockchain – is perhaps the most important of Bitcoin’s utopian aspects, and one that can be separated from the (various) theories of money that are associated with it. Herein lies one important aspect of Bitcoin’s significance that has both political and financial implications, because curiously, the theory behind the currency attracts interest as *both* a (quasi-anarchist) monetary means of escaping state surveillance, *and* as a financial asset (or store of value) that has the potential not only to rival but to surpass gold. This, however, is where a gulf opens up between the ideology behind Bitcoin and the practical reality of its operation – and where the three stories with which this paper began momentarily collide.

When it comes to Bitcoin's horizontalism, Brett Scott captured some of what is at stake when he once suggested that Bitcoin embodies a "Rousseauian" approach to finance, which can be contrasted to the old, "Hobbesian" world of central banks. In other words, Bitcoin has replaced the sovereign with the general will: "In place of a centralised, hierarchical group of banks keeping score of the money, a decentralised network of individuals records every transaction on a virtual ledger called the blockchain".²⁰ Scott subsequently qualified that view by suggesting that Bitcoin might also be seen as a "Techno-Leviathan", which he defines as "a deified crypto-sovereign whose rules we can contract to".²¹ This is not a contradiction in Scott's interpretation of Bitcoin, but rather a reflection of its own peculiar ambiguous properties, as a network that sits somewhere between, on the one hand, a structureless, quasi-anarchist, quasi-libertarian space that is free from state regulation – much as celebrated in the "Declaration of Bitcoin's Independence" with which this paper began – and on the other, a system that simply replaces human agency, and therefore human autonomy, with machine code. Arguably, Bitcoin's essential strangeness – and the difficulty we have in defining it sociologically – is that it fits both descriptions up to a point. But the argument cannot be left here, because there is much more to Bitcoin than can be gleaned from focusing on its technological features alone.

If it were true that Bitcoin has replaced a Hobbesian monetary system with one that could have been derived from Rousseau, it must follow that the general will has been abstracted from social networks and embedded in computer code. This, essentially, seems to be the view taken by Maurer, Nelms and Swartz. According to them, with Bitcoin the sociality we would normally associate with trust has been embedded computer code:

Bitcoin provides a useful reflection on the sociality of money, despite its embedding of that sociality of trust in its code itself. In this world, there is no final settlement – as with a state demanding payment in the form of taxes or tribute – *and trust in the code substitutes for the (socially and politically constituted) credibility of persons, institutions, and governments.* It is this – *not the anonymity or the cryptography or the economics* – that makes Bitcoin novel in the long conversation about the nature of money" (Maurer et. al., 2013: 3)

If this is right, Bitcoin would resemble robot money, circulating in a robot society. But for all of its value as a reading of the significance of Bitcoin for the theory of money, I want to suggest that this particular reading of Bitcoin – as a horizontal network that simply embeds trust into computer code – misses some crucial aspects of the reality of Bitcoin’s actual operation, and replicates the ideology behind it. As with all complex technical systems, social practices are crucial. Let me take two of the main arguments about Bitcoin: the first is about its *horizontalism*, the second is about its *social reality*.

Politically, it tends to be as means, as much as an end, that horizontalism matters. In his book on Occupy and the Arab Spring, the English journalist Paul Mason describes this in terms of the distinction between network and hierarchy. Social media such as Twitter epitomize the world of the network, governed not by central sources of authority but by the wisdom of crowds (Mason, 2012). Likewise, David Graeber has drawn attention to horizontalism as one of the defining features of Occupy’s strategy. He also finds evidence of it in Argentina after its 2001 crisis – in which, of course, alternative currencies played a key role (Graeber, 2013). Perhaps the ultimate financial expression of the wisdom of crowds is P2P lending, while the fast-growing sharing economy – couch surfing, for example – has taken the principle into the consumer world. Bitcoin seems to belong to this world. The only caveat is that it is meant to have automated the crowd.

However, while Bitcoin resonates with the anarchist or libertarian idea of rigging up a machine to create a DIY currency, the argument for its horizontalism is undermined by the way the system operates in practice, because it incentivizes the most powerful producers of the currency to become even more powerful. This is not about wealth concentration, but monetary production. If someone – say, a Winklevoss twin – chooses to accumulate a large percentage of Bitcoin by buying them on the open market, this tells us nothing about the world that we do not already know. What matters, however, is that Bitcoin’s *production* is being dominated by a very small number of mining pools, indeed the software favours the most powerful producers and incentivizes monopolistic practices. If you want to mine for Bitcoin, your best – and perhaps only – chance of doing so successfully is to join such a pool, for example by renting space on a larger mining rig (for an example of how this works, see <https://ghash.io/>). This means that the Bitcoin network is not quite as “distributed” as its advocates claim, indeed one could argue that it demonstrates quite a strong tendency towards the centralization of monetary

production by massively favouring those with more processing power. Reinforcing the incentives, rewards are scaled: the rewarded block is split according to processing power. It is mathematically possible for one miner (or mining pool) with enormous processing power to monopolize the creation of new coins. If this were to happen, Bitcoin would resemble the most hierarchical monetary system imaginable, indeed it would make most existing monetary systems (wherein money is created through commercial bank lending) look 'flat' by comparison. It is ironic, but significant, that this is a result of technical features of Bitcoin's design. I say significant, because it suggests that another cryptocurrency with a new design might avoid this tendency to concentrate monetary production so much – which is exactly what designers of other altcoins, such as Litecoin and Dogecoin, have been claiming. In response to such dynamics, more egalitarian Bitcoin enthusiasts have developed Bitcoin Script (<http://bitcoinscript.org/>), which is committed to 'Mining Decentralization'. This contrast between the dynamics of mining pools (where relative size is rewarded proportionately) versus mining decentralization is ideologically charged. What looks like an apolitical technological network from a distance becomes socially nuanced and politically loaded once one starts looking at who is mining, where, with whom and with what.

Despite the claim that Bitcoin is a horizontal network, which is politics-free because it distributes the power of money creation, the currency is characterized by a strikingly high degree of political hierarchy and social organization. The currency has not lived up to the techno-hype surrounding it. This further underlines the importance of looking beyond Bitcoin when considering the potential role of cryptocurrencies in the future of money. In this regard, Bitcoin tells us something important about the relationship between technology and the social context of its use. Technology cannot enact social organization on its own. As a form of money, Bitcoin has been sustained by sociological characteristics – e.g. structure, leadership, hierarchy, friendship and community – much more than it has evaded them. This is no bad thing, and it is surely no surprise to any sociologist or anthropologist of money. My point is simply that the reality of Bitcoin – its social reality – is at odds with the theory behind it. A system that originally appealed because of its distributed qualities is in some ways rather centralized.

Calling Bitcoin horizontalist renders it sociologically anaemic, buying into the ideology that it is essentially a machine. On the contrary, there is a strong sense of community

around Bitcoin, as reflected in discussion groups, Internet forums and the organizations that are associated with it. In monetary terms, one could argue that the community around Bitcoin is still an important source of the disembedded trust that characterizes the currency itself. Besides the issue of horizontalism, there is also the social reality of Bitcoin itself as a social space to consider. Bitcoin may be a virtual currency whose production is carried out by a computer network, but those who use it often express quite a strong sense of collective identity: far stronger, one might say, that one finds in the case of mainstream currencies such as the Euro or pound sterling. Bitcoiners demonstrate quite a strong sense of community, with regular meetings bolstering (and bolstered by) quite intense participation in online forums. One Bitcoin trader I spoke to reported that he usually mixed with his counterparties following a trade on Skype, often during the ten minutes it takes for the blockchain to be produced (and thus the transaction he had just participated in to be recorded across the distributed ledger). This was, he suggested, a great opportunity to socialize. I asked him what he and his fellow traders tended to talk about: “Money”, he replied.

4 *Bitcoin 2.0: A Blockchain Without Coins?*

While some of Bitcoin’s supporters still celebrate it as a currency that can overcome difficulties arising in conventional monetary and payment systems whenever trust breaks down (or is breached), many others accept that whatever form it takes, money will always require trust simply for people to accept it as payment. Just to be clear on this question, Nakamoto was specifically referring to two aspects of monetary trust: first, the trust we place in the monetary policy makers – central bankers, for example – to act responsibly; and second, in the specific context of digital currency, the trust we need to place in one another not to double spend. These are critically important aspects of Bitcoin today, indeed they point to two separate development trajectories in Bitcoin’s future. The first relates directly to money. Although it is open to debate whether fiat monetary systems have been undermined by a reliance on trust, Nakamoto was arguably right to criticize a system that enables banks to lend money “out in waves ... with barely a fraction in reserve”.²² In this sense, Bitcoin is in tune with political sentiments that emerged after the 2008 financial crisis (see Dodd 2014). The second trust issue points to wider applications of blockchain technology beyond money. The idea of keeping failsafe records through a distributed network that does not rely on trusted (but potentially inefficient, corrupt or

incompetent) intermediaries is perhaps the most radical aspect of Bitcoin, and will be pivotal to a future that will be much broader than money alone.

Bitcoin gained much of its early notoriety from associations with Silk Road, the online marketplace (now closed) on which it was possible to buy illicit goods such as drugs, pornography and arms. Bitcoin has also been associated with money laundering, and it is notable that the report on Bitcoin and other cryptocurrencies recently published by HM Treasury in the UK focused almost exclusively on anti-money laundering in its considerations as to how the currency should be regulated (HM Treasury, 2015). These associations with illegality gave rise to the widespread assumption that the key to Bitcoin's attractiveness for its users is the *anonymity* it gives them (e.g. Reid and Harrigan, 2013). This is a misconception. As readers of Bitcoin.org are told, "all Bitcoin transactions are stored publicly and permanently on the network, which means anyone can see the balance and transactions of any Bitcoin address".²³ So if you want to use Bitcoin anonymously, you have to ensure that nobody can connect you with the Bitcoin address you use: "This is one reason why Bitcoin addresses should only be used once," the website helpfully adds. Seeking to ensure a more mainstream future for the currency, many advocates of Bitcoin have challenged its associations with criminality, mainly by emphasizing the fact that this is a distributed ledger on which all transactions are stored publicly and permanently. Bitcoin, presented in these terms, is no longer primarily a tool of anonymity, but rather a means of achieving transparency and trackability of data across a network that does not rely on a centralized agency. Every computer within the network logs every Bitcoin transaction; this is what the blockchain does.

Conceived in these terms, Bitcoin is essentially a database of transactions that relies on a protocol, i.e. an agreed-upon format for transmitting data between devices. It is important to remember that, in relation to Bitcoin, the distributed network of computers that produces the currency and records all transactions that use it, carries out two tasks simultaneously. First, it *mines* for coins by solving cryptographic problems every ten minutes. Second, it *listens* for transactions, which are processed and confirmed by being included in a block, which is then added to the blockchain that is produced every ten minutes. One way of thinking about this latter process is to imagine a rolling spreadsheet, with each new line being added every ten minutes, containing a record of everything that has happened across the network during that period of time. Up until now, most of the

attention and debate around Bitcoin has focused on the first of these processes, i.e. the production of coins. Hence the focus on the price of Bitcoin, as well as on the costs of mining and the organizational dynamics of mining pools. The key to my argument here lies with the second process.

Viewed solely as a distributed ledger that is effectively just a database, blockchain technology encourages another, *epistemological* utopianism that goes beyond money. Contrary to the infinitely copiable world of plenty we associate with digital media, the blockchain makes finitude and singularity possible: from the idea that money is a “thing” whose production can be regulated and controlled, through the notion that each of our actions or transactions (e.g. voting, buying property, medical vaccinations, getting married, receiving a degree, etc.) is a uniquely verifiable *event*. Jorge-Luis Borges wrote about philosophical – and, specifically, linguistic – aspects of a similar idea through his character, Funes the Memorious. Funes’s memory was so prodigious that he could recall each day in such painstaking detail that merely to think his recollection through would take an entire day. By imagining Funes, Borges’s aim was not to explore memory as such but rather the assumptions underlying philosophical nominalism: Funes memory would, he surmised, be a match for the language that Locke envisaged whereby “each individual thing, each stone, each bird and each branch, would have its own name” (2000: 93).

This may help to explain why the blockchain is sometimes compared to a language, and further, why it is supported with quasi-religious zeal. The blockchain appeals not only because it can remember every discrete event within the network, but crucially, because its memory is *infallible*. The blockchain seems to promise a world of absolute certainty but with no god, or at least no central figure that could be likened to a god – and yet we have god-like guarantees. Moreover, and more importantly perhaps, as a form of memory the blockchain is *distributed*. To its supporters, perhaps the most important attraction of the blockchain as a distributed ledger is that it makes such verification possible without reference to an intermediary. In other words, every node within the network can replicate and verify Funes’s memory. The technology may be god-like but it is a distributed god, at least in theory.

There are many possible applications of this technology, from the idea that our identities can be validated and secured within the blockchain without being substantively known

(e.g. Factom for a global application of this), through a real time gross settlement system for clearing payments, to a system of smart contracts used for property transfer or the settlement of debts. Hence blockchain technology, i.e. a distributed ledger jointly maintained across a network, is now being applied to various applications for storing data, recording transactions and agreements, and if necessary, enacting procedures on the basis of rules on which all participants in the system have agreed in advance. This, essentially, is a smart contract, defined as “computer protocols that facilitate, verify, execute and enforce the terms of a commercial agreement” (Swanson, 2015: 15). We have moved from money, to law.²⁴

The literature on smart contracts – much of it in the blogosphere, at the time of writing – is replete with notions such as records being “truly honest” without needing to trust other humans (who are flawed or may be dishonest corrupt) or institutions (which may not have our interests at heart, and can be hacked or politicized). The blockchain, its supporters claim, stops us from *lying about history*. This is a compelling shift of emphasis: far from being a tool for illegal transactions, the blockchain is now heralded as a means for achieving more efficient regulation, near-perfect auditing and greater transparency.²⁵ There is a strong realist tenor within this discourse. The fundamental idea is of a referencing system (i.e. the records stored within the blockchain) in which there is an exact one-to-one correspondence with reality, but which requires no God. The ultimate goal is to establish a system of records (recording everything from property transactions to marriages to degree awards etc.) that cannot be corrupted and does not need any third party to verify that what is recorded is true. This is because everything is stored in the blockchain, which nobody controls and nobody can tamper with. In Borges’s story about Funes, one of the conclusions we might draw is that Locke’s language makes it impossible to have categories, and without categories, genuine thought is impossible. One can but wonder whether this resistance to categories is one reason why the blockchain tends to appeal so much to individualists.

Herein lies an important twist in the Bitcoin story with which I began this paper, a twist that even the most enthusiastic supporters of the technology did not necessarily envisage when the experiment began. This is the notion of a blockchain *without* coins, using the distributed ledger solely as database. While the commercial viability of potential offshoots of Bitcoin – all focusing on other applications of blockchain technology – has

been discussed almost from the outset, it was always assumed that it was necessary for the network to produce coins in order to incentivize people to participate, given that participation is costly (e.g. in terms of the energy consumed). Hence an organization such as Ethereum, which has its own blockchain and was launched as a direct rival to Bitcoin that is not designed *primarily* with the production of money in mind, nevertheless still produces its own money, known as Ether. Ethereum is one of a series of platforms – others include Invictus Innovations and Ripple Labs – that are collectively described as “Bitcoin 2.0”.²⁶ Almost all such platforms share the assumption that blockchain technology is not simply a platform for producing currency but can be used in other applications such as e-commerce, smart contracts and various other financial transactions. The crucial aspect that unites these is the absence of a central intermediary or middleman. The key distinguishing feature, in other words, remains focused on decentralization: the notion of a distributed ledger, a database simultaneously maintained by all nodes on the network.

By contrast, the idea of a blockchain *without* coins – which is mainly being promoted by Eris Industries – seeks to overturn two traditional assumptions behind Bitcoin. The first is that the ledger must be open to any potential participant in order to be genuinely distributed. This is the contrast between a permission-less and permissioned blockchain: whereas the latter continues along the Bitcoin model, the latter enables the blockchain to be private owned and run, e.g. by a bank, with access to it controlled. The second assumption that is overturned by the notion of a blockchain without coins is that coins are necessary in order for participants to join and maintain the system. The argument behind Eris is that utility – not the production and transmission of monetary value – is reason enough to maintain a blockchain in cases where it is genuinely useful *as a database*. These two arguments come together in an interesting way when justifying the permissioned aspect of the coin-less blockchain, because its advocates argue that it is the very presence of money within Bitcoin that – much as I suggested above – sets in place a tendency towards centralization, e.g. by favouring those with higher processing power and incentivizing players to acquire more such power. While Bitcoiners argue that a blockchain without coins is unworkable, because there is no incentive to keeping maintaining the ledger, Eris argue that flexibility and utility are the only incentives we need. Their blockchain can be maintained by a central entity, such as a company or group of companies, who use the blockchain as a “low-cost, low-overhead, run-anywhere

infrastructure”. Moreover, they argue that by removing the monetary incentive, the motivation for participants to game the system is also removed. Eris further argues that a permissioned chain can be controlled and tailored to specific needs, and can be a tool of regulation in its own right.

Conclusion

So where does all of this leave Bitcoin? Will it – or another altcoin – succeed or fail as *money*? Critics of Bitcoin complain that it is too slow for efficient payments, too cumbersome and energy sucking, and they see the Bitcoin Foundation as problematic. On the other hand, there are some 800 million pounds worth of venture capital tied up in Bitcoin, so it would be unwise to right it off. What surely is clear for the time being, however, is that Bitcoin is currently being sustained by sociological features that are directly at odds with the political ideology the theory of money that underpin it. These include leadership, social organization, social structure, sociality, utopianism and trust. None of these necessarily means that it will work as money: hard-headed analysis suggests that the Bitcoin has far less chance of succeeding as money than the blockchain technology, which will be (and is being) adapted for other purposes, such as Mastercoin and Ethereum, which are essentially smart contracts.

The idea behind Bitcoin is premised on denying what I believe is Simmel’s most important insight into the social life of money: by treating money as a *thing*, not a *process*. This idea cannot withstand close scrutiny. What Bitcoin surely does confirm is that it no longer makes much sense to talk of money as a claim upon society if, by society, we essentially mean something we ‘belong’ to. This is a good reason to read Simmel, because was careful to avoid such a notion of society from the outset. In his terms, money is a claim, if not on “society,” then on *varying modes of shared existence and experience*. As sociologists of science and technology have been arguing for a long time, technological artifacts cannot simply enact organizational forms on their own. Human, social, and political factors inevitably emerge as those who interact with and use these artifacts both shape and are shaped by their practical use. In Bitcoin’s case, there is a close analogy between the underlying view of money as a “thing” in itself and the notion that technology is capable of shaping a social system—in this instance, money—all by itself, free from human intervention. Arguably, it was faith in technological solutions to

information problems in the economy that enabled people to believe that credit risk could be managed through securitization. This was blind trust. Collateralized debt obligations, like Bitcoin, were underpinned by a trust in numbers that few people who used them actually understood.

The idea of the failsafe, distributed ledger is perhaps the aspect of Bitcoin that will be key to a future that goes beyond money alone. This is not to say that Bitcoin has no relevance to the future of money, it surely does. But its role will most likely be a partial one (Vigna and Casey, 2015). For reasons I have discussed here, world in which *all* money is organized along the lines of Bitcoin, with money's production strictly controlled, would possess a similar level of inflexibility as the world when it was geared to the gold standard – and as I have also argued, Bitcoin itself seems not only to replicate but exacerbate the self-same inequities of wealth and power that can be found in the existing financial system. Bitcoin, and cryptocurrencies in general, are part of a diverse future for money. And monetary pluralism, arguably, is ultimately more likely to bring higher levels of systemic resilience, political openness and financial inclusion.

Endnotes

¹ See <https://www.youtube.com/watch?v=XQqZ9b0S0BY>, last accessed 8 April 2015.

² The text can be found at <https://bitcoinmagazine.com/13072/declaration-bitcoins-independence/>, last accessed 8 April 2014.

³ Source CoinDesk, see <http://www.coindesk.com/price/>.

⁴ See <http://www.bloomberg.com/news/articles/2015-01-14/bitcoin-has-been-getting-obliterated>, last accessed 8 April 2015.

⁵ See <http://uk.businessinsider.com/bitcoin-price-drop-2015-1>, last accessed 8 April 2015.

⁶ See <https://coincenter.org/survey/>, last accessed 8 March 2016.

⁷ See <http://www.positivemoney.org/>, last accessed 13 April 2015.

⁸ See <http://www.godepenge.dk/>, last accessed 2 June 2015.

⁹ See <https://www.facebook.com/pages/Fair-Money-Australia/1387804951470301>, last accessed 2 June 2015.

¹⁰ See <http://betrapeningakerfi.is/>, last accessed 2 June 2015.

¹¹ For more recent investigations of the merits of this plan, see Benes and Kumhof, 2012; and Jackson and Dyson, 2012.

¹² Intriguingly, the possibility that states themselves could be the producers of cryptocurrency has been muted, largely in the form of a thought experiment it would seem, e.g. by Casey and Vigna in the form of a “digital dollar” (2015: 304-5), by the Bank of England in its recent report outlining a research agenda (Bank of England, 2015: 31), and by J P Konig in the form of “Fedcoin” (see <http://jpkoning.blogspot.co.uk/2014/10/fedcoin.html>).

¹³ A survey of 510 members of the Bitcoin community on the Bitcoin forum (<https://bitcointalk.org/>) and /r/bitcoin (<http://redd.it/1ojfxx>) conducted by Caitlin Lustig – a PhD student in the Informatics department at the University of California, Irvine – yields some interesting results. From a survey population aged mainly between 25 and 34 that was overwhelmingly (96%) male, and half of whom were based on the US (and a quarter from California), Lustig found almost 60% of those surveyed professed themselves to be Libertarian, and 27% Anarchist (although it should be emphasized that respondents were allowed to choose more than one option – so a further 25% said they were Left-wing, while 36% answered yes to “Moderate”), see <https://bitcointalk.org/index.php?topic=486149.msg5354626#msg5354626>, last accessed 8 March 2016.

¹⁴ See Roger Ver, “How Bitcoin Can Stop War”, 22 July 2014, http://original.antiwar.com/roger_ver/2014/07/21/how-bitcoin-can-stop-war/, last accessed 15 April 2015.

¹⁵ Scott, “A Dark Knight is better than no Knight at all”, *King’s Review*, 24 March 2015, available at <http://kingsreview.co.uk/magazine/blog/2015/03/24/a-dark-knight-is-better-than-no-knight-at-all/>, last accessed 13 April 2015.

¹⁶ The terminology matters: supporters of local currencies such as the Brixton and Bristol pound, and time-based currencies such as Spice and Echo, prefer *complementary* currency because they want their monetary forms to circulate alongside, rather than replace, existing legal-tender. Those who use and support Bitcoin often take a more bullish view, preferring the term *alternative* currency because they believe that state fiat currency can (and should) be replaced by a cryptocurrency such as Bitcoin.

¹⁷ “Bitcoin open source implementation of P2P currency”, P2P Foundation, 11 February 2009, <http://p2pfoundation.ning.com/forum/topics/bitcoin-open-source>, last accessed 2 June 2015.

¹⁸ For examples of this genre of discussion about Bitcoin and other cryptocurrencies, see Patterson (2014) and Tucker (2014) – and there are countless others.

¹⁹ Karlström, too, emphasizes the “material embeddedness” of Bitcoin, i.e. the “complex chain of technology that has to be in place before even the first Bitcoin transaction can be ... the manufacture of computers, fiber-optic cables, and all the other kinds of physically grounded machinery that underlie the wrongly assumed-to-be nonphysical internet” (2014: 30), although he adds that “this does not mean that virtual money is material in the same way as non-virtual money” (2014: 27).

²⁰ See Brett Scott, “If you want to know what money is, don’t ask a banker. Take a leap of faith and start your own currency”, *Aeon*, 28 August 2013, available at <http://aeon.co/magazine/society/so-you-want-to-invent-your-own-currency/>, last accessed 13 April 2013.

²¹ See Scott, “Visions of a Techno-Leviathan: The Politics of the Bitcoin Blockchain”, *E-International Relations*, 1 June 2014, <http://www.e-ir.info/2014/06/01/visions-of-a-techno-leviathan-the-politics-of-the-bitcoin-blockchain/>, last accessed 2 June 2015.

²² “Bitcoin open source implementation of P2P currency”, P2P Foundation, 11 February 2009, <http://p2pfoundation.ning.com/forum/topics/bitcoin-open-source>, last accessed 2 June 2015.

²³ “Some things you need to know”, <https://bitcoin.org/en/you-need-to-know>, last accessed 2 June 2015.

²⁴ See for example, Preston Byrne, “Smart contract platforms != Law ... Smart contracts as law?”, 25 April 2014, <http://prestonbyrne.com/2014/04/25/smart-contract-platforms-law/>, last accessed 2 June 2015.

²⁵ See for example “How the Blockchain Could Stop Firms Cooking the Books”, *CoinDesk*, 7 February 2015, <http://www.coindesk.com/how-the-blockchain-could-stop-firms-cooking-the-books/>, last accessed 22 April 2015.

²⁶ See “Bitcoin 2.0 Shows Technology Evolving Beyond Use as Money”, *Bloomberg Business*, 28 March 2014, <http://www.bloomberg.com/news/2014-03-28/bitcoin-2-0-shows-technology-evolving-beyond-use-as-money.html/>, last accessed 28 May 2015.

References

Bank of England (2015) *One Bank Research Agenda: Discussion Paper* (London: Bank of England), available at <http://www.bankofengland.co.uk/research/documents/onebank/discussion.pdf>, last accessed 13 April 2015

Benes, J and M Kumhof (2012) “The Chicago Plan Revisited”, *IMF Working Paper* WP/12/202 (Washington DC: International Monetary Fund)

Birch, D (2013) *Identity is the New Money* (London: London Publishing Partnership, 2013)

Borges, J-L (2000) “Funes the Memorious”, in *Labyrinths* (London: Penguin, 2000), pp. 87-95

Bryan, D and M Rafferty (2006) *Capitalism With Derivatives* (Basingstoke: Palgrave)

Clippinger, J H and Bollier, D (2014) “Introduction”, in Clippinger, J H & D Bollier (eds) *From Bitcoin to Burning Man and Beyond: The Quest for Identity and Autonomy in a Digital Society* (Amherst, Mass.: ID3/Off the Common Books), pp. x-xxiv

-
- de Goede, M (2012) *Speculative Security: The Politics of Pursuing Terrorist Monies* (Minneapolis: University of Minnesota Press)
- Desan, C (2014) *Making Money: Coin, Currency and the Coming of Capitalism* (Cambridge, Mass.: Harvard University Press)
- Dodd, N (1994) *The Sociology of Money* (Cambridge: Polity Press)
- Dodd, N (2005) “Reinventing Monies in Europe”, *Economy and Society* 34 (4): 558–83
- Dodd, N (2014) *The Social Life of Money* (Princeton, NJ: Princeton University Press)
- Fisher, I (1935) *100% Money: Designed to keep checking banks 100% liquid; to prevent inflation and deflation; largely to cure or prevent depressions; and to wipe out much of the National Debt* (New York: The Adelphi Company)
- Fisher, I (1936) “100% Money and the Public Debt”, *Economic Forum*, Spring (April-June): 406-420
- Golumbia, D (2015) “Bitcoin as Politics: Distributed Right-Wing Extremism”, in Lovink, G, N Tkacz and P De Vries (eds) *MoneyLab Reader: An Intervention in Digital Economy* (Amsterdam: Institute of Network Cultures), pp. 117-31
- Graeber, D (2001) *Toward an Anthropological Theory of Value: The False Coin of Our Own Dreams* (Basingstoke: Palgrave Macmillan)
- Graeber, D (2011) *Debt: The First 5,000 Years* (Brooklyn, NY/London, Melville House Publishing)
- Graeber, D. (2013) *The Democracy Project: A History. A Crisis. A Movement* (London: Penguin)
- Hart, K (1986). “Heads or Tails? Two Sides of the Coin”, *Man* 21: 637–56.
- Hart, K (2001) *Money in an Unequal World* (New York/London: Texere)
- Hayek, F A (1976). *Denationalisation of Money, The Argument Refined* (London, Institute of Economic Affairs)
- HM Treasury (2015) *Digital Currencies: Response to the Call for Information* (London: HM Treasury)
- Ingham, G (1996) “Money is a Social Relation”, *Review of Social Economy*, 54 (4): 507-29
- Ingham, G (2004) *The Nature of Money* (Cambridge: Polity Press)
- Jackson, A and B Dyson (2012) *Modernising Money: Why Our Monetary System is Broken and How It Can Be Fixed* (London: Positive Money)
- Karlstrøm, H (2014) “Do libertarians dream of electric coins? The material embeddedness of Bitcoin”, *Distinktion: Scandinavian Journal of Social Theory* 15 (1): 23-36

-
- Mason, P (2012) *Why It's Kicking Off Everywhere: The New Global Revolutions* (London: Verso)
- Maurer B, T C Nelms and L Swartz, L (2013) “When perhaps the real problem is money itself’: the practical materiality of Bitcoin”, *Social Semiotics* 23(2): 261-77
- Menger, K. (1892) “On the Origin of Money,” *The Economic Journal* 2: 239–477
- Nakamoto, S (2008) “Bitcoin: A Peer-to-Peer Electronic Cash System”, available at <https://bitcoin.org/bitcoin.pdf>, last accessed 13 April 2015
- Orléan, A (2014) *The Empire of Value: A New Foundation for Economics* (Cambridge, MA: MIT Press)
- Patterson, S (2014) “Bitcoin is Not Backed by Anything (And That’s OK!)”, *Bitcoin Magazine*, 21 October 2014, available at <https://bitcoinmagazine.com/17392/bitcoin-is-not-backed-by-anything-and-thats-ok/>, last accessed 13 April 2015
- Pyhtinen, O (2010) *Simmel and “The Social”* (Basingstoke: Palgrave Macmillan)
- Reid, F and M Harrigan (2013) “An Analysis of Anonymity in the Bitcoin System”, in Y Altshuler, Y Elovici, A B Cremers, N Aharony and A Pentland (eds.) *Security and Privacy in Social Networks* (New York: Springer) pp. 197-223
- Simmel, G (2005) *The Philosophy of Money* (London: Routledge)
- Simons, H et al (1933) “Banking and Currency Reform”, manuscript, printed in Warren Samuels (ed.) *Research in the History of Economic Thought and Methodology*, Archival Supplement, Volume 4 (Greenwich, CT: JAI Press)
- Soddy, F (1926) *Wealth, Virtual Wealth, and Debt*, 2nd American Edition (New York: Dutton)
- Soddy, F (1933) *Money versus Man* (New York: Dutton)
- Soddy, F (1943) *The Arch Enemy of Economic Freedom* (London: Self-published)
- Strange, S (1986) *Casino Capitalism* (Manchester: Manchester University Press)
- Strange, S (1998) *Mad Money* (Manchester: Manchester University Press)
- Swanson, T (2015) “Consensus-as-a-service: a brief report on the emergence of permissioned, distributed ledger systems”, available from <http://www.ofnumbers.com/wp-content/uploads/2015/04/Permissioned-distributed-ledgers.pdf>, last accessed 22 April 2015
- Tucker, J A (2014) “What Gave Bitcoin Its Value?”, *The Freeman*, 27 August 2014, available at <http://fee.org/freeman/detail/what-gave-bitcoin-its-value>, last accessed 13 April 2015

Vigna, P and M Casey (2015) *The Age of Cryptocurrency: How Bitcoin and Digital Money Are Challenging the Global Economic Order* (London: The Bodley Head)