Ruth Catlow

Artists Re:Thinking the Blockchain
Introduction

We want to stimulate a conversation with you about what arts brings to blockchain developments and vice versa. To discuss the implications and potentials for the arts of the blockchain.[1]

We know that the blockchain is an important and powerful new technology but 'we don't know what a blockchain can do yet.'[2]

You will find here starbursts of joy about the potential extensions of creative collaboration offered by blockchain technologies.[3] But it is also darkly poetic that another energy-ravenous financial technology should emerge just as we watch the tipping point of manmade global-warming recede to the distant horizon in our rear view mirrors. So this is not a marketing campaign, but a discussion of 'what is.' In spite of the, as yet, unresolved technical obstacles of scalability and environmental cost blockchain technologies are here to stay. They are overtaking the WWW as the next big network technology for speculation and disruption. Investors recognize their potential for authentication of identity and matter, more efficient and secure financial transactions and distribution of digital assets; communications so secure as to facilitate voting; and as a coordinating technology for the billions of devices connected to the Internet.[4] They currently attract huge investment from finance, technology and government sectors[5] in anticipation of the fourth industrial revolution of decentralized, super-automation and hyperconnectivity.

Powerful technologies develop to reflect the interests and values of those who develop them, but impact the everyday lives of us all. The World Economic Forum predicts that these developments will be accompanied by a significant increase in global inequity.[6] This vision of the future disenfranchises and demotes the role played by an ever increasing number of humans (and no doubt other life forms too) in the business of determining what makes a good life. It has been shown that 'strategies for economic, technical and social innovation that fixate on establishing ever more efficient and productive systems of control and growth, deployed by fewer, more centralized agents [are] both unjust and environmentally unsustainable. Humanity needs new strategies for social and material renewal and to develop more diverse and lively

Our efforts to publish this book represent our assertion that artists have a crucial part to play here. As Gene Youngblood says: 'Radicals don't predict they build.'[8] So we must aim for more variety in background and outlook among the people involved in the building of blockchains and the imaginaries that underpin them.

Artists have worked with computing and communication infrastructures for as long as they have been in existence. They have consciously crafted particular social relations with their platforms or artwares. When artists approach new technologies a number of things happen: by making connections that are neither necessarily utilitarian nor profitable, they explore potential for diverse human interest and experience; they discover expressive and communicative potentials of its tools, devices, systems and cultures; they make difficult concepts more feelable, legible and fascinating.[9] They have also already had central roles in projects such as D-Cent[10] and FairCoop,[11] the blockchain-based tools for enhanced democracy.

Artists are good at mediating abstractions for our perceptions through play, open exploration and supposition. They can tolerate, even relish, extended encounters with difference, contradiction, muddle and slippage between symbolic and material possibilities without rushing to usefulness or simplicity. They have a kitbag of methods and processes for revealing the practical affordances and animal spirits of a subject, medium or technology. They know that a way to get to know something that doesn't yet exist is to collaborate with its possibilities and to do something/anything with it or about it. And by doing so they materialize and shape what it will be, allowing many other people to access, approach, and reach out to it with different parts of themselves.

The contributors to this book are developing and sharing a situational awareness of a technology that is notoriously hard to conceptualize. The difficulty of understanding how the blockchain works, and why it is significant, may partly be due to the fact that the majority of us are still mystified by the working of both money and markets. Perhaps the most important and hard-to-grasp characteristics of the blockchain is the way it puts finance, or its mechanisms, at the heart of every action in the digital domain. This also means, as Rob Myers writes, that 'AltCoins, cryptotokens, smart contracts and DAOs are tools that artists can use to explore new ways of social organization and artistic production. The ideology and technology of the blockchain and the materials of art history (especially the history of conceptual art) can provide useful resources for mutual experiment and critique.'[12]

The remainder of this introduction is in two parts. The first offers some simple blockchain orientation. The second part sets out to tell the story of how we got to this point and to share with you our plans and intentions for the future. Perhaps with this information you will want to get involved. We hope so.

[The blockchain is…]

00:15	00:20	Irra Ariella Khi, Co-Founder and CEO Vchain Technology	The blockchain is a new way of building our information technology. In a way that's truly never been done before.
00:21	00:25	Ben Vickers, Curator of Digital, Serpentine Galleries Co-Founder, unMonastery	The blockchain is my darkest nightmare.
00:26	00:35	Jaime Sevilla Developer, Researcher GHAYA #hackforgood	The blockchain is a way of coordinating computers all over the world in a way that they have always the same information.
00:36	00:41	Research Fellow, Associate Director – Centre for Cryptocurrency Research, Imperial College	The internet was about the exchange of information. Blockchain is about exchange of assets and exchange of value.
00:42	00:51	Sam Davies, Digital Catapult	Because of the Blockchain in the future there's going to be less reliance on central points of authority, to handle data and to handle transactions and the rules around how that data's used.
00:52	00:59	Dr. Catherine Mulligan	Blockchain is that final crest on the tsunami of digital technologies that will really challenge fundamentally the way that we structure society.
01:00	01:10	Vinay Gupta Resilience Guru Hexayurt	It really is a generic technology like the web you could build almost any kind of workable system on top of it, it can enhance almost any political model. So what we're going to get depends on what we choose.
01:13	01:20	Elias Haase Developer, Thinker, Beekeeper Founder, B9lab	With this technology especially you are chiseling away on a new kind of society.
01:21	01:30	Irra Ariella Khi	In terms of relating to each other, the number one thing as human beings we use is trust. Blockchain allows us to replace trust with proof.

The blockchain is the underlying technology for the first global digital currency, Bitcoin, and was first described in 2008 in a white paper by the pseudonymous Satoshi Nakamoto. This coincided with (and some suggest was a direct response to)[14] the financial crash which saw the banks bailed out by government with taxpayers' money. Since 2013 it has been developed to facilitate not only the decentralized creation, tracking and exchange of digital money but also smart contracts – 'unstoppable applications'[15] deployed by humans and then enacted without further human interference.

Its proponents claim that the global deployment of smart contracts via this new protocol will change everything forever. And depending on the kind of person you are, and the kind of access you have to knowledge, tools and resources you will find this exciting, exasperating, foolish, terrifying, the latest hype swing, or just plain not-your-business. If you are old enough it will remind you of the clamour surrounding the emergence of the World Wide Web. In terms of its ecology of tools and infrastructures, the blockchain is at the same stage of development as the WWW in the early 90s. It's not surprising therefore that many people find blockchain hard to understand.

A good way into this is to realize that the history of computing is tied up with the history of database management.[16] Which I will now simplify like this…

☐ A computer is a machine that stores information in a database and a collection of software to manipulate and move that information around.

☐ The Internet is a network of computers (and their databases).

☐ In 1991 the Web gave us a way to access the information on the network of computer databases around the world.

☐ In the early noughties peer to peer technologies enabled file sharing on a global scale.

☐ 1999 ubiquitous computing and mobile technologies allowed computers to 'live among us in the world'.

☐ In 2008 the Bitcoin digital currency was launched – a secure, anonymous and transparent, way to record all trans-

☐ In 2013 people realized that Bitcoin is underpinned by the blockchain protocol that can be used to distribute and enact smart contracts (and smart contracts are pieces of software that can manipulate and move around information, and now digital assets).[17]

[*Cryptocurrency is…*]

A cryptocurrency is digital, but it can be used and exchanged electronically like other currencies. After they are unleashed on the world cryptocurrencies are not controlled by a central authority like countries or central banks. Instead, their value and use as an exchange medium is reached by consensus between its users using blockchain technology. In cryptocurrency, trust in people and institutions is replaced by trust in the fairness of market forces and the mathematics of cryptography which prevent counterfeiting and maintain its security.

The value of a cryptocurrency is set by market supply and demand, just as with gold or silver. Hard metals derive their value from scarcity and the difficulty of extraction, with cryptocurrencies the only difficulty is computational, the only scarcity by design. In a system called proof-of-work[18] miners' machines run software that uses processing power and lots of energy to compete for coins. To mine new coins, these computers periodically gather up a 'block' of new transactions from across the network and then race to solve a difficult mathematical puzzle for that block. The winner is said to have successfully mined the block, granting them ownership of the freshly minted coins and any transaction fees paid by users.

This new block incorporates a reference to the previously mined block (represented by its 'cryptographic hash' ID number), and joins a sequential, unmovable chain of blocks. The security and stability of a blockchain is maintained because all users hold a record of every transaction made. Because each new block takes so much computational power to mine, it very quickly becomes prohibitively expensive to hack the currency. In this way it solves the double spend problem, answering the question: 'how do I prove, without the mediation of a central authority, that the payment I have received can be honoured, in order that I may release my asset to the payee?'

The initial advertised benefits of cryptocurrencies (there are lots of altcoins now all with slightly different features) included the lack of inter-ference by states and banks, the 'trusted third parties' in Nakamoto's

white paper; the low cost of payment processing (compared with wire transfers); and the ability of its underpinning blockchain technology to provide infrastructure connecting transactional apparatus to secure votes and share holdings. Because of the anonymity of transfers, Bitcoin is also said to have facilitated money laundering, the trading of illicit goods and nefarious services such as assassination markets.[19]

[A smart contract is...]

02:58 03:10	**Rob Myers** Artist, Writer, Hacker	A smart contract is a piece of code now on the Blockchain which performs the function of a legal contract without the interference of a possible corruptible human agency.
03:11 03:21	**Elias Haase**	In a way, code is law. We don't control it, we can't alter it once it's been implemented and it will do what it's been built to do.
03:22 03:28	**Jaya Klara Brekke** Digital Strategy, Design, Research and Curating Durham University	When you're looking at money you're looking at governance, you're looking at law. You know that's not trivial stuff. That's not just something you can reinvent within a few lines of code.
03:29 03:41	**Dr. Catherine Mulligan**	The redefinition of society will happen in smart contracts and these kind of places unless the law courts are actively ensuring that people aren't getting disenfranchised
03:42 04:02	**Pavlo Tanasyuk** CEO BlockVerify	Information systems they are fundamentally social, and when we think about a bank or certain organization we have to understand that it's not only technologies we have to be able to be aware of but also this social interaction of people and we have to understand how we can map that into the system.

– Excerpts from *The Blockchain: Change Everything Forever*, (2016)[20]

Since 2013 blockchain-based platforms like Ethereum have been under development to enable software programmes known as 'smart contracts' to enact decisions and to distribute capital on a blockchain network, according to agreed terms, without human user verification; with the responsibility for doing so embodied in their programming rather than in written or spoken legal contracts. The resulting Decentralized Autonomous Organizations, and Applications (DAOs and DAPPs), can automate the administration of company business and act like computer viruses with wallets in their pockets.

Vitalik Buterin the coder and co-founder of Ethereum describes the second wave of development, after digital currencies, as a 'universal programmable blockchain' packaged up for...

p2p commerce, 'distributed governance and human collaboration as a whole' offering the 'ability to create technologies that are decentralized, removing middle men'.[21]

And so it follows that blockchain technology promises to facilitate the automation, monetization, manipulation (through smart contracts) and marketization of every transaction across a decentralized global database.

While the Web is the Internet of information and communication, the blockchain is the Internet of Money.[22]

Smart contracts have ambiguous legal status. While the law's defaults technically apply, until very recently[23] they have flown under the radar of government regulation. While this is one of the main attractions to people whose political complexion we might describe as anarcho-capitalist and who ask 'what has regulation ever done for us?',[24] there is growing concern about the impact of these technologies. As Dr. Catherine Mulligan puts it 'the worry is that society is being restructured by a small unrepresentative group of technocrats while it's something that everyone needs to participate in – the discussion about society and economy, and also governance, how we rule ourselves.'[25]

[Blockchains and the arts... warm up]

It's normal that Furtherfield should pay attention to the blockchain. It is an emerging network technology and we are an arts led community who work with networked media and pay attention to how network technologies are changing reality. As Marc Garret, Furtherfield's co-director has written: 'The meaning of art is in perpetual flux, and we examine its changing relationship with the human condition... Neoliberalism's panoptic encroachment on everyday life has informed Furtherfield's own motives and strategies and, in contrast with most galleries and institutions that engage with art, we have stayed alert to its influence as part of a shared dialogue.'[26]

Like many people we started experimenting in the Furtherfield office, with mining bitcoins in the late noughties, but not with any real focus. It was difficult and boring, it wasn't art and it didn't make any sense. We have since trashed those old computers with their wallets installed (these would be worth tens of thousands of £££s now).

Over the following years artist and hacker Rob Myers, a long-time Furtherfield contributor and advisor, wrote a series of articles and made a series of software-artworks that explored algorithms, accelerationism, art in the era of smart contracts, and the relationship between conceptual art and cryptocurrency. In 2014 he shared with us a draft for a paper called *DAOWO – DAO it With Others*[27] which set the scene for our work with the blockchain. It proposed to combine DAOs with *DIWO (Do It With Others)*[28] – arts-led methods and actions for critical and collaborative production and a commons for arts in the network age. It pointed at the many internal ethical contradictions of the rhetoric surrounding blockchain developments, all of which resonated very strongly with me, as a recovering WWW-utopian.

It was at this point that philosophical fascination coincided with an increasingly urgent need to build a more resilient future arts economy to sustain Furtherfield's communities and platforms. Art is, after all, practical philosophy and as media art pioneer Shu Lea Cheang has noted: 'Money, value, monetary exchange… These concepts have long been excluded from the field of new media, as if the Internet and Net Art were emancipated from these issues, living not on love and fresh water but on silicon and bits, living in a utopia of collective intelligence detached from economic constraints.'[29] Accordingly, we were gripped by the idea that interventions into established currency systems by citizens, artists and cultural workers could provide a source for new thinking and potentially create an ecology of value and values in which arts and artists would play a central role.

This prompted further investigation and we started to take inspiration from, and to connect up with, the work other people and programmes such as the the activist hedge fund *Robin Hood Cooperative*,[30] *Digital Futures: Money No Object*[31] with Rachel Falconer at the White Building and Irini Papadimitriou at the V&A in London; *MoneyLab*[32] at the Institute of Network Cultures, Amsterdam; and the experimental Art Reserve Bank[33] where you can change your money into a new reserve currency created by artists. We continued to be informed by our friends at the Foundation for Peer to Peer Alternatives[34] which proposes theories and methods for a transition to a global commons; and by our *Reading the Commons* group led by Tim Waterman, Research Associate in Landscape Commons, at Furtherfield. Most crucially it was activated by 20 years of art and conversation between hundreds of artists, techies, activists, thinkers and doers with diverse perspectives, who participate from around the world on the Furtherfield website[35] and the Netbehaviour email discussion list.

[Dancel]

Futherfield launched the *Art Data Money* programme in Autumn 2015 with the intention of drawing an active international community of artists, technologists and activists to look at the opportunities for increased collaboration and sustainability in the arts offered by big data and the blockchain. We invited them to join us online and at our 2 venues, a gallery and lab space in the heart of Finsbury Park in North London to build a commons for arts in the network age for a programme of:

□ **Art Shows where finance, cryptocurrencies and data are made tangible through critically engaging, feelable artworks for everyone.**

□ **Labs using hacking, play, and artistic techniques to take apart existing financial structures; algorithms and data flows to discover how they work and create new more participatory models.**

□ **Debates involving an alliance of diverse partners to generate new conversations, networks, and ways of organising value exchanges across traditional divides.**[36]

In 2015 we curated an exhibition at Furtherfield Gallery and a toured an offshoot exhibition around the UK with Digital Catapult. *The Human Face of Crypto Economies* (2015)[37] and its accompanying lab series featured work by Dani Admiss, Émilie Brout and Maxime Marion, Shu Lea Cheang, Sarah T Gold, Jennifer Lyn Morone, Rob Myers, The Museum of Contemporary Commodities (MoCC), Brett Scott at the London School of Financial Arts, and Cecilia Wee. The work sought to demystify money and cryptocurrencies, to discover in whose interest data is gathered and circulated, and at how we might produce, exchange and value things differently in the age of big data and the blockchain. This work garnered a broad spectrum of attention, review and discussion from across the art, blockchain and fintech worlds. In 2016 we received a small research collaboration grant from The Culture Capital Exchange, to work with Sam Skinner of Torque to explore the possibilities for experimental publishing on the blockchain.

2016 also saw the start of a partnership between myself and Ben Vickers of UnMonastery and Serpentine Galleries that brought fo-

organization, and a desire to interrogate and address more closely the possibilities offered by the blockchain for cooperation and collabora- tion within the art world.

In April 2016 we convened a two day event to explore the potential for the arts of the blockchain. The first day's workshop at Furtherfield Commons brought together a range of artists and developers, re- searchers and activists to map the fast emerging field. Much of the work of participants in that workshop is represented in this book. Jaya Klara Brekke and Elias Haase crystalize the ethical challenge to devel- opers in the form of *The Satoshi Oath*, setting out one of the clearest analyses I have seen of the worrying and dangerous absence of scaf- folding for social responsibility in engineering and enterprise cultures. Curator and theorist Helen Kaplinsky points our the current trend in arts-focused blockchain startups such as Ascribe, Monegraph and Verisart (that focus on IP tracking for digital art and provenance of artworks) to replicate the Victorian conception of art, represented by the operations and capital flows within existing museum and gallery systems, in the service of the artworld oligopoly. She also discusses *Ampliative Art*, an early art DAO mapped out by Spanish artist-aca- demic Adrian Onco who was also present. Artist and researcher, Kei Kreutler drew connections between artist manifestos and organiza- tional constitutions that may inscribe the solidarity-generating (or otherwise) values of arts collectives into DAOs. Max Dovey, over from the Institute for Network Cultures, brought his experience of programming the *MoneyLab* conference and his recent participation in a blockchain bodystorming workshop with Chris Speed and the Design Informatics team at the University of Edinburgh, in which their *Geocoin* prototype app provided the catalyst for the devising of a temporary, location-based Bitcoin marriage system as an explora- tion of informal contracts. This is the starting point for his article in this book about the consequences of the blockchain's immutability rule and the dangers of irreversible contracts. Also present was Sam Skinner, co-director, with Nathan Jones, of the experimental publish- ers Torque, with whom we collaborated on this very book!

The second day's event was of a different nature. Hosted by the Austrian Cultural Forum, we invited art and technology world-play- ers, thinkers and policy makers to gather together, in order to share our findings and invite them to rise to the challenge of engaging with this critical moment in history, stating in no uncertain terms: 'block- chain technologies are set to shape the next century.'

We offered a short introduction to the affordances of the technology and then presented our view on the potential impact of the block- chain and arts together, informed by the previous day's discussions:

☐ **New funding models – Renegotiation of the economic and social value of art.**

☐ **Lowering the cost for organising – DAOs could remodel collaboration.**

☐ **Automated solidarity for artists and new kinds of audi- ences, patrons and participants.**

☐ **Redefine 'Authorship' – Incentives for fractional, progres- sive ownership & collective production of art and livelihoods.**

☐ **Unanticipated futures – New imaginaries for how we act in the world.**

☐ **Opening up black box technologies – to diversify engagement**

This event provided the context for thinking together and learning quickly without a preset artistic, commercial, or ideological agenda. What emerged was a cautious interest in the 'potential for blockchain to devolve mechanisms and processes for funding for artists, as well as allowing various players in the arts ecosystem – artists, collectors, viewers, curators, and others – to define how they want to interact, with the possibility that sharing and artwork almost merge, or at least become as two sides of the same coin.'[38] This event was notable for its presentation of the technology as inherently ambiguous, in contrast to critiques of it as both literal fascism,[39] and 'to the original libertar- ian or revolutionary claims made for Bitcoin, the evolution of the technology today seems to offer as many risks of a dystopian future as emancipatory opportunities.'[40] There was also a level of perplexity in the audience and a desire voiced for making the subject more acces- sible, while still critical. I'm sure that someone said that a book may aid this!

We followed this up with the creation of the short film *The Blockchain: Change Everything Forever* directed by film maker Peter Gomes (2016), in collaboration with Digital Catapult, London, which set out to broaden the range of people involved in its future by bringing together leading thinkers, computer scientists, entrepreneurs, artists

and activists. It asked 'What can a blockchain do? Who builds this new reality? How will we rule ourselves?' and How will the future be different because of the blockchain?'[41] We deliberately selected contributors across the spectrum – from fierce critics to evangelists, and we made an art film. This film has been described as 'the most critical film yet to be made about the blockchain'[42] (there is a LOT of blockchain video marketing out there). It has been watched online by over 13,000 people and viewed at art exhibitions, screenings and blockchain conferences and festivals around the world.

Since this time we have been building our understanding and range of approaches to working with blockchains. At MoneyLab 2016 Vickers and I ran a *Live Action Role Play* for 35 people called *Role Play Your Way to Budgetary Blockchain Bliss*. It took the hackathon as a scenario and made concrete the inequities often at play at the start of any real world enterprise. Pablo Velasco's account in this book captures the methods and spirit of the event. This activity was a precursor to a series of smart contract role-play and design activities for people of all backgrounds and disciplines where participants will write social relations into code as a basis for debate. From Autumn 2017 we will partner with Goethe-Institut on a series of *DAOWO* workshops to build capacity in the arts for working with and understanding blockchain, as part of a European collaboration project *State Machines: Art, Work, and Identity in an Age of Planetary-Scale Computation*.

Our recent exhibition at Furtherfield Gallery *NEW WORLD ORDER*[43] invited visitors to imagine a world in which responsibility for many aspects of life (reproduction, decision-making, organization, nurture, stewardship) are mechanised and automated. Transferred, once and for all, from natural and social systems into a secure, networked, digital ledger of transactions and computer-executed contracts. Envisioning a future world of world-making machines, markets and natural processes, free from interference by states and other human institutions. These included two blockchain-based artworks, both presented in this book: O'khaos' self-replicating metal flower *Plantoid*, a new hybrid life-form that evolves on the blockchain, and *terra0* the augmented forest that owns itself and sells its own assets on the blockchain. It also presented the crypto based sci-fi story *Bad Shibe* by Rob Myers with illustrations by Lina Theodorou, reprinted here, which is a pathos-rich meditation on the emergence of ideologies propounded and executed by an elite of technical experts who are also free market believers. The installation by xfx (*a.k.a.* Ami Clarke), also represented in this book, included a video as data capture, showing glimpses of the material parts of an Ethereum mining…

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energy used and the sweat equity of a DIY cryptocurrency prospector with finely tuned financial calculations and a (not so free) money mining system. This exhibition will tour in 2018 to Aksioma, Slovenia and Drugo More, Rijeka as part of the *State Machines* programme.

All of this work is also helping to prepare the ground for moving a part of Furtherfield onto the blockchain in the context of Platforming Finsbury Park, a 4 year initiative in which we plan to transform Finsbury Park in Haringey, North London, into a canvas for adventurous, world-class digital art, and into a site for fieldwork in human and machine imagination. Our intention is to think through, with researchers of all stripes, the ways in which artists, participants and audiences might create, value and circulate previously unimagined artforms to interact with beliefs, decisions and intentions. The three most interesting design problems we anticipate are: how to ensure that any cultural value generated benefits diverse local communities; how to value strangeness, difference and mystique (without which we might ask, what value is art?) and; how to negotiate the bridge between users of local physical spaces and international digital networks.

We do not underestimate the work to be done here but look to the work of socially, artistically, and design minded organizations and projects already underway: Ascribe, Aragon, Art is Open Source, Backfeed, Colony, Constant, Deckspace, Faircoin, Freecoin, Metahaven, Robin Hood Cooperative, Upstage.

The artists working with the early WWW created software to craft experiences and relationships, pre-empting by 10 years, developments in the social web. Audiences for Net Art[44] became participants in and co-creators of distributed online artworks, making really strong user interfaces to engage people. The new social relations were integral to the aesthetics and message of their work. Many recent technology developments offer promise and potential as artistic media, for cultural contexts, and for expanding expressive potentials and dramatic interventions. As a new network protocol the adoption and formation of new forms of the blockchain has the potential to provide the organising principles for the deployment and use of other emerging technologies and tech cultures, IoT, VR, AR, AI, and Biotech.

If we have learned anything in our twenty years of effort to produce artworks and art contexts to stimulate and diversify debate around life since-Net it is that decentralized infrastructure does not equate to decentralized resource or power, or at least not for any length of time…

inherently repressive. The blockchain can be used to support pretty much any political outlook.'45 This is a point worth pressing on and is best understood by work going on around cultures of the commons. These promote constructive experimentation through peer learning, nuanced openness, access to knowledge, tools and contexts that extend freedoms of expression, association and collaboration. But this is also accompanied by the understanding that it's not enough for radicals just to build. Their visions must also incorporate processes of maintenance and stewardship in order to negotiate ongoing prosperity in contexts, increasingly uncertain, chaotic and unpredictable conditions, or else see their communities or cultural commons harvested, hoovered and alienated by recentralizing forces. It is for this reason that artists' engagement with the art and politics of infrastructure — through discussions of power, law, governance, cooperation, creative collaboration, cultural stewardship, legacy and expression — are a running theme through this book.

One of our intentions in creating this book is to offer a set of differently crafted lenses through which to spy a territory, some of which exists only in our imaginations. By reading it and by playing its marketized contributions through the FinBook platform that is threaded through it, you will discover more about the origins, concepts, uses and users of blockchain technologies at work now, and to make your own mind up about what a future with the blockchain will be. Our understanding is that, as with the early days of the WWW, we have an opportunity to build our own contexts for cultural production. We should be ambitious and aspire to construct an ethical perspective on the networked society that Gene Youngblood describes as an 'ecosocial nervous system' operating across 'translocal social heterotopias.'46

In order to achieve this we must involve more diverse people in the process of making the game rather than increasing the number of people who are just to be played!

[*Acknowledgements and thanks*]

Marc Garrett, for being a critically engaging badass, and a dedicated partner in adventures of the networked imagination. The unstoppable creative experimentalists Nathan Jones and Sam Skinner of Torque publishing. Peter Gomes, Kei Kreutler, Rob Myers, and Ben Vickers for high art and high geek insight and inspiration and crypto-solidarity. For generous, accessible and engaging writing and acting about crypto-things and why they are important Vinay Gupta,

Notes

1 Opening statement at *Potentials for the Arts of the Blockchain at Austrian Cultural Forum*, April 2016. Convened by Furtherfield and Ben Vickers.

2 Artist and researcher, Kei Kreutler in *The Blockchain: Change Everything Forever*, A Furtherfield film by Pete Gomes, 2016.

3 See the interview by Marc Garrett with Holly Herndon and Mat Dryhurst in this book.

4 *How Many Things are Currently Connected to The 'internet of Things' (IoT)?* http://forbes.com/sites/quora/2013/01/07/how-many-things-are-currently-connected-to-the-internet-of-things-iot

5 $1.4bn investment in blockchain start-ups in last 9 months of 2016, says PwC expert John Kennedy, *Silicon Republic*, November 2016, http://linkis.com/Ayjzj

6 UBS White Paper for the World Economic Forum, Annual Meeting 2016, *Extreme Automation and Connectivity: The Global, Regional, and Investment Implications of the Fourth Industrial Revolution*.

7 Catlow, Ruth. 'WE WON'T FLY FOR ART: MEDIA ART ECOLOGIES.' *Culture Machine*, Vol 13, 2012, http://culturemachine.net/index.php/cm/article/download/475/493

8 Gene Youngblood in Third Space Network convened by Randall Packer, 2017, http://thirdspacenetwork.com/gene-youngblood

9   See also: Catlow, Ruth. *Art and the Blockchain, Digital Catapult*, 2016, http://digitalcatapultcentre.org.uk/art-and-the-blockchain

10 http://dcentproject.eu

11 http://fair.coop/faircoin

12 Myers, Rob. 'Conceptual Art, Cryptocurrency and Beyond.' *Furtherfield*, 2014, http://furtherfield.org/features/conceptual-art-cryptocurrency-and-beyond.

13 *The Blockchain: Change Everything Forever*, 2016.

14 http://en.bitcoin.it/wiki/Genesis_block

15 http://www.ethereum.org

16 Gupta, Vinay. 'Programmable Blockchains in Context: Ethereum's Future.' *Consensys*, 2015, http://media.consensys.net/programmable-blockchains-in-context-ethereum-s-future-cd8451eb421e

17 This elaborates on a slide presented at the Austrian Cultural Forum, April 2016 in an event convened by Furtherfield and Ben Vickers in which we invited arts and policy makers to join us to explore the potential for blockchain and the arts.

18 Proof-of-work is the system used by Bitcoin and other major cryptocurrencies at time of writing. However other systems are now being developed to address energy use. Ethereum is working on proof-of-stake and, to discourage hoarding and currency speculation, Faircoin now implements proof-of-cooperation.

19 This long explanation is reprinted mostly verbatim from my *Afterword* for *Bad Shibe*, 2017. I'm pleased to say that this glorious Dogecoin-inspired sci-fi novella by Rob Myers is reprinted here along with illustrations by Lina Theodorou.

20 *The Blockchain: Change Everything Forever*, 2016.

21 'Vitalik Buterin explains Ethereum.' *YouTube*, http://youtube.com/watch?v=TDGq4aeevgY.

22 Antonopoulos, A.M. *The Internet of Money*. Createspace Independent, 2016.

23 *SEC Issues Investigative Report Concluding DAO Tokens, a Digital Asset, Were Securities* issued by U.S. Securities and Exchange Commission, Washington D.C., July 25, 2017, http://sec.gov/news/press-release/2017-131.

24 Asked in all seriousness by Vinay Gupta, in one of his informative, entertaining and terrifying podcasts.

25 Dr. Catherine Mulligan, in *The Blockchain: Change Everything Forever*, 2016.

26 Garrett, Marc. 'Furtherfield and Contemporary Art Culture – Where are We Now.' *Furtherfield*, 2015, http://furtherfield.org/features/articles/furtherfield-and-contemporary-art-culture-where-we-are-now.

27 http://furtherfield.org/artdatamoney/includes/files/daowo.pdf

28 http://furtherfield.org/projects/diwo-do-it-others-resource

29 Cheang, Shu Lea and Annick Rivoire. 'We Grow Money, We Eat Money, We Shit Money.' *MCD*, #76, 2015, http://www.digitalmcd.com/la-version-anglaise-du-mcd76-est-disponible.

30 http://bollier.org/blog/robin-hood-coop-activist-hedge-fund

31 http://furtherfield.org/programmes/event/digital-futures-money-no-object-prototyping-session

32 http://networkcultures.org/moneylab

33 http://arteservebank.com

34 http://p2pfoundation.net

35 http://furtherfield.org

36 http://furtherfield.org/artdatamoney

37 http://furtherfield.org/programmes/exhibition/human-face-cryptoeconomies

38 Chakrabarti, U. Kanad. 'From Bearer Bonds to the Blockchain: Artistic Perspectives on Digital Money.' *Eatthe hipster*, 2016, http://eatthehipster.org/2016/05/01/blockchains-potential-in-the-arts

39 Golumbia, David. *The Politics of Bitcoin, Software as Right-Wing Extremism*. University of Minnesota Press, 2016.

40 *Ibid.*

41 Made in collaboration with London's Digital Catapult http://furtherfield.org/projects/blockchain.

42 In conversation with Pablo de Soto of Hackitectura.

43 http://furtherfield.org/programmes/exhibition/new-world-order

44 In her 2011 book *Nettitudes – Let's Talk Net Art*, Josephine Bosma describes Net Art as 'art based on Internet cultures, which revolve around technology, games, social networks, commerce and politics.'

45 Chakrabarti, U. Kanad. 'From Bearer Bonds to the Blockchain: Artistic Perspectives on Digital Money.'

46 Gene Youngblood in Third Space Network convened by Randall Packer, 2017, http://thirdspacenetwork.com/gene-youngblood.