Money Talks

EXPLAINING HOW MONEY REALLY WORKS

Edited by Nina Bandelj, Frederick F. Wherry & Viviana A. Zelizer

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To the Princeton University Sociology Department,

where it all started

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PREFACE

ON SEPTEMBER 12, 2014, a group of scholars came together at the Yale Law School, the School of Management, and the Center for Cultural Sociology for the Money Talks Symposium, which we organized to celebrate the twentieth anniversary of the publication of *The Social Meaning of Money* (1994) by Viviana Zelizer. Daniel Markovits at the Law School proved to be an excellent co-convener. Participants included legal scholars, behavioral economists, economic anthropologists, social psychologists, political scientists, and economic and cultural sociologists, as well as historians who had developed or extended different aspects of Zelizer's landmark book. They ranged from established leaders in their fields to some of the most innovative younger scholars working on money. They all welcomed this pioneering effort to engage in sustained dialogue across our disciplinary boundaries. None had previously encountered collaborative sites such as the one afforded by the symposium. All became fully engaged in discussions about different approaches to exploring money's new forms and about policy-sensitive issues such as those involving low-income household finances as well as considerations of money's moral impact.

We were deeply inspired by conversations that flourished at the Money Talks Symposium and left the conference with a firm belief that a broader audience should have an opportunity to benefit from these conversations. With this purpose in mind, fourteen essays were further developed specifically for this volume. In this process, it became inevitable to recruit Viviana Zelizer as our coeditor. While her book provided the impetus for the conference, let us note that the book that has emerged from that meeting is not a festschrift to Zelizer, as the chapters develop new approaches to our understandings of money, and aside from Bandelj and Wherry, none of the contributors are Zelizer's former students or close collaborators. Moreover, we also found out about a meaningful conversation between Zelizer and her cherished collaborator and friend, Charles Tilly. A decade ago they had discussed editing a volume of the kind that we have now assembled. Building on Zelizer's *The Social Meaning of Money*, their envisioned volume would, in fact, include some of the same authors that are now part of this project and would forge an interdisciplinary conversation.

Then, the idea for the Zelizer and Tilly volume was filed into a manila folder, reopened by Zelizer a decade later. The time for collaboration had come. The volume before you fulfills that early Zelizer/Tilly vision about

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CHAPTER 13

Blockchains Are a Diamond's Best Friend

ZELIZER FOR THE BITCOIN MOMENT

Bill Maurer

VENMO. LEVELUP. APPLE PAY. SQUARE.[1] In ten years' time we will see which, if any, of these new electronic payment providers still exist, much less capture the kind of market share enjoyed by that most venerable of digital payment devices, the plastic card. At the time of my writing, there is an unprecedented proliferation of new payment technologies and a pace of innovation not seen before in the history of ways to separate people from their money, quickly, conveniently, and reliably. Scott Mainwaring, an industry researcher, has termed it a "Cambrian explosion in payments": a blossoming of myriad technologies, using different platforms, devices, and networks, to help people pay (Deville 2014; Maurer and Swartz 2015). Where the payment card networks originated in retail store credit and later, associations of banks sharing communications networks for clearing and settlement, the new systems rely on a variety of infrastructures: mobile telecommunication, the Internet, distributed peer-to-peer networks. They harness features of new digital and mobile computing devices not originally designed to support payment, such as the digital camera and display screen (for optical recognition and transmission of payment information between a person's device and a point-of-sale terminal, in the case of LevelUp) or the earphone jack (for input of payment data from the magnetic stripe on the back of a traditional magnetic stripe card, in the case of Square). It is a Cambrian explosion in that new body forms, adaptations of existing structures, and novel relationships in a variegating ecology of retail payment are coming into being all at once, radiating

out into a landscape heretofore the exclusive preserve of paper banknotes, coins, and plastic cards.

If *The Social Meaning of Money* were written today, Viviana Zelizer would have to account for these new technologies. Indeed, they beautifully make the case she put forward: these are socially differentiated and differentiating ways of paying that render the monies associated with them similarly multiple. Different groups gravitate toward different payment technologies: teenagers and college-age students today are the near-exclusive users of Venmo, a micropayment service that integrates with social media so that users can see each other's payment activity. Early adopters of Bitcoin,[2] an experiment in cryptographic currency, were almost exclusively white, male, hard-core programmers, with a heavy smattering of libertarians. If the Bitcoin community has diversified since then, it is only in its internationalization, especially as Chinese adherents trade in the currency despite their government's efforts to crack down against it. Apple's mobile payment service, Apple Pay, is only available to owners of Apple's newer (and more expensive) iPhones, creating a segmented market that itself is further separated from the hoi polloi of commerce because, at least in the early days, Apple Pay was only accepted at select retailers (such as the high-end supermarket chain, Whole Foods). They are socially differentiating, too, in that Venmo, for example, not only reflects but creates circles of friends with whom one shares one's economic activity—a new kind of conspicuous consumption (Tung 2015). Bitcoin facilitated transactions on Silk Road, an online anonymous marketplace for illicit goods and services, until the latter was shut down by authorities in 2013.

While these are, for the most part, new payment infrastructures, and not wholly new monies, the line is blurring. Private companies creating new payment "rails" (as they are termed in the payments industry; see Maurer 2012) are also floating new kinds of value-laden tokens, electronic coupons, and point- or credit-based systems that enter into circulation alongside state-issued money, albeit, for now, in "closed loops"—another industry term referring to the limited redeemability of such tokens. American Express, the charge card company, and Amazon.com, the online retailer, have an agreement allowing the use of Amex's Membership Rewards points for purchases. People taking advantage of this arrangement discuss the ins and outs of the variable exchange rates between points and dollars, and the difference between purchasing directly over Amazon.com with one's Amex card, versus using Amex points.[3] Such arrangements attract regulatory attention, with central bank regulators, among others, worrying about whether they augur the re-emergence of private currencies, or, more prosaically but equally concerning, whether they open new possibilities for money laundering or tax evasion.

If new payment services shade into new monies, they make more complex the already multiple and cross-cutting social relations of money that Zelizer documented. But they may do more. As I will argue, such developments in the

Cambrian explosion of payment highlight money itself as *money of account*. That is to say, they draw attention to, underscore, rely on, and reanimate the unit of account function as the core, distinguishing function of money in general.[4] This is not to suggest that they desocialize money (as perhaps Ingham 2001 would argue) but rather reveal the social meanings of money in its accounting. New payment systems remind us that people's everyday earmarking and sequestering of special monies is itself a kind of accounting.

In what follows, I discuss Bitcoin and its underlying technology. Specifically, I address how new uses of that technology shed light on money as money of account. This bolsters the arguments of alternative monetary theorists like Geoffrey Ingham and Randall Wray, which were often seen in opposition to the Zelizer view. Both Zelizer and alternative monetary theorists agreed on the paucity of the mainstream economists' take on money as a neutral medium of exchange. Zelizer highlighted its social variegation. Ingham highlighted money of account, the "means of accounting for value" (2001: 307). Such accounting is always linked to the state's ability to demand taxes paid in its own token and the systems of claims and counterclaims in credit-money that ultimately relied on states' and banks' promises to pay (ibid.: 312). Whatever social variegation may exist, Ingham argued, would still be determined by and denominated in money of account. I ask whether developments like Bitcoin and other forays into new payment services more generally have the potential to open up these relations between states and banks with regard to money.

Bitcoin is also interesting in the universe of electronic forms of payment because of the way it both does and does not "tell tales" of its movements and sociability (see Guseva and Rona-Tas in chapter 12 of this volume). It was designed to be anonymous. But central to its functioning is a publicly available, shared, verifiable ledger, a giant digital record book of all transactions. Bitcoin depends on a chronicle of transactions whose principals' identities are difficult, if not impossible, to ascertain. To its proponents, this is a virtue, and a form of asociality that takes "trust" out of the business of money. As I discuss below, however (and as Nigel Dodd explains in chapter 14 of this volume), the picture is a bit more complex. Understanding how Bitcoin elevates money as money of account helps explain why.

Earmarking and Accounting

There is not as much distance between Zelizer and Ingham as appears at first glance. Earmarking as discussed by Zelizer is nothing but accounting. If Zelizer relegates the state to the background, it is only to reveal more clearly the everyday practices and meanings of people's money worlds and repertoires (Guyer 2004; Eagleton and Williams 2007). Zelizer opened *The Social Meaning of Money* with a plea to move beyond the view of people as rational individuals "making decisions only of price and quantity" (Zelizer [1994] 1997: 4).

She referenced the wonderfully evocative stories of midcentury housewives' "tin can accounting" and Orange County, California, shoppers' " 'cash stashes' for special uses" (ibid.: 5). Listen to one such housewife:

> I have a silly little system. Whenever my husband gets paid I take away so much for my grocery money and put it in my kitchen drawer. Then I take all the rest and I put it into a tin can. If we can pay a bill in person we take the cash out of the can. . . . Now, whatever is left over in the tin can by the time the next payday comes we transfer into the bank account to pay our future bills. If my husband doesn't have enough money for gas out of his allowance, or if we go out for some entertainment we just take the money out of the tin can. Sometimes there is only a little left in the tin can at the end of the period, and sometimes there is a lot—it just all depends on the weeks. (quoted in Rainwater, Coleman, and Handel 1968: 165)

Such stories led Zelizer to excavate how money, presumed to be purely fungible, gets parceled out into distinct bundles and set to specific uses that open a window into social worlds of meaning and relationality.

Earmarking is an accounts-keeping operation, as Rainwater, Coleman, and Handel point out. Lacking other easy means of keeping track of their money and their expenditures, midcentury housewives found ways materially to segregate and visualize their financial standing and to make savings and purchasing decisions. Their accounts, physically manifested in tin cans, envelopes, or china pitchers, were also a material demonstration of their relationships and values. Other researchers building on Zelizer and citing this and similar studies were able to prove experimentally how people deploy funds and other resources based on implicit and explicit labeling schemes (Heath and Soll 1996). This kind of research, however, generally aimed to show how such labeling led to misallocations—irrational decisions—rather than to underscore money's social meanings. Things that are easier to label or categorize end up being "the most subject to the rigors of budgeting" (Heath and Soll 1996: 40). The primary sources on such forms of "mental accounting" also documented that the practice breaks down because, among other things, people using it have a "tendency to 'cheat' a little" (Rainwater, Coleman, and Handel 1968: 169).[5]

I linger over this material because I think authors in the mental accounting literature actually got something wrong that Zelizer, at least indirectly, got right. Tin can accounting was a form of physically differentiating monies. It was a socio-material practice that embodied social meanings. The aim was not merely to control spending but to give a visceral account, not a mental account as is so often claimed, that women could literally weigh in their hands to help them assess current status and future spending. The brute materiality of the cup constrains and conveys by its heft, providing women an alternative metric to evaluate their financial standing and to plan their future decisions.[6] The

quality of constraint, the need to deal with the tendency to cheat, and the rendering nonfungible of otherwise liquid currency prefigure some important aspects of the Bitcoin system and its own social relations and meanings.

Bitcoin Accounting

Zelizer wrote that "popular conceptions of money seem to be wiser than academic sociology" ([1994] 1997: 5). The actual uses of the technology underlying Bitcoin may be wiser than the initial ideology espoused by so many of its participants.

Bitcoin is the brainchild of an anonymous programmer or programmers who penned a white paper under the name Satoshi Nakamoto on the design of a digital currency and released it over the Internet in 2008. The system "he" described used a combination of two existing ideas to create a digital system for exchanging value that shares many of the attributes of physical banknotes—chief among them anonymity, irrevocability, and the inability to double-spend, that is, to duplicate a token and effectively double one's money. This last quality is crucial in digital environments where such duplication is easy. Satoshi and other cryptocurrency advocates also desired a system that would not depend on any central point of control. This commitment to decentralization derives both from a skepticism or hostility to states and banks—the desire to disintermediate their role in creating money—as well as a transformation of the Internet's distributed network structure into an ideology (Brunton 2015; Dodd 2015).

The first system Bitcoin relies on is a distributed database that contains a ledger of all transactions, called the blockchain. Rather than living on one computer or server, the database resides in duplicate form on all of the computers verifying Bitcoin transactions. The second system is a protocol for verifying transactions in that ledger by way of a computationally difficult competition, called a proof-of-work, among parties to the system who are rewarded for their effort. The technical details are challenging (Clark 2013), but the concept is relatively straightforward: Bitcoin is based on a ledger, the blockchain, which exists on all the computers participating in the Bitcoin system (at least in theory, as there are now third-party services that will exchange your bitcoins for you without your having to maintain a copy of the ledger on your own computer). The ledger is continuously updated by the nodes in the network, which are undertaking proof-of-work to verify any new transactions in a kind of computationally intensive lottery. When a node wins the lottery and completes the verification of a set of transactions, a "block" is said to be completed, and it is broadcast to the whole network. The update has to be agreed to by 51 percent of the nodes. This process is called "mining," and Bitcoin miners who win the competition to complete a block are provided a reward in bitcoins, which provides a mechanism for the introduction of new currency into the

system, but only as far as a predetermined upper limit. Miners can also charge transaction fees.

The blockchain contains entries of all bitcoin transactions. The ledger records the "addresses" of the transacting parties, which are themselves cryptographically secured and quasi-anonymous—there is no identifier linking a person's name, say, to that address. Transactors' ownership of bitcoins is essentially the right to a ledger entry. In other words, there are no actual tokens or digital ledger ticks. Rather, the ledger contains entries of transactions between addresses. Addresses are secured by a set of cryptographic keys—a public key, from which is computationally derived the public address, and a private key, to be held only by the owner, which is used as the authorizing signature of a transfer of ownership. Hence, "cryptocurrency." One cannot access bitcoins—that is to say, the proof of the completion of a prior transaction exchanging value denominated in bitcoin—without a private key corresponding to the public key associated with the address containing the record of that prior transaction. If I want to send bitcoin from my address to another user's address, the Bitcoin protocol distributes my request to send to the entire network, which in turn requires that I authorize the transaction with my private key. If I lose my private key, there is no way to reclaim access to the bitcoin associated with my public address. It becomes locked up in the blockchain forever, or "burned."

No coin, just accounting. No central authority issuing currency. A database containing a ledger maintained through computation, competition, and consensus. These are the basics of the Bitcoin system. But still, as Christine Desan (in chapter 6 of this volume) might say, it is a governance project. It is a digital money of account, almost exactly like the clay tablets of ancient Mesopotamia that so exercised John Maynard Keynes (Ingham 2000), except instead of being "recorded by word of mouth or by book entry on baked bricks or paper documents" (Keynes [1930] 1958: 3) it resides in a distributed digital ledger.

When Bitcoin began, the rhetoric of mining, the built-in upper limit to the amount of bitcoin ever to be "mined"—that is, a hard limit on the ultimate size of the ledger—and the antigovernment ideological positions of some adherents lent an anarchist and metallist character to the system. Bitcoin adherents were like latter-day goldbugs (Maurer, Nelms, and Swartz 2013). Bitcoin's association with criminal activity over the so-called dark web, Silk Road, and other illicit trading services, and scandals involving several Bitcoin currency exchanges imbued the system with an air of dangerousness, as well as a libertarian political charge. When I attended a payments industry conference in 2013, Bitcoin proponents surreptitiously affixed stickers and handmade signs to tables and displays in the exhibit hall. People vocally espoused antigovernment, anti-fiat currency and anti–Federal Reserve views (Brunton 2015). At the next year's meeting of the same conference, however, the exhibit hall was graced with professional-looking corporate displays, complete with hired female

models(!), to promote new Bitcoin start-ups. In 2014, one such start-up announced its sponsorship of the St. Petersburg Bowl, renamed the St. Petersburg Bitcoin Bowl.[7]

Football aside, Bitcoin is entering the world of big business. Bitcoin-related venture capital funding approached $1 billion in 2015; it was just above $300 million in 2014. But it is the blockchain, not the currency itself, that seems to hold appeal outside of Silicon Valley and in the halls of Wall Street, among legacy payment providers (such as Visa or MasterCard), and for the IT departments of regional banks and credit unions. This is because of the blockchain's essential nature as a database—more precisely, as a distributed ledger.

A blockchain is a special kind of ledger. It exists everywhere in the network. There is no one central repository where it resides or one central records keeper. Picture the old ledger books kept in the back rooms or vaults of a bank. Now, imagine a flood, or fire. With a blockchain database, the risk of loss is miniscule if not nonexistent, because every node in the network has a copy of the whole ledger and the system is designed so that the nodes in the network continuously update and synchronize those ledgers.

Now, go back to that bank ledger book, and imagine a bad actor: someone who through malice, fraud, error, or stupidity makes an incorrect entry. There may be audits, there may be reconciliation of accounts, but the effort to locate the discrepancy may be costly and time-consuming. A core feature of the blockchain as a distributed ledger is that it is public—every node in the network can see it; in fact, everyone in the world can see it, because it is posted online in real time, too. Although it is public, the identities of the transacting parties are concealed by the protocols governing their addresses, as mentioned earlier. Those transacting parties do not need to know or trust one another in order to do business; the process of transaction verification through distributed consensus, and the public nature of the blockchain, militates against fraud. At least, militates against fraud once a transaction has entered the blockchain and has been verified: blockchain entries cannot be altered without the consensus of 51 percent of the nodes. Fraud can take place outside the system—I can steal the private key to your Bitcoin address and make off with your money. Or, more simply, I can ask you to send me your credit card number for your participation in a Bitcoin mining scheme and just steal your credit card number. These are not vulnerabilities of the blockchain itself, however, but are external to it.

I have been told personally and have heard public statements to the effect that the "brand" of Bitcoin as a currency is too tainted by the early scandals, criminal investigations, and prosecutions to gain any traction in mainstream legal and financial services sectors.[8] Bitcoin's association with radical libertarianism has attracted both positive and negative interest—libertarianism in the first decades of the twenty-first-century United States had appeal, especially for elites garnering an ever larger share of the nation's wealth—nevertheless,

Bitcoin is seen as too controversial for polite corporate strategic planning. But the record-keeping quality of the Bitcoin system is attracting interest among more established financial industry actors. The wholesale financial services industry sees promise in blockchain databases combined with some sort of proof-of-work verification system to facilitate and speed up interbank clearance and settlement, as well as equities and derivatives trading. People say you have to do a "search and replace" in order to get the idea across to higher levels of the organization: replace "Bitcoin" with "blockchain" or "distributed ledger" before you make your pitch.

Why this interest in the blockchain? It is (relatively) immutable—no one can go back and change old entries without everyone seeing what has been done. Such changes have to be agreed to by consensus, so they probably would not "take" anyway. The blockchain therefore provides a verifiable, time-stamped record of transactions. It is also persistent—it lasts even if some of the nodes go dark. It is a historical chronicle—one damn thing after another—that cannot be easily or unilaterally altered. The participating nodes are continuously synchronizing their copies of the database, and thus money does not "move" from point A to point B in the system. Instead, credits and debts simply get updated, everywhere and in near-real time (about ten minutes, on a good day).[9]

At a conference sponsored by the *American Banker* trade magazine in July 2015, Blythe Masters, formerly of JP Morgan Chase and at the time CEO of a new blockchain-related start-up, Digital Asset Holdings, declared that the blockchain would solve the problem of "settlement latency"—the amount of time it takes assets like equities changing hands to clear. This is, admittedly, an obscure area, that of the "infrastructures of post-trade processing," as she put it. But the benefits are faster settlement times, which means the ability to make money on otherwise latent assets awaiting clearance—as well as the resiliency and, importantly, resistance to cyberattack that blockchain-based systems display as a result of their distributed nature. She and others at this conference, formally, and in the corridors, expressed the view that distributed ledgers would also reduce back-office operations costs. "You can fire your IT department!" said one, informally. Masters more diplomatically put it this way: You will have "no more reconciliation costs—you have to live in the world of financial services to understand the profound implications of that statement." Of course, you could not really fire your IT department, because you need it to set up and maintain the system, and these are difficult systems to develop. But distributed ledgers offer the same promise of automaticity as earlier technologies like the assembly line and the computer itself.

As a ledger, though, the blockchain promises still more: the potential to be able to account for everything, since anything can be entered into it, and not just bitcoin transactions. In a seminar at the University of California–Irvine School of Law in 2013, I was outlining the basics of the blockchain when a law professor with expertise in housing finance had an epiphany. If mortgage

notes had been entered into something like a blockchain database, he explained, the mortgage settlement mess after the financial crisis of 2008 might not have happened. After all, one of the main problems in addressing the crisis was determining ownership of mortgage paper. Mutual distrust, operational inefficiencies, and outright malfeasance among lenders prevented information sharing. Two years later, at the *American Banker* conference, said one participant, "I can't help but to wonder if things would have played out differently with the financial crisis if things like liens were in the blockchain."

A funny thing is happening on the way to the "distributed ledger space," as some are calling this area of potential business opportunity. While leaving aside bitcoin the currency, participants are discovering that ledgers are really good for managing and manipulating other things of value. In rediscovering accounts, they are potentially rediscovering money of account. At least some are getting there by way of Zelizerian processes of sequestering and earmarking.

Blockchains are a Diamond's Best Friend

"Don't store your value in a rock, store it in a block." So reads the website of BTCring.com. The brainchild of Sebastian Neumayer, an MIT engineering PhD, it offers the ability to create a Bitcoin-based novelty item: a ring linked to a Bitcoin address. BTCring provides the code necessary to design a three-dimensional ring that points toward a Bitcoin address. I can create a Bitcoin address specifically for the purpose of making a ring. I then use the code on the BTCring website to create a file that can be sent to a 3D printer. I can add my own design elements to the ring plans before printing it out. The printed ring contains a QR code—a matrix bar code, recognizable by applications run on mobile devices with cameras or optical scanning capability—that links to the public Bitcoin address. By scanning the QR code, I or anyone can see how much the ring is worth in bitcoins.

Although tongue in cheek—or maybe not?—the BTCring project neatly encapsulates a number of assumptions: love can be expressed in terms of monetary value. The wedding ring is a special kind of sequestered value, symbolizing that love, or securing the relationship in which that love presumably flourishes. Yet, as the website and several accompanying online videos demonstrate (hilariously), actual diamond rings can be lost. If lost, the value is lost, too. Or, a ring might look pretty but be fake, holding less value than it would appear to worth at first glance. Or, further, the diamond might have been the product of exploitative practices in a conflict zone, its value tainted by its origins. As one woman actor says in one of the BTCring's videos, as she hurls a diamond ring back at her hapless suitor, "I don't want blood on my hands!"

Who holds the private key of the value to which a BTCring points? Well, as with all matters of the heart, this can be negotiated. One of Neumayer's recom-

mendations is to split the private key between the two partners, so that the value sequestered in the blockchain cannot be spent without the consent and participation of each. The BTCring provides a means of "restricting fungibility," as Neumayer put it in an interview with me. He reflected on an extreme way to restrict that fungibility: "instead of putting the bitcoin in an address that the couple controls together, you could send the bitcoin to a burn address where you can show that no one holds the private keys—it's like throwing the money into the fire—it's kind of like the proof of burn that a diamond is. . . . You know that someone burned a lot of money to buy the ring, but you're never going to get the money back again."

Zelizer has taught us not to automatically recoil from the apparent monetization of persons and relations that always seems to attend capitalism but instead to inquire into the social and cultural bases of economic action (Zelizer 1985). Some online commentary of the BTCring project is critical of the idea that you can put a price on love. Others say that only an isolated geek with little understanding of actual human relationships would find it appealing.

But what is most interesting about the BTCring is its reliance on the blockchain to sequester earmarked value and its use of the blockchain to create a permanent record of a relationship. Neumayer is very explicit on this point: blockchain systems have "the ability to show proof of existence" without having to rely on a third party, while restricting the fungibility of otherwise convertible value. BTCring creates a special money, in Zelizer's sense, inside the Bitcoin system. Specific techniques can ensure its continued sequestration, like splitting the private key between the two parties to the relationship or, more drastically, "burning" the bitcoin. BTCring also explicitly reminds visitors to its website of the political economy of actual wedding rings, proclaiming, "Support Bitcoin Mining not Diamond Mining." Absent a verifiable and unalterable tracking and certification system from the mine to the jewelry store, there is no way to guarantee that a diamond did not originate in a conflict zone or was otherwise unethically produced and distributed. So, while at some level a novelty toy, the BTCring occupies that same family of phenomena as tin can budgeting and pin money. It does so while also pointing to the fundamental accounting operations central to the social meanings of money—in this case, by way of a QR code to the Bitcoin blockchain. The BTCring also offers "social commentary," Neumayer said, raising awareness of both the monetary basis of many personal relationships, as well as conflict diamonds.

At the time of this writing, a very early stage start-up, Everledger, is actually trying to do something about conflict diamonds. Everledger is a London-based company that uses the Bitcoin blockchain to identify and track diamonds. Barclays Accelerator invested US$118,000 in the company in March 2015, and it has received very favorable press. The idea behind the company is to gather data on diamonds from insurance companies, law enforcement, and diamond producers to create a digital fingerprint for each diamond and store

it in the blockchain. This eliminates the problem of conflicting means and standards of diamond documentation and certification. The digital fingerprint contains enough data to identify a diamond, and the record in the blockchain can track changes in its ownership. The founder, Leanne Kemp, whose background includes both the insurance industry and the jewelry business, imagines expanding beyond diamonds to other high value items. As TechCrunch reported, "It's starting with diamonds, with a view to expanding into all sorts of luxury goods—such as high end watches, designer handbags and fine art—so basically high value items whose provenance might otherwise be reliant on paper certificates and receipts that can easily be lost or tampered with. The blockchain is a distributed public ledger for tracking provenance in a way that's more robust and accessible than a paper trail" (Lomas 2015).

Here, the blockchain could be used to demonstrate the proof of existence, Neumayer might say, of a relatively nonfungible object of wealth, and thereby provide a chain of documentation of ownership or of provenance.[10] For Everledger, this is of potential interest for the insurance industry. But Everledger also wants to take on diamond trading fraud and conflict diamonds. It is attempting to do so by using the blockchain to record not just proof of existence but a host of data on individual diamonds, with enough detail to be able to identify a diamond of suspicious origin that might come on the market. "If you have a 5 carat diamond, not only do we capture the serial number that's inscribed on the stone, but most diamonds are described with four Cs (the cut, the clarity etc.). We taken [*sic*] not only those four Cs, we then take the 40 metadata points that make up the diamond. . . . All of the angles and the cuts and the pavilions and all of the crown. And we take all of that, as well as the serial number, as well as the four Cs, and we put all that into the blockchain," says Kemp" (Lomas 2015). Say a large diamond is stolen and cut into smaller gems. Its specificity, described by that metadata and recorded in the blockchain, would permit the identification of those smaller gems and their association with the original item. If BTCring restricts fungibility of otherwise convertible value, creating the equivalent of a precious stone, Everledger provides a way to account for nonfungible things, or, better, a way to enforce their nonfungibility, to forever be able to specify this diamond as distinct from that one.

Ledgers, Laundry, and Love

Bitcoin is opening up money into other relations besides those of state and market. If one accepts Bitcoin adherents' own reflections on the system, its peer-to-peer network structure permits it to operate in its own separate, parallel zone of economy and politics. For true believers, it is governed by the code, not by people or governments. The hard cap on the number of bitcoins ever to exist also removes bitcoin-as-money from the laws of supply and demand, the price mechanisms of the market. This, for some, is a transcendent coin. Of

course, it is shot through with people, ideology, market devices, law, and regulation—there are exchanges, after all, that serve as points of connection between bitcoin and the rest of the world, and these are key sites for regulatory intervention.

To me what is most compelling about Bitcoin is that the blockchain provides an alternative account, quite literally, in the form of a distributed ledger. Despite most Bitcoin proponents' claims that the currency is completely fungible, it provides this alternative account by constraining fungibility: no one bitcoin is truly the same as another, as each contains the history of its transactions along the way. Each is always earmarked already. Money of account, in Bitcoin, contains within it its individual, socioeconomic history. Even if that history is very, very difficult to read, it is still there, and the fact that it is there is the key to the whole system, ensuring that there is no double spending of the same bitcoin. This is a digital version of physical earmarking. Unlike tin can accounting, however, there can be no cheating, at least not within the blockchain (there can be all kinds of fraud outside the blockchain, as Silk Road and Mt. Gox demonstrate): hence, Everledger's use of the blockchain to create provenance for diamonds to prevent their illicit trade or the concealment of their origins or BTCring's use to record and solidify a relationship with a split private key or a burn.

Ingham could argue, in 2001, that the ability of money to be laundered proved his case that the social meanings of money as described by Zelizer were secondary to the social relations of banks and states animating the money of account: "The state does not enquire into the meaning of money or differentiate between 'dirty' or 'clean' money in payment of taxes" (2001: 314). Alternatively, one could say, I can use a bill that had spent much of its life folded up in origami and sequestered from circulation tomorrow to buy a pack of gum; or I could take money from the tin cup earmarked for the rent and use it to buy a birthday present—cheating, as those mid-twentieth-century housewives did. For Ingham, money's fungibility works because money's moneyness is ascribed outside the market, by the state, which cares only about certain relations. All others can evaporate—or be laundered—away (again, see Desan in chapter 6 of this volume).

The use of the technology underlying Bitcoin may be challenging this assessment. Anything placed in the blockchain is there forever—or for as long as participating nodes keep up the system. It becomes a kind of immovable property: it is not that it cannot be separated from its owner, but rather that it cannot be separated from its history in the blockchain.[11] It can never be laundered. It can be used to launder other currencies, however: ill-gotten gains in US dollars can be converted into bitcoin, their origins outside the system available to observers only if the public address can be traced back outside the system to their source. So, one can launder *with* bitcoin, but one cannot launder bitcoin. This quality of bitcoin led some developers to the concept of "colored coins," which would be specially marked bitcoin based on particular ownership or transaction histories, precisely to track their origins and pathways. Colored coins make explicit that a bitcoin's past is always with it, and always visible to anyone who cares to look. Its carries its relations along with it—even if it's hard to know exactly with whom or what it has had those relations.

Bitcoin is also opening to technological change the universe of nonfungible things—paradoxically allowing them to be more easily liquidated by making them more permanent, more indissoluble. This is Blythe Masters's point about the potential of the blockchain to reduce settlement latency: if we have a better and faster way to track ownership of equities, or mortgage paper, or diamonds, we can trade more quickly and easily and reduce the amount of time a nonfungible asset just sits idle. We always have proof of its existence, in the ledger. We do not have to chase a paper trail that may have been intentionally obfuscated. The ledger depends on consensus—to alter records, one would need the coordinated participation of 51 percent of the nodes in the network. The blockchain can facilitate trade by providing a permanent, verifiable, secure, and public ledger maintained among nontrusted parties or peers. Bitcoin carries forward tin can accounting because it allows special monies and sustains the nonfungibility of value, the moral or social boundaries around different items of worth. So, by supporting nonfungibility and differentiation, the blockchain can permit more things, more distinct and different relations, to enter the market. As with the Cambrian explosion in payment, technology here is supporting, not erasing, the social differentiation of monies.

Bitcoin supports Ingham's position on the centrality of money of account in that it depends on a computationally derived system of record keeping that warrants its own moneyness. Yet, à la Zelizer, it retains its meanings—forever. It is this feature, and not its cryptoanarchist orientations, that is captivating Silicon Valley start-ups and Wall Street investment banks alike, and adding yet another money-form to the Cambrian explosion in payment.

Notes

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2. In keeping with the emerging standard in the Bitcoin community, I capitalize the term to refer to the community, network, system, and infrastructure, but use lowercase to refer to the currency unit (bitcoin).

3. For example, a comment dated October 1, 2013, on one of Amazon's customer forums reads, "I just ran a comparison of paying for a $65.70 charge made on my Amex with points (deduction was 10950) v. paying for the same item at Amazon with points (deduction was 9104) so I would use almost 17% less points on Amazon than I would by charging it to my Amex and applying points. Interesting!", accessed August 1, 2015, http://www.amazon.com/gp/help/customer/forums?ie=UTF8&cdForum=Fx2NFGOONPZEXIP&cdThread=Tx39M4OYRJRK46T.

4. Eric Helleiner (2003) has discussed the euro's creation first as money of account and later as circulating note and coin.

5. Such research also laid the foundation for behavioral economics, which, in turn, is contributing to the "Cambrian explosion" in payment technology referenced earlier, in the form of smartphone applications to create incentives for saving or investing, as well as mobile-enabled banking and money transfer products that allow earmarked accounts for special purposes.

6. Compare Nancy Munn ([1986] 1992) on qualities of objects that function as signs, after C. S. Peirce, or Jane Guyer (2004) on volumetric measures as distinct from pure interval scales for measuring value (e.g., "one cup" versus "10 units").

7. The sponsorship lasted only one season, however. The start-up, BitPay, and the sports news network, ESPN, ended their relationship, leading to speculation about which one had evaluated the other as the bad marketing bet (see Roberts 2015).

8. The most notable include the failure of Mt. Gox, at the time, the largest bitcoin exchange, and the arrest of Mark Karpeles, its founder, on August 1, 2015, for defrauding clients of hundreds of millions of dollars; and the arrest and conviction of Ross Ulbricht, the creator of the Silk Road online marketplace, which accepted payment in bitcoins and is said to have facilitated more than $200 million in the trade of illicit drugs and services. Ulbricht was sentenced to life in prison on May 29, 2015.

9. In July 2015, when I was co-teaching a class on Bitcoin with Donald J. Patterson at UC Irvine, students sending bitcoins back and forth experienced settlement times of several hours to several days. At first we hypothesized that the Greek debt crisis was leading Greeks to buy up bitcoins, placing a drag on the system (our "sending bitcoin" lab coincided with the July 5, 2015, Greek referendum on the Greek bailout and the extension of the Greek bank holiday through July 8). Exploration of blockchain transactions, however, revealed it was not Greek or European but rather Chinese purchases of bitcoins that were slowing things down (based on the geographical location of IP addresses originating transactions, via the Web-based tool Fiatleak.com), coinciding in time with a run on the Chinese stock market and the drastic fall of shares traded on the Shanghai Stock Exchange between July 8 and 9, 2015.

10. Kevin McCoy's Monegraph project similarly provides proof of existence and provenance, specifically for digital works of art, using the Bitcoin blockchain (McCoy, interview by Bill Maurer and Donald J. Patterson, July 7, 2015, https://www.youtube.com/watch?v=NAJh1kEba18).

11. Compare Weiner (1992: 32): in ancient Greece, livestock were considered movable property; "things stored in chests" were considered immovable property. Things stored in the blockchain have that same quality of restricted fungibility.

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