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RESEARCH ARTICLE

The Blockchain as a Narrative Technology: Investigating the Social Ontology and Normative Configurations of Cryptocurrencies

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Abstract In this paper, we engage in a philosophical investigation of how blockchain technologies such as cryptocurrencies can mediate our social world. Emerging blockchain-based decentralised applications have the potential to transform our financial system, our bureaucracies and models of governance. We construct an ontological framework of "narrative technologies" that allows us to show how these technologies, like texts, can configure our social reality. Drawing from the work of Ricoeur and responding to the works of Searle, in postphenomenology and STS, we show how blockchain technologies bring about a process of emplotment: an organisation of characters and events. First, we show how blockchain technologies actively configure plots such as financial transactions by rendering them increasingly rigid. Secondly, we show how they configure abstractions from the world of action, by replacing human interactions with automated code. Third, we investigate the role of people's interpretative distances towards blockchain technologies: discussing the importance of greater public involvement with their application in different realms of social life.

Keywords Blockchain technology · Cryptocurrencies · Ethics · Politics · Narrative · Ricoeur · Searle · STS

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1 Introduction

One of the incipient global narratives about revolutionary technological innovations revolves around the so-called blockchain technology, with the well-known cryptocurrency Bitcoin as its most well-known instantiation (Roio 2013, p. 12). The imagined potential of the blockchain is coming to fruition in recent years, with the development of applications that mimic services that are usually exclusively offered by governments like Bitnation (Allison 2015), initiatives for citizen engagement and new forms of democratic participation like D-Cent (D-Cent 2015) and digital platforms for the creations of all sorts of decentralised applications, like the Ethereum platform (Wood 2014). In this paper, we investigate blockchain technologies and the way they are able to transform our society from a philosophical perspective. By virtue of doing so, we counter the instrumental view according to which humans merely use blockchain technologies for pre-defined purposes and instead show how blockchain technologies can actively shape our social world.

Philosophy of Technology increasingly engages with the study of financial technologies and their social, cultural and political ramifications. For instance, it discusses how the rise of technologies that enable high frequency trading (HFT) has contributed to an ontological process of "distancing", investigating high-speed, global financial transactions that create distances between people in the real economy (Coeckelbergh 2015b). Similarly, it discusses how the rise of digitalised global derivative trades that triggered the financial crisis in 2008 "re-organised our understanding dynamic character of a world of informationalised, monetised space-speed" (Pryke and Allen 2000, p.282). Since blockchain technology is not only claimed to be the "new big thing" for financial technologies, but also seen as able to transform organisations, democratic governance and human culture as a whole (Tapscott and Tapscott 2016), we believe that it is valuable and urgent that Philosophy of Technology would engage with it. However, up until now, philosophers of technology have largely neglected blockchain technologies as a serious topic of investigation. We aim to answer to this neglect, by engaging in a philosophical investigation of the way in which blockchain technologies might shape our understanding of the social world.

We situate our investigation in the context of a growing number of social critiques of blockchain technologies, which predominantly focus on Bitcoin. Scott (2015) distinguishes four types of such critiques. The first type criticises the libertarian ideology that underlies the blockchain technology, by raising the argument that the individual empowerment it enables does not trickle down to collective empowerment; that certain forms of social injustice are still possible and perhaps even amplified by using blockchain technologies (Golumbia 2015). The second type focuses on the concern that the already powerful strata of society benefit the most from the possibilities of the blockchain, which amplifies political divides on the basis of gender, race, education level. Bitcoin is therefore not the "apolitical" economical technology it is often assumed to be (Kostakis and Giotitsas 2014, p. 437). The third type focuses on the claim that, even if the technology can be considered to be neutral, it still can be abused. For instance, it can be used for criminal activities, money laundering and blackmailing (Ogunbadewa 2014), and even (unintentionally) lead to a centralisation of power in the hands of a small number of "mining pools" (Scott 2015). The fourth type focuses on the intrinsic power dynamics of the technology itself, on the way it mediates social

relations of people conducting transactions and setting up "smart contracts". Rather than rendering conventional governance fully obsolete, the blockchain introduces a novel form, a new infrastructure of governance with its own power-dynamics (Kavanagh and Miscione 2015; DuPont 2014). In these latter critiques, it is argued that blockchain technologies have the capacity to transform our social reality.

Adding in particular to the fourth type of these critiques, our aims in this paper are (1) to provide for an ontological framework that helps us to understand how blockchain technologies mediate human social reality and (2) to use this framework to explore the normative implications of this mediation, focusing on the example of cryptocurrencies. Thus, rather than studying and discussing particular ideological or ethical issues, we start from an ontological and hermeneutic analysis of blockchain technologies—with a particular focus on cryptocurrencies. We thereby do not approach the normative implications of technology in the way applied moral and political philosophy do, i.e. by means of discussing blockchain technology according to ethical and political principles (e.g. justice, autonomy) and values, or by applying established ethical and political theories. Instead, we propose an ontological framework inspired by the work of Paul Ricoeur that allows us to investigate the normative impacts of blockchain technologies in a holistic manner, interpreting blockchain them as what we call *narrative technologies*. Using this framework, we particularly focus on the active role that blockchain technologies can have in shaping our social reality.

To structure our argument, we first critically reflect on ways in which John Searle's social ontology, postphenomenological theory and approaches in social studies of science and technology (STS) can shed light on our understanding of blockchain technologies, to eventually turn to the hermeneutic work of Ricoeur. Taking Ricoeur's narrative theory as the basis of our ontological framework, we show how blockchain technology can be understood by investigating the way it configures our human narrative understanding. Using the ontological framework of narrative technologies, we then discuss the normative implications of blockchain technologies by considering the extent to which they actively configure the human understanding of the social world, the extent to which they bring about abstractions from the world of action and to what kind of interpretative distances they configure. For this analysis, we focus on cryptocurrencies because they represent as yet the most "worldly" instantiation of blockchain-powered technologies (being already developed and used widely on a global scale).

2 The Blockchain as a Narrative Technology

In this section, we inquire into the meaning and use of blockchain technologies by discussing how we can understand them ontologically, as elements of human social reality. This question needs to be addressed, for no normative implications can be derived from a phenomenon that is not properly understood and of which most possible implications still lie in the future rather than in a present that we can subject to empirical scrutiny. The blockchain, which was developed as the underlying "nervous system" of the cryptocurrency Bitcoin (Vigna and Casey 2015, p. 92), will be the central focus of this paper. In 2008, Bitcoin's mysterious founder—or group of founders—Satoshi Nakamoto, characterised Bitcoin as an "electronic payment system based on

cryptographic proof instead of trust" (Nakamoto 2008, p. 1). Its architecture had been based on the blockchain protocol, "which assures transaction authenticity, integrity, and ordering" (Folkinshteyn 2015, p. 84). As a "consensus mechanism", the blockchain as applied to Bitcoin was meant to overcome deficiencies of conventional monetary systems that function thanks to consensus based on trust in institutions.

The main innovative feature of blockchain technology is arguably not its potential for bringing about pseudonymous transactions between sending and receiving addresses,[1] but its capacity to track transactions within decentralised, public databases and thereby excluding counterfeiting and fraud (Kostakis and Giotitsas 2014, p. 434). This capacity relates to the possibility to decentralise authority and conduct transactions on a peer-to-peer basis by using blockchain-based technologies. In the case of cryptocurrencies, this has the implication that governments and banks (the "middlemen") are not needed to authenticate and validate monetary transactions; these tasks are delegated to the technology and the network supporting it. The blockchain can be regarded as a public digital ledger (a book of accounts) that contains all the transactions made within its system. "Blocks" are digital, time-stamped records containing the most recent transactions that are cryptographically signed and added to the blockchain in a designated sequence, in a linear, chronological manner (Mcreynolds et al. 2015, p. 3). Whenever a transaction occurs, anywhere in the world, so-called "miners" validate it and add it to the public blockchain, which makes it impossible for the same digital object (which could be money, but also a contractual agreement) to be "double spent": to be transacted to different addresses at the same time. The miners are the agents that collectively control the computational nodes validating transactions within the network. For Bitcoin, the service these miners provide is guaranteed according to a system of incentives, which currently amounts to the miners being rewarded newly created Bitcoins.

Already in the 1980s, David Chaum, the developer of one of Bitcoin's main predecessors called Digicash, argued that the rise of decentralised applications (which the blockchain enables to build) could bring about major global changes by solving (ethical) problems of mass surveillance, online participation and democratic governance (Chaum 1985, p. 1044). In less than a decade since the birth of Bitcoin in 2008, the applications of blockchain technologies seem to increasingly move in the direction Chaum predicted—and in multiple other directions, some of which might even go against Chaum's hopeful expectations. Apart from cryptocurrencies, the blockchain protocol allows for the creation of so-called "smart contracts"—including property right contracts and insurance contracts—systems for "distributed governance" like voting systems and decentralised governance of companies and organisations (also called Decentralised Autonomous Organisations or DAOs) (Vigna and Casey 2015). Currently, conventional political and financial powers have begun to regulate or appropriate blockchain technologies, like the state of New York which has issued a "BitLicense" for companies dealing with Bitcoin (New York State Department of fincancial services 2015) and the Santander bank which is investing in blockchain innovations (Williams-Grut 2015). Thus, blockchain technologies are not only

[1] In its original form, Bitcoin allows only for pseudonymous use rather than for anonymous use, as is often believed, although the level of anonymity can be improved by means of specialized techniques like using "mixing" services that mix transactions to confuse the link between sender and receiver (Möser 2013).

influencing the ways we understand and use money and contractual relations, but also the governance of our societies.

We approach the development and application blockchain technologies as a challenging paradigmatic technological trend from a philosophical perspective for three distinct reasons. Firstly, we use the blockchain as an illustrative example to develop our philosophical framework of narrative technologies that, as we argue elsewhere (Coeckelbergh and Reijers 2016), is suitable for understanding what we will later on designate as the *active*, *abstracting* configuration of ICTs: the capacity of ICTs to shape people's understanding of the social world. Secondly, the blockchain gives rise to a generic ICT infrastructure and does therefore not merely refer to a single novel technology, but to what some already designate as the "decentralised web 3.0" (Gerring 2016): an internet different from the World-Wide Web that is inherently decentralised and would fundamentally alter the way we organise online interactions. Thirdly, the blockchain is a technology that is explicitly designed to organise aspects of our reality in a way that has been shown to be philosophically significant (see, e.g. Kavanagh and Miscione 2015; DuPont 2014).[2] Because of their capacity to challenge authority and to control interactions in the respective crypto economies, cryptocurrencies are argued to be "weapons in the new control society". (DuPont 2014, p. 7). Not only can philosophy therefore be used to understand how blockchain technologies mediate our social world, but the reverse seems also to be true: the understanding of blockchain technologies can inform philosophical theories that account for how modern technologies shape society.

2.1 The Social Ontology of Blockchain Technologies

In order to ground our analysis of the normative impacts of blockchain technologies, we first need to delve into the question of how we can understand these technologies ontologically and how we can conceptualise the ways in which they mediate the human life-world. One straightforward answer to the ontological question of what blockchain technologies are is that they are programming codes and strings of data: that we can ontologically describe the technology by referring to the ever-growing digital chain containing records of transactions. Advancing the ontological question, we can state that the blockchain consists of programming code as a sequence of symbols that can be read by computing devices. However, this code has a significant human and indeed social-institutional dimension. Cryptographic code, as Lessig argues, is similar to human-made law for it can enforce confidentiality as well as identification in similar ways as law can (Lessig 2006, p. 53). John Searle offers an ontological theory of social reality that explains the similarity between law and programming code by pointing at their linguistic origins. He states that all human-made phenomena, ranging from streets to governments to laws, share a linguistic basis. The origin of certain artificial phenomena, called institutional facts, is traced back to linguistic entities called "status function declarations" (Searle 2010, p. 13). An example of a simple status function declaration is "I hereby declare that the provided information is true". By agreeing with

[2] The narratives surrounding blockchain technologies concerning "distributed" technologies and "distributed" organisation and governance as a result show surprising similarities with the expectations people had during the dawn of the World-Wide Web (Naughton 1998, p. 98). At least in the case of the Internet, history has shown to be largely different than expected.

such a statement in an ICT-mediated setting, the linguistic act of agreeing (the speech act) results in a new reality (Searle 2006, p. 69): it provides the agreeing party with a new set of digital rights and duties, of constitutive rules, that define the ontology of the respective ICT environment.

Status function declarations include both locutionary aspects (linguistic aspects, propositions) and illocutionary aspects (extra-linguistic aspects: intentional states like a beliefs and desires). They are characterised by what Searle calls a "double direction of fit": a notion that refers to the fit between the locutionary, propositional aspect of the declaration and the human directedness to the world implied by the illocutionary aspect (Searle 2010, p. 12). For declarations, two different illocutionary aspects coincide: the desire to make something the case and the belief to make something the case. In other words, if we declare something to be the case, we are able to create a reality while desiring it to come about. For example, when a certain person declares to become the president of the United States, the propositional form of the declaration "I, Barack Obama, hereby declare that…", fits with the collective desire to bring about a new state of affairs implying a new ontological reality (the new president of the United States).

When we apply Searle's theoretical model to understand the ontology the phenomenon of blockchain technologies, we can state that they indeed can be understood as status function declarations. They are declarations because they have a linguistic, propositional structure that allows them to bring about their own reality. Moreover, they are status function declarations because their meaning depends on a coinciding structure of human desires and beliefs: when using the blockchain of a cryptocurrency, we believe the new state of affairs (a transaction) which coincides with our desire to bring it about (we wanted the transaction to occur). These desires and beliefs do not belong only to the individual but to a collective. We collectively intend status function declarations to become part of our social reality. In other words, the individual act of transacting an amount of cryptocurrency depends on the collective intentionality that amounts to the validity of this act. In the words of Nakamoto, collective "consensus" (and to achieve this, a "consensus mechanism") is needed in order to make the system of status function declarations work (Nakamoto 2008, p. 8).

However, this does not seem to lead to an adequate understanding of the socio-linguistic grounding of cryptocurrencies. Two main lacunas make Searle's theory inadequate to serve as a solid basis for the examination of cryptocurrencies. First of all, Searle leaves the gap between individual intentionality and collective intentionality unexplained, merely stating that collective intentions are biologically primitive phenomena: intentionality in the "we" mode instead of in the "I" mode. By suggesting this reductionist view, he disqualifies the impact of culture that is precisely not reducible to human biology (Heidemann 1999, p. 259). Since we are particularly interested in understanding how individual intentionality is culturally mediated to arrive at the collective consensus constituted by blockchain technology, we are in need of a theoretical framework that does account for the interrelation between individual and collective intentionality. Secondly, Searle's theory does not include an aspect of normativity that is needed to explain why declarations can have a status function at all (Heidemann 1999, p. 260). In the case of cryptocurrencies, we would want to explain why we assign a status function to them. In more common terms, we would want to explain why people assign value (not just economic value, but also emotional and political values) to cryptocurrencies. This is not a trivial point, for the meaning of

cryptocurrencies (as well as their classification as money) depends on their relation to human normative values.

2.2 Turning Towards Narrative Theory

In order to overcome the problematic aspects of Searle's social ontology, we turn towards theories in philosophy of technology and in social studies of science and technology (STS). First, we consider postphenomenological theories of technology that focus on the role of technological mediation. As Ihde concedes, instead of understanding technologies as formations of formal rules, we should aim to understand the way in which their materiality shapes our experience of the world (Ihde 2009). We might for instance say that a technology such as glasses constitute an "embodied" experience of the world or, as Verbeek puts it, that technologies such as scientific instruments make our objects of experience "present in a specific way" (Verbeek 2005, p.141). Consequently, we can analyse blockchain technology by conceptualising the kind of relationship it constitutes between the subject and its life world. However, the focus on the material aspects of technologies in postphenomenological theories neglects the important role of linguistic and symbolic mediations (Coeckelbergh 2015a) that is at stake when aiming to understand the mediating role of blockchain technologies. Moreover, the focus of these theories on the individual mediation captured by the subject-technology-world relationship fails to provide for an explanation of how "being-with-each-other", social relationships (Van Den Eede 2010) are shaped by technologies. Therefore, the conceptual leap from technological mediation at the individual to the collective level remains as problematic as in Searle's social ontology.

Secondly, we consider approaches in STS that unlike postphenomenological theories are more focused on the role of language, by capturing technological mediation using notions of "de-scribing" "scripts" of technological objects (Akrich 1992) or the "interpretative flexibility" of artefacts (Pinch and Bijker 1984). Works in STS focus on the relevance of the mediation of the collective: mapping networks of social groups or of human and non-human actors. For instance, Jasanoff argued that "socio-technical imaginaries", which are "collectively held, institutionally stabilised and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (Jasanoff 2015, p.6) shape the design of technologies. These socio-technical imaginaries can incorporate accounts of technological artefacts in popular fiction, but also institutional narratives of nationhood and citizenship. On a slightly different note, expanding on works such as Winner's analysis of the politics of architectural structures (Winner 1980), Edwards argues that socio-technical infrastructures are designed according to "mutual orientation" of normative goals of both small social groups and large institutions towards a design of a socio-technical system (Edwards 2004, p.22). Dawson and Buchanen articulate an informative perspective on this kind of approaches in STS, arguing that technology change happens through the outcomes of competing *narratives* (Dawson and Buchanan 2005), a process of interaction between interpretations of technologies that would be characterised by Pinch and Bijker as "closure" (Pinch and Bijker 1984, p.44).

Indeed, the development of blockchain technology seems to be influenced by different interpretations of social groups and institutions (for instance, the cypherpunk

movement and government regulators in the state of New York[3]). Moreover, it seems to revolve around a "socio-technical imaginary", being amongst others the "libertarian dream" of stateless institutions such as Bitcoin that has driven its development (Karlstrøm 2014). In a similar vein, Joerges (1999) argues, against Winner, that narratives play an important role in politics of technologies. Turning to blockchain technologies, we could say that people construct narratives about them, which are related to the expectations and negotiations various individuals and organisations hold. As such, development of technologies such as Bitcoin is indicative of a politics, understood as interactions between social discourses and social imaginaries.

Thus, STS approaches focus predominantly on interpretations and narratives *about* technology. As Pinch and Bijker explain, a distinct social group might have a certain interpretation of a technology that subsequently influences a discourse between different actors (relevant social groups). This focus on narratives about technologies as elements of a social discourse puts human agency somewhat in the forefront. Even though it is argued that a design is "co-produced" (Jasanoff 2015, p.16) or that artefacts, like words, are also tools of politics (Joerges 1999), it is co-produced by different groups of people. It therefore seems that these approaches insufficiently answer to the valuable lessons gained from postphenomenological theories, namely that humans and technologies co-shape reality: that a certain agency has to be ascribed to technologies as well (Verbeek 2005, p.112). Moreover, it seems that the narratives themselves are viewed as pre-given and the technology design as a consequence of interaction between these narratives. For instance, different social groups are said to have different interpretations of a technology, and the design is changed accordingly. Conversely, in line with Searle, we should say that technological structures, as consisting of systems of status function declarations, do not just incorporate interpretations or delegate scripts, but *create* or *constitute* new social realities. Therefore, we do not merely want to ask how different interpretations of blockchain technologies shape their designs, but also how the technology itself in turn shapes our understanding of the world we live in.

Going back to the idea that a "competition" between narratives can result in technology change, as Dawson and Buchanen suggest, we suggest to re-frame the problem they present by asking: how do humans and technologies *co-shape* the narrative structures that have the potential to transform our understanding of our technologically mediated social reality? Such an approach might answer to the concern raised by Feenberg about postphenomenological theories of technology and theories in STS, namely that they provide for a convincing relational ontology but insufficiently offer a corresponding hermeneutic theory of meaning (Feenberg 2009, p.228). At the same time, we have to resist ideas of technological determinism such as the one proposed by Winner, because our framework should explicitly acknowledge the agency of both humans and technologies in the mediation of social reality. These concerns caused us to turn to narrative theory, and notably to the work of Paul Ricoeur.

With regards to the ontological significance of narrative, there are various philosophical views on how this concept can contribute to our understanding of the social world and on the way in which they shape social reality. Some scholars consider

[3] For instance, consider this article on the resistance of Bitcoin activists to regulation of Bitcoin, as has happened in the State of New York: https://www.bitcoinnotbombs.com/the-declaration-of-bitcoins-independence/, accessed on 04-03-2016.

narrative as an instrumental cognitive ability or linguistic tool, whereas others consider it as an ontological category connected to the way humans are in the world (Meretoja 2014, p.89) or understand human life itself as having a narrative character (e.g. see Macintyre 2007, p.114) Another theoretical division with regards to the role of narrative exists between an empiricist tradition that denounces narrative as a fundamental philosophical concept (e.g. see Strawson 2004) and a hermeneutic tradition that instead rejects the idea of experience unmediated by narratives. The latter tradition holds that all representations of the human social world are mediated by human-linguistic interpretation (see, e.g. Taylor 1971, p.4), that subjectivity is always mediated by language, "by 'signs, symbols and texts'" (Meretoja 2014: 96). Ricoeur belongs to the philosophical tradition that conceptualises narrative as being deeply connected to human lives, as a fundamental mediator of human social existence. Thus, rather than viewing narrative merely as an instrumental or discursive tool that shapes the design process of technologies, we argue that it should be understood as a fundamental ontological aspect of human social reality.

Going beyond philosophy, multiple scholars have shown how a narrative ontology can improve our understanding of concrete aspects of our social world. For instance, Bruner explains how we can increase our understanding of human psychology, as embedded in a cultural context, by looking at how a "text affects the reader" (Bruner 1986, p.4). As such, he claims that narratives can "make events" and even "make history" (p.42). In a similar vein, Czarniawsma employs a methodology for organisation studies that allows for an understanding of the "reflexive nature" of the human condition as the basis for collective action (Czarniawsma 1998, p.77). She understands an organisation as a story, understood as a social construct that is shaped by human interaction and interpretation through narratives. Gotham and Staples show how the significance of narrative goes beyond our understanding of history and can help to analyse "human agency in processual, action-oriented ways" (Gotham and Staples 1996, p.492). As such, it is argued that a narrative understanding of our social world would improve sociological inquiries. These and many other scholars have shown how a narrative ontology can be fruitfully employed in studies of different aspects of our social world. We will build on this idea, by exploring how narrative theory, focusing on the work of Ricoeur, can assist us in studying the role of blockchain technologies in our social world.

2.3 Exploring Ricoeur's Narrative Theory

Unlike Searle, Ricoeur addresses the two aspects of linguistic mediation of social reality we discussed in the previous section. Firstly, he characterises narratives as cultural phenomena: accounting for ways in which we interact with narratives from within our culturally embedded time. Secondly, he explains why narratives can configure our social reality: because they configure narrative plots that refigure social events (Borisenkova 2010, p.93) and thereby refigure our social reality. Emplotment, which is the process that defines a narrative structure, has an outspoken normative character because the characters in a narrative are not just neutral "doers" as Searle would portray them but are "endowed with ethical qualities" (Ricoeur 1983, p. 59). Unlike generalised "doers" like the rational economic man who figures in economic theories, acting according to coherent, non-normative motives, characters can be good or evil, rational and irrational: the protagonists or antagonists of the narrative structures.

These features of Ricoeur's theory enable him to go beyond Searle's formal approach and to provide a holistic, normative account of linguistic mediation of our social world. Moreover, the notion of narrativity enables us to link the two spheres that modern (analytic) thinking tries to keep separate: the material-technological and the narrative-linguistic-cultural.

How could we utilise Ricoeur's narrative theory to understand the technological phenomena of cryptocurrencies and blockchain technology? We want to explore in what sense these technologies can have "narrative" qualities themselves, rather than being merely shaped by narratives that are constructed *about* them. At first sight, the notion of narrative seems to be far removed from anything technological. Since Ricoeur's theory revolves around the paradigm of the text, we need to justify the claim that the concept of narrative in a text can be extended to the concept of a narrative technology. Technology only plays a marginal role in Ricoeur's work, although he explicitly argues that narrativity should be considered as a general aspect of human existence that goes beyond our understanding of literature and also includes distinct areas of human knowledge like "cosmology, geology, and biology" (Ricoeur 1983, p. 135). Unfortunately, most scholars in philosophy of technology dealing with the ways technologies mediate the human life world (see for instance Ihde 2009; Feenberg 1999) do not include Ricoeur's work in their theories. However, David Kaplan has drawn a connection between Ricoeur's work and the philosophy of technology. He suggests that Ricoeur's hermeneutical method as well as his analysis of the hermeneutic circle between human experience and narration can be fruitful in discussions about technology (Kaplan 2006, p.p. 43, 44) because these elements can enrich the analysis of technological mediation by including notions of linguistic and social mediation. Moreover, he argues that the model of the text can be utilised as the model of the mediation of experience by technology (Kaplan 2006, p. 49), for it can explicate how humans interpret technologies and how technologies play a role in our narrative understanding. Yet, although Kaplan discusses the value of Ricoeur's theory for philosophy of technology, he does not offer a theory of technology that is inspired by Ricoeur's work on narrative theory. Therefore, we have ventured to construct a theory of narrative technologies that allows us to analyse the normative impacts of blockchain technologies.

In one of his major works that consists of three volumes, *Time and Narrative*, Ricoeur (1983; 1985; 1988) constructs a comprehensive narrative theory. Unlike Searle, Ricoeur does not focus on the formal structure of language (like the formal structure or syntax of programming code), but on its hermeneutic aspects: on the ways people interpret language and, *through* language, how they understand their life world. His theory revolves around a basic model that designates the way in which a text considered as a narrative can mediate human reality. This central model consists of three conceptual stages that indicate the move from "not having read" to "having read" a narrative. Ricoeur claims that our social reality is embedded in a prefigured time. This means that the way we experience our temporal, social existence is embedded in a cultural context that is shaped by narrative structures (Ricoeur 1983, p. 54). For instance, we understand ourselves and our life worlds through narratives about our national identities (e.g. "I'm a citizen of the Netherlands), economic narratives (e.g. "I lost my job due to the financial crisis") and even technological narratives (e.g. "robots are going to render many jobs superfluous"). Thus, whenever we engage with human language, we act from a cultural basis, which means that our understanding is shaped

by the narratives that are a part of our collective narrative "repertoire" (Ricoeur 1983, p. 64). This view ties into Jasanoff's account of socio-technical imaginary, as a collectively held repertoire of narratives ("visions of the future") embedded in "shared forms of life and social order" (Jasanoff 2015, p.6). However, Ricoeur goes beyond this idea of prefigured time and explains how an instance of a text in turn can *configure* this collective narrative repertoire.

Prefigured time indicates the moment at which a human starts to interact with a text. From the prefigured time, we proceed to the moment of the configured time, which is the backbone of Ricoeur's theory. The paradigm of configured time is the notion of the plot in a story, brought about by the process of emplotment. The plot is defined as an organisation of events that mediates between heterogeneous factors (such as agents, goals and interactions) and the syntagmatic order of a narrative as a whole (Ricoeur 1983, p. 65). More commonly said, the plot is the organisation of elements of a narrative (characters, events) that makes it possible for someone interacting with the text to follow it to a certain conclusion. By means of configuration, Ricoeur argues, a text *re*figures our understanding of the social world we live in. This notion can be related to Searle's account of the constitution of a new social reality by means of status function declarations. However, the configuration of social reality as considered by Ricoeur does not entail an analytical, "direct" but rather a hermeneutic, "indirect" mediation of the world. The world of the text and our human world intersect at the moment of refiguration (Ricoeur 1983, p. 71). Refiguration is therefore the third conceptual moment in Ricoeur's model: the moment at which the narrative circle has been closed, or rather completed, and the life world of the reader has been transformed. For our analysis of blockchain technologies, we will focus on their configurative capacities, limiting our discussion to the second conceptual moment of Ricoeur's model. At this point, we should note that, as Ricoeur acknowledges (1983, p.76), the relation between narrative structures and our understanding of the social world is a circular one. To understand this relation, we have to deal with a hermeneutic circle that consists of the stages of prefigured, configured and refigured time. However, this hermeneutic circle is, in the words of Ricoeur, a "healthy" one, "in which arguments advanced about each side of the problem aid one another" (ibid.). In other words, the organisation of the narrative structure helps us to understand the social world, but at the same time, the understanding of the social world is the basis for any new narrative structure. In what follows, we will use Ricoeur's model of configuration to conceptualise the way in which technologies can configure human social reality.

2.4 Constructing a Framework of Narrative Technologies

In this section, we present our general conceptual framework of narrative technologies that is inspired by Ricoeur's model of emplotment.[4] Like texts, technologies have the capacity to configure our narrative understanding by organising events into a meaningful whole: a plot that encompasses both humans and technologies. For instance, we can say that a car, as a technology, configures events such as "starting the engine" and "adjusting the mirrors" in a meaningful whole that includes both human and non-

[4] A first, preliminary outline of this theoretical framework can be found in a previous publication (Anonymous 2016)

human characters. Many aspects of this process of technological emplotment are related to a prefigured understanding of the world. For instance, *before* a person has ever driven a car, she might already have an understanding of the way the traffic works and of the car as a cultural artefact (including understanding of for instance the environmental impact of the use of cars and the impact for drunk-driving). Through interaction with the car, however, this prefigured understanding is *configured*; the understanding of both the traffic and the car as an artefact is altered and configured into a new understanding of the social world.[5] As such, the technology and the technological system in which it is used play active roles in shaping the way we understand our activities, experiences and relations with other people.

However, technologies do not configure our narrative understanding in only one unified way.[6] Firstly, configurations by technologies differ because some technologies (in particular ICTs) might be very similar to the paradigm of the text while others (such as a hammer) are very different from it. We capture this difference between technologies by considering to what extent they bring about a process of active configuration. Secondly, the narrative structures that technologies constitute can, like those of texts, abstract from the world of action or engage with this world of action. We capture this difference between technologies by considering the extent to which they bring about what Ricoeur designates as quasi-entities or events that are configured in a quasi-plot. Important to note is that the hermeneutic differences between technologies we establish are to be considered as differences in degree rather than categorical differences in kind (denying for instance that a technology can configure *absolute* abstracting narrative structures[7]). They function as the epistemological "relay stations"[8] with which we can examine the ontological narrative structures as configured through interaction with technologies.

The first hermeneutic distinction that we derive from Ricoeur's theory relates to the capacity of technologies to bring about an active process of configuration. Through interaction with a text, a narrative actively re-organises the pre-figured understanding a reader has of her social world (Ricoeur 1983, p.53). For instance, a reader might understand the impact of surveillance technologies in a different way by reading Orwell's *Nineteen Eighty-Four*. Similarly, we argue that a technology can actively configure the narrative understanding of the social world of a person interacting with it. A metaphorical comparison with a computer process might be helpful to illustrate this process: in the process of reading data by a computer, data are simultaneously written. This does not mean that reading and understanding of a text by a human is identical to a computer-manipulating code, as Searle forcefully showed to be incorrect by means of his "Chinese room" argument (Searle 1980). Rather, we want to make explicit the two-

[5] An existing empirical study about the narratives of older women driving cars clearly shows the dependency of the understanding of driving a car on both the "practical" narratives (narratives about the practice of driving) and "experiential" narratives (narratives arising from the experience of driving) (Siren and Hakamies-Blomqvist 2005)

[6] This ties into Verbeek's critique of Heideggerian philosophy of technology; which states that modern technologies don't disclose our being-in-the-world in a singular way as "gestell" (Verbeek 2005, p.72), but rather in a myriad of different ways; depending on the type of technological mediation they instantiate.

[7] Ricoeur deals with this "temptation" to consider "absolute" mediations in volume 3 of Time and Narrative, in which he attacks Hegel's notion of total mediation between human culture and the individual (Ricoeur 1988, p. 202)

[8] Ricoeur uses the term "relay station" to indicate an epistemological structure which enables one to proceed from one level of a hermeneutic analysis to the other (Ricoeur 1983, p.182).

sided activity of understanding the world through a text: the text is adjusted to our prefigured understanding (as a current computational state), and our understanding is consequently configured (as a configured computational state) *due* to the interaction with the text. Hence, the interpretation of a narrative implies a coinciding *active* process of mental "reading" and "writing", understood as two dimensions of the practical activity of understanding a text.

The degree of activity is determined by the extent to which a technology is similar to the paradigm of the text. Some technologies have very little in common with the paradigm of the text and for the most part play a role in our prefigured understanding. For instance, a bridge is predominantly part of a prefigured narrative structure in which events and characters are already configured into a plot: it may be a bridge to transport goods and people across the Rhine River. When a bridge gets built, it plays a role in configuring our narrative understanding (for example by disclosing new areas of a country) but soon it becomes part of our prefigured time. Such an understanding of technology ties into Heidegger's analysis of the bridge (Heidegger 1977, p. 16): the bridge has become a passive element of human culture in the course of several generations. The bridge configured the narrative understanding of the people who interacted with it once it was build, but in time became an element of their social reality that found "closure". This interpretation is in line with Joerges' point that narratives are the tools of politics, narratives in which technological artefacts play a passive role. However, some technologies *actively* configure our narrative understanding. They can simultaneously "read" and "write" our narrative understanding by bringing about a process of emplotment. Information and Communication Technologies (ICTs) are exemplary for this type of narrative technologies by being very closely related to the paradigm of the text. This can first of all be derived from their very "textual" character: many forms of human-computer interaction revolve around mediation by textual information. More importantly, though, ICTs and humans can be said to "co-author" or "co-act" the narratives they engage in. Blockchain technologies in particular are very text-like technologies, not only with regards to their superficial textual qualities (primarily understood as textual elements of their user interfaces), but also, and more importantly, with regards to the configurative capacities of their code (their capacities to *organise* characters and events in a meaningful plot). This does not refer to the actual reading of the code, for instance by a cryptocurrency developer, but rather to the narrative structures enabled by the code. For instance, interaction with the code of a blockchain technology could configure a user's narrative structures that form his understanding of "money" and "property". Thus, instead of looking at the source code in order to investigate the narrative structures it configures, we aim to look at the plot, the organisation of characters and events, as it is configured by blockchain technologies.

In order to make the notion of active configuration by technologies workable, we consider the way in which Ricoeur explains that narrative configuration can configure our understanding of the world: namely by organising the *temporality* of the plot. This organisation of temporality of a narrative depends on two distinct temporal dimensions: a chronological and an a-chronological one (Ricoeur 1983, p. 66). The chronological dimension comes about by means of an episodic sequence of events ("first this happened, secondly this happened"). This dimension is eventually directed at abolishing the human sense of temporality, according to Ricoeur (1983, p. 160) by reducing temporal experience to "simple succession". In contrast, the a-chronological dimension enables a

reader to oscillate between the narrative as a whole and separate events, to jump between different "times" (e.g. as happens in a flash back) and to create a sense of ending. The a-chronological dimension of narrative configuration consequently entails a dynamism that closes in on human temporal experience. For technologies that actively configure our social world, this means that they can either enforce a rigid temporal structure on our understanding of the social world or a dynamic one. Blockchain technologies are paradigmatic in this respect, because of their fundamental capacity for decreasing a sense of human temporality in the organisation of events they configure: reducing the activity of humans transacting with one another to a simple recorded succession of transactions (the enforced chronology of blocks added to the chain).

The second hermeneutic distinction we propose is one between abstracting and engaging narrative technologies. This distinction captures the difference between what Ricoeur conceptualises as the modes of *historical* and *fictional* narratives. Crucial to understanding the difference between these two narrative modes is the significance of historical narratives on the one hand as "standing for" something that really happened and of fictional narratives on the other hand to instantiate "imaginative variations" (Ricoeur 1988, p. 177). Thus, whereas history aims to achieve a level of strict representation of historical events, fiction aims at providing both the author of a text as well as its reader a sense of imaginative freedom, and correspondingly a sense of responsibility (the responsibility of following the plot). However, Ricoeur stresses that these two narrative modes are not absolutely separated, but are rather interwoven (Ricoeur 1988, p. 99): history always contains elements of fictional narratives and vice versa. Put differently, both history and fiction eventually adhere to the same model of narrative configuration that makes them intelligible.

We argue that the same difference in "narrative modes" (understood as a difference in degree between two extremes) can be applied to technologies, meaning that technologies can (1) configure narratives that engage people by means of bringing about imaginative variations or (2) configure narratives that are almost strictly representational ("standing for" events that *really* happened) and abstract from the world of action. A paradigm of the first kind of technologies is the video game, which can offer players a great sense of freedom (and, correspondingly, of responsibility) by offering the possibility of a multitude of imaginary variations in which the emplotment of characters and events takes place. It thereby *engages* the players with the unfolding process of emplotment. The blockchain can be regarded as paradigmatic for the second kind of technologies, because it configures the narrative structure in such a way that it *stands for* events that *really* happened. As such, the blockchain can be considered as a technology that fixates our historical narrative in the form of a public archive containing both *documents* and *traces*[9] (in the form of traceable transactions of digital objects) that stand for, or represent the past "as it really happened". However, as Ricoeur importantly notes, the term "really" is signified only through the concept "as" ("*as*" it really happened—representing a reality that has itself become inaccessible) (Ricoeur 1988, p. 155). This has the implication that in order to relate a transaction of a digital

[9] Ricoeur argues that it is "the use of documents and archives that makes the trace an actual *operator* of historical time" (Ricoeur 1988, p. 184). In other words, a trace that refers back to something that has been there in the past (such as a fossil, but equally so a validated block on the blockchain that can be "re-traced") combined with the use of documentation or an archive (such as a public ledger that links to digital objects) constitute a sense of historical time.

object found on the blockchain to the actual event of it being transacted between actual people, we have to deal with an abstraction from this actual event that took place. As Ricoeur argues, "this abstraction is a result of *forgetting* the complex interplay of significations that takes place between our expectations directed toward the future and our interpretations oriented toward the past" (Ricoeur 1988, p. 208—emphasis added). This forgetting is the main effect of the abstraction brought about by the "standing for" of a technology's narrative configuration and has important normative implications, as we will see later on.

To make this second hermeneutic distinction workable, we need to make explicit what the abovementioned process of abstraction entails.[10] Ricoeur explains that the way in which narrative structures can be made increasingly abstract is by means of constructing so-called second- and third-order entities (or quasi-entities) that are based on first-order entities, which are actual characters and events (Ricoeur 1983, p. 181). Historical narrative does so by constructing quasi-entities such as "Germany" and "First World War", which *stand for* actual characters (e.g. the German minister of foreign affairs) and events (e.g. the battle of Warsaw). These quasi-entities can be organised in a quasi-plot, which is a plot that is removed from direct interaction of characters and events. For instance, socio-cultural structures like electronic networks and exchanges are abstracted, quasi-entities that do not directly denote actual people or events. Nonetheless, any attempt aimed at explaining plots that involve theses structures will require and activity of referring-back to first-order entities: it will require narratives about actual characters that act within a first-order plot. In line with Ricoeur's theory, we can say that abstracting technologies remove themselves from the realm of action by configuring quasi-characters and quasi-events in a quasi-plot. Blockchain technology and monetary technologies that are built on it organise not so much humans and direct interactions between them, but rather quasi-characters and quasi-events (Ricoeur 1983, p. 181). That is, they organise quasi-characters such as "addresses" and "exchanges" and quasi-events such as "transactions" in quasi-plots, such as "mining a block".

To illustrate how Ricoeur's framework assists us to understand the way in which technologies abstract from the world of action, we can think of a construct in the financial world that is known as a *derivative*. The construct of a future—a specific type of derivative—was already used in 1730 in Japanese rice markets (Takatsuki 2008) and has evolved into one of the major financial products that are currently traded in the global digital economy (Pryke and Allen 2000). A future is a contract with a price agreement between two parties, based on the buying or selling of an asset at a specific moment in the future. For instance, a rice farmer in Japan might agree with a derivative trader that she is guaranteed to sell his future harvest at a certain price. This allows the trader to bear some of the risk of the rice farmer (the harvest might fail, in which case the income of the farmer is still guaranteed) and at the same time make a profit on it by spreading out her own risk amongst multiple farmers. A derivative is a typical example of a linguistic construct that abstracts from the world of action (the farmer who tries to survive by harvesting from his lands) by constructing quasi-entities (e.g. derivative exchanges, credit risks). These are quasi-entities because similar to quasi-entities in

[10] As Ricoeur also suggests, modern technologies render "time" itself abstract: the machines that measure time, such as digital clocks but the blockchain as well, enable an "abstract representation of time" (Ricoeur 1983, p. 63).

historical narrative (e.g. "Germany", "the Iron Curtain"), they configure our understanding of the world without disclosing their mediation of the world of action. That is, when a local derivative exchange goes down, a referral-back to the world of action needs to be made in order to explain the event (for instance: a severe drought that destroyed the harvests of all rice farmers who were securing their livelihood through derivative contracts). As Pryke and Allen argue, in our contemporary world in which derivatives as linguistic contracts have merged with digital technologies, they reflect a cultural shift that is an "outcome of a transformation in our experience of everyday temporal and spatial co-ordinates" (Pryke and Allen 2000, p.282). Derivatives have become technologically mediated contracts that automatically respond to changes in the quasi-plots they configure (e.g. price fluctuations, risk indicators), thereby increasingly obscuring their configuration of the world of action. However, as the financial crisis in 2008 has shown us, a referral-back to the world of action, of families losing their income and therefore being unable to pay their mortgage, was necessary to explain how the abstract complexities of derivative trades could have contributed to a global financial catastrophe (Hellwig 2009).

In addition to the two hermeneutic distinctions that characterise narrative configuration by technologies, we need to account for the difference between the prevalence of narratives *about* technologies and narratives *configured by* technologies. This is not a hermeneutic distinction characterising the configuration by technologies as such, but rather a classification of the *position* of a narrative structure as being either *proximate* or *remote* from the actual human interaction with a technology. We refer to this difference, which does not apply to the kinds of technologies but to the position of the human interacting with them, as *interpretative distance.* To draw an illustrative comparison that can assist in understanding this distinction, consider the narrative configuration of George Orwell's *1984* and the commentaries related to this configuration. By reading the book, one's ideas about the role of technologies in modern society might be configured. Even though only a reader of the narrative engages in the process of narrative configuration, commentaries *about* the narrative configure narrative structures of the same form (for instance by stating the term *Orwellian technology* in an academic article) that nonetheless are different in contents because they are farther removed from the original reading. Similarly, there is a difference in understanding of the narrative configuration by blockchain technology between a developer who works with its code (being very proximate to the narrative configuration of the technology), its user who interacts with a blockchain-based application interface and a person who only hears or reads *about* the technology without having used it (being remote from the narrative configuration).

Carr captures this difference we call "interpretative distance" by conceptualising two types of narratives as the *practical* "first-order" narrative (narratives configured by technologies), and the "second-order" narrative (narratives about technologies) that have the same subject but a different aim, namely an aesthetic or cognitive one (Carr 1986, p.131). This distinction reflects Ricoeur's distinction between "commentary" (which can be a text *about* a narrative) and a narrative configuration itself (Ricoeur 1985, p.68). Even though both these types of narrative structures have the same form, or in Ricoeur's terms the same *schematism*, and are therefore fundamentally interrelated, we need to distinguish between them because they denote an interpretative distance between humans and technologies that can lead to differences in power and understandings of the world. That is, the more a

technology is accessible and the more one interacts with it, the more proximate one gets to the first-order narrative configuration by technologies. For instance, a layperson who is mildly interested in blockchain technologies has significantly less power in co-authoring the narrative structures of blockchain technologies and a *different*[11] understanding of them than a core developer of Bitcoin. This is not to say that those people interacting with first-order narrative structures *necessarily* have a greater power over the narrative configuration of the technologies, compared to people who only interact with second-order narrative structures. For instance, a layperson in a powerful political position can enforce regulations that strongly influence the prefigured narrative understanding in which the design of blockchain technologies takes place. Rather, we refer to what Foucault designates as the authority of expert knowledge (Philipps 1996) as an attribute of those people interacting with first-order narrative structures of blockchain technologies. According to this understanding of power, people who are proximate to the first-order narratives are powerful in the sense that they have acquired the capacity to co-author the process of emplotment. A powerful regulator, when being far removed from the first-order narrative, would not have this power to intentionally co-author the process of emplotment, but only to change the prefigured circumstances in which it takes place.

Before we proceed to the next section, it is important to stress that no *direct* normative judgement can be derived from the two hermeneutic distinctions and the distinction between interpretative distances. Whether active or passive and abstracting or engaging technologies can be considered as normatively positive or negative cannot be a priori determined but has to be interpreted in the context of the narrative structure they configure.[12] Moreover, even though for instance the accessibility of first-order narrative configuration by nuclear technologies and interaction with those technologies is highly restricted, this seems to be a beneficial thing. In a similar vein, the high accessibility of the first-order narrative configuration by bicycles and high level of interaction with them can be said to be very beneficial.

3 Applying the Framework of Narrative Technologies to Understand Technological Mediation of the Blockchain

Now, we have presented the ontological framework of narrative technologies; we can proceed to utilise it in order to analyse how blockchain technologies configure our social reality, focussing on the illustrative example of cryptocurrencies. As a result of this analysis, we will not only be able to explicate the mediating roles of cryptocurrencies in a descriptive manner, outlining what cryptocurrencies *are*, but more importantly in a normative manner, outlining what they *do*: how they configure our social reality.

[11] We explicitly refer to the *difference* in understanding of the narrative structure, rather than for instance to a *lesser* understanding of a layperson. In certain cases, a certain remoteness from technological narrative configuration might actually help inform the human about important hidden aspects of this configuration (think for instance about the position of game addicts vis-à-vis non-addicted non-gamers).

[12] This is based on a broader understanding of what Ihde designates as the understanding of the "use-context" of technologies (2009, p. 33).

3.1 First Hermeneutic Dimension: the Active Narrative Configuration of Cryptocurrencies

Firstly, we investigate how cryptocurrencies configure our narrative understanding both passively (as elements of our prefigured narrative understanding) and actively (as technologies that actively configure characters and events in a plot). To analyse the prefigured time in which cryptocurrencies play a role, we have to consider cultural "repertoire" out of which they emerged, which means that we need to consider the narratives that surrounded the world of money and finance at the birth of the blockchain.[13] As Cameron argues, our understanding of the monetary system is thoroughly shaped by narrative structures. In the last decade, particularly after the financial crisis in 2008, these have been placed in the greater context, or quasi-plot, of the global financial crisis. Cameron forcefully shows how abstract financial processes have been broken down into narratives about people (bankers, traders) that are characterised as "Gods" and "demons" (Cameron 2015, p. 12), assigning strong ethical qualities to these characters. Systems that were perceived as being ruled by abstract rational calculations turned out to be embedded in a narrative structure incorporating characters with strong ethical qualities. The wake of cryptocurrencies can be interpreted as being embedded in these global, prefigured narratives. One of the major catalysing factors in the development of Bitcoin was the political blockade of Wikileaks by the world's major payment companies (Roio 2013, p. 4). On the one hand, this blockade fuelled a narrative structure that laid bare the roles these financial companies play, which showed that the assumed neutrality of the monetary system was illusory. On the other hand, the emergence of Bitcoin configured this narrative understanding by presenting an alternative based on two distinct features: the decentralisation of power and the delegation of trust from legal authorities to the authority of the blockchain protocol.

The emerging narrative or socio-technical imaginary as Jasanoff puts it (Jasanoff 2015) was based on prefigured narratives of the disillusions brought about by the conventional financial system and the socio-technical promises of cryptocurrencies as being part of a "libertarian dream" (Karlstrøm 2014). Cryptocurrencies are thus part of a prefigured understanding with ethical and political qualities, in which different narratives *about* the technology compete (Dawson and Buchanan 2005). Unlike with the example of the bridge we discussed earlier, the prefigured understanding of blockchain technologies is not yet part of a passive cultural repertoire. We can illustrate this by observing how the developers of Ethereum, which is a platform for creating all sorts of decentralised, blockchain-based applications, describe their most recent creation: the DAO—a first full-scale implementation of a decentralised autonomous organisation. They describe it as a "blockchain congress" in which humans and artificial agents *together* organise their worldly relations (Ethereum 2016). By offering such narratives, the Ethereum developers play an important role in transforming the

[13] The careful observer will have noted that we provide only a very limited account of the prefigured understanding of cryptocurrencies, since other cultural "repertoires" (as formed by e.g. the cypherpunk movement or the scientific community working on cryptography) are left out. As mentioned in the previous section, we focus on the stage of narrative configuration and less so on the stage of narrative prefiguration in this paper. This passage is meant to illustrate the relevance of including the narrative prefiguration in order to gain a holistic understanding of the narrative configuration, as well as to reply to important findings of the earlier mentioned STS literature.

prefigured technical imaginary of blockchain technologies: envisioning its promises in sometimes-utopian futures. However, their interpretations of blockchain technologies have recently been confronted by other narratives in the context of the so-called "DAO attack", which we will discuss at a later point.

Next to analysing the prefigured time of cryptocurrencies, our framework of narrative technologies helps us to explicate that cryptocurrencies actively configure our narrative understanding.[14] In line with Dupont, we argue that the reason why cryptocurrencies can be said to be *active* narrative monetary technologies is because they can actively "modulate" the social order of humans and things (DuPont 2014, p.7). To assess what kind of active configuration cryptocurrencies bring about, we have to consider how they organise the temporal dimensions in the plots they configure. This analysis relates to a fundamental problem that blockchain technologies aim to solve: the so-called "timestamping problem", which is the problem of validating the chronological order of transactions (Van Rompay et al. 1999). By time-stamping transactions and adding them in a fixed, irreversible order to the public ledger, cryptocurrencies enforce the chronological time dimension in the narrative structure of transactions. Based on the previous analysis, we can argue that they therefore render the a-chronological dimensions of the transactions increasingly obsolete by enforcing chronological time into their systems. This process configures our understanding of "making a transaction" from an organisation of events with no fixed order that can be reversed, to one with a fixed order that is irreversible. However, we emphasise that this configuration of the temporal aspects of transactions remains subject to the "fallibility" of empirical reality. Cryptocurrencies can be said to move *towards* the ideal of abolishing the a-chronological temporal dimension, but are not free from practical flaws, illustrated for instance by Bitcoin's "transaction malleability" (Decker and Wattenhofer 2014). This is in accordance with Ricoeur's argument that even though texts can enforce a rigid, chronological narrative structure, they always retain dynamic, a-chronological aspects: aspects that can undo the order enforced by the technology.

How could this active configuration of our human time by blockchain technologies affect our understanding of social reality? By allowing transactions to be delegated to blockchain technologies, and therefore increasingly getting rid of the a-chronological dimensions of inter-human exchange, our social relations are transformed in such a way that they become rigid, irreversible and non-negotiable. For certain social relations such as financial transactions, this level of rigidity can be beneficial for it prevents cases of fraud, counterfeiting and "creative bookkeeping". However, as Ricoeur shows, the consequent decrease of a dynamic understanding of temporality reduces the freedom and the responsibility of humans interacting with the blockchain. In the case of social relations that rely on free and responsibly acting humans, for instance relations between caregiver and caretaker, the application of blockchain technologies might have disempowering effects. Inter-human relations might become "entangled" in their technological dependency as argued also by Hodder (Hodder 2014). We would regard the transactions or the contracts mediated by the blockchain technology as the rigid

[14] In line with Winner (1980), we thus argue for a stronger sense in which technologies configure our social reality. It is the configurative capacity of the artefacts and the technologies themselves (the extent to which they are similar to the paradigm of the text), next to the discourse that surrounds them, which shapes our social reality. However, since we argue that narrative structures are co-shaped by humans and technologies, we denounce Winner's technological determinism.

end-points of our relations with other human beings, rather than intermediate relay stations. In case a contract is formally breached, the blockchain protocol functions as the arbiter: its acceptation or rejection of a transaction functions as the final verdict without a question being asked as to whether the transaction is desirable in the first place, given the social context in which it took place. For instance, a health insurance policy based on blockchain technology could automatically block coverage according to automatically detected violations of the "smart contract", disregarding the personal contexts affected by the technology's configurations.

3.2 Second Hermeneutic Dimension: the Abstracting Narrative Capacity of Cryptocurrencies

Secondly, we can use our framework to investigate how cryptocurrencies configure abstractions from the world of action they mediate. Georg Simmel already mentioned this process of abstraction in his classical account of the cultural impacts of financial technologies in his work *The Philosophy of Money* (Simmel 1900). In this work, Simmel questions the processes of abstraction (what he refers to as "distancing") that accompanied the development of modern money (Simmel 1900, p. 4). According to Simmel, there is a "profound cultural trend" Simmel (1900, p. 148) towards the quantitative; money is part of that trend in so far as it becomes "pure quantity in numerical form" (p. 150). Because of this trend, money moves away from the world of action of consuming, producing and trading people. We can reframe Simmel's account of money to understand the abstraction brought about by cryptocurrencies by using our conceptual framework of narrative technologies. As we argued, blockchain technologies move towards a configuration of social reality that is strictly representational, meaning that the blockchain itself aims at configuring history of actual transactions between people *as* they really happened. However, the narrative mode involved in this configuration (one that is similar to what Ricoeur designated as the historical narrative mode) inherently brings about an abstraction from the world of action it represents. As Ricoeur indicates, this process of abstraction, which involves the replacement of first-order entities and events (e.g. actual people engaging in actual trades) by quasi-entities and events (addresses engaging in transactions and nodes validating these), has as its primary effect a *forgetting* of the complex interplay of significations that configured the emplotment of the first-order entities and events. We can analyse the normative implications of this process of forgetting by looking at the way in which cryptocurrencies configure narrative structures that abstract from the world of action they mediate.

The notion of "trust", abstracted from the world of action by cryptocurrencies, is central in this analysis. Nakamoto put the notion of "trust" at the centre of the decentralised architecture of Bitcoin, though without offering a clear explication of its meaning (Nakamoto 2008). One of the core intentions of his design of the blockchain was to render the trust in first-order entities—the complex and messy trust that defines the human social world—obsolete. In modern times, trust in first-order entities such as people and material goods has already increasingly been replaced by trust in a more abstract monetary system. As money dematerialised, trust increasingly depended on what was written down and recorded (Coeckelbergh 2015b). We argue that blockchain technology goes beyond this abstraction due to dematerialisation, by turning trust between people (first-order entities) into trust in decentralised

technological systems (quasi-entities). Dupont and Maurer strikingly illustrate this point in their discussion of smart contracts, which are computational mechanisms executed on a blockchain that enforce rules of interaction between different nodes. It is argued that smart contracts replace the "difficult social and psychological work of contracting with self-executing code" (Dupont and Maurer 2015). In line with this claim, we argue that the acts of negotiating and discussing a contractual agreement between first-order entities in the world of action is rendered abstract in a smart contract by the configuration of quasi-entities (e.g. addresses included in the smart contract) and quasi-events (e.g. the price of a certain digital asset rising above a pre-determined threshold) in quasi-plots (such as a rule-governed execution of the smart contract). The first-order narrative that a smart-contract *stands for* is forgotten in this process: the quasi-plot of the smart contract eventually configures the narrative structures that mediate our social world.

However, we also showed that this process of abstraction is never absolute (thereby denouncing a form of determinism). In line with Ricoeur, we argue that any attempt to *explain* abstract processes configured by blockchain technologies will always involve a referral-back to first-order entities, an explanatory process that Ricoeur refers to as "retrodiction"[15] (Ricoeur 1983, p. 135). This especially happens whenever a cryptocurrency system "breaks down" due to technological limitations, suffers from attacks on cryptocurrency exchanges or is affected by other unintended factors. At such moments, the narrative structure of first-order entities (traders, programmers, users) and their normative roles is revealed. In line with Heidegger, we can say that abstract entities configured by the blockchain are only revealed when the technologies break down and become "present at hand", when the trust in the computational system is eroding. Heidegger writes in *Being and Time* about the "conspicuousness" of tools that lose their usefulness; they are then stared at as "something objectively present" (Heidegger 1996, p. 69), becoming a technology that we are unable to put our trust in anymore. We illustrate this point by referring to the recent attack on the so-called "DAO", which, as we mentioned earlier, is the first full-scale implementation of the idea of a decentralised autonomous organisation. By exploiting a systemic weakness in the system, an attacker was able to obtain an amount of cryptocurrency (Ether) that at the day of the attack had a market value of approximately 60 million Dollars. This attack created friction in the community of users and developers of the DAO, with some arguing in favour of keeping intact the abstraction brought about by the system (arguing that developers should not interfere with its basic design) and the others arguing that the community should "rewrite history" by interfering in the blockchain's basic design and thereby countering the attack (Reutzel 2016). This event clearly shows how the abstraction brought about by the blockchain is challenged by the community that built it by *referring back* to the world of action, of complex significations and intent. Moreover, it reveals an important normative implication of the narrative configurations of blockchain technologies, namely that they result in a *forgetting* of the complex significations that exist in the world of action that they configure. This

[15] That is, to explain the narrative configuration of the blockchain, we "do not authorise prediction, but rather *retrodiction*, in the sense that, beginning from the fact that something has happened, we infer, backward through time, that the antecedent necessary condition must have occurred and we look for its traces in the present" (Ricoeur 1983, p. 135—emphasis added). This implies that we have to refer back to the world of action to explain abstracted narrative configurations.

means that the intentions of the people interacting with one another through blockchain technologies can become hidden, which reduces normative judgements to either the acceptance of rejection of transactions by the blockchain.

3.3 Interpretative Distances of Blockchain Narratives

Thirdly, we need to take into account the interpretative distance between "commentaries" of blockchain technologies (second-order narratives about the technologies) and the narrative structures that arise from active configuration by blockchain technologies (first-order narratives).[16] We can observe for instance significant differences between regulatory frameworks that can be seen as second-order narrative structures of blockchain technologies (De Filippi 2013), between Bitcoin developers, Bitcoin users and policy makers in different countries. Regulators disagree about the extent to which Bitcoins can be legally regarded as commodities, as electronic money or intangible assets and in which way taxation should play a role in setting up regulatory schemes for cryptocurrencies. In the words of Pinch and Bijker, we could say that no "closure" has yet been reached in the regulation of Bitcoin (Pinch and Bijker 1984). However, rather than saying that closure is a process of converging narratives *about* the technology of different social groups, we argue that narratives configured by the technology significantly add to this process. We need to remember that commentaries such as regulatory regimes do not directly impact the technology design of the blockchain, but that this can only happen through the involvement of "proximate" first-order narrative structures (developers re-designing the technology). Because for blockchain technologies, no closure has yet occurred, interpretative distances might change substantially in the future, which means that the following analysis can merely serve as a preliminary one. We argue that at least when considering the current state of affairs, both the accessibility of the technology (with regards to regulatory restriction, but also sufficient technical competences) and the degree of interaction with it are indicative of the interpretative distances of cryptocurrencies. The first-order narrative configuration by blockchain technologies seems to be very accessible to developers of cryptocurrencies, who also intensively interact with the technologies. Their narrative understanding of cryptocurrencies is mostly shaped by active configuration of the blockchain protocol: working with the code and its applications on a daily basis. In contrast, the first-order narrative structure is much less accessible to an interested layman who has neither ever made a transaction nor has knowledge of the way in which the technology is able to shape our social reality. We can discuss the normative aspects of these differences of access to and interaction with the technology between different people.

At the moment, a relatively small number of people, primarily belonging to the cryptocurrency developer community, have a high level of access to and interaction with the narrative configuration by blockchain technologies. A growing number of users of cryptocurrencies—people actually performing cryptocurrency transaction—have gained considerable levels of access and interaction as well, experiencing the

[16] We should not confuse the distinction between first-order entities in a plot and second- and third-order entities in a quasi-plot, with the distinction between first- and second-order narratives at this point. The first distinction indicates a feature of the hermeneutic "schema" that functions as basis for understanding any narrative configuration by technologies, while the second distinction indicates the distance between the narrative configuration by the technology and the interpreter.

ways in which the understanding of transactions and systemic trust are configured. However, a vast number of people have a narrative understanding of cryptocurrencies that is predominantly configured by second-order narratives (about the technology). They might have interacted with narratives about Nakamoto's mysterious virtual money, the dubious use of Bitcoins on Silk Road and the scandal of the collapse of the Mt. Gox Bitcoin exchange (Decker and Wattenhofer 2014), but have not interacted with the technology itself. As argued before, no direct normative implications can be derived from the current state of the interpretative distances to the first-order narrative configuration of cryptocurrencies. However, since we have shown that blockchain technologies such as cryptocurrencies can potentially have significant impacts on the way our social relations are configured, a case can be made for the need to democratise the design and application of blockchain technologies to increase accessibility and interaction. If the blockchain can really configure our social reality as a "techno-leviathan" (Scott, 2014), in which case it would be a highly political technology, we would want more people to understand and interact with it. This can be done by both improving "cryptocurrency literacy" through education, but also by subjecting the governance of cryptocurrency design to a greater level of democratic scrutiny.

4 Concluding Remarks

"All the world's a stage, and all the men and women merely players" (Shakespeare 1623, p. 52). These words of Shakespeare remind us of the importance to consider the impacts technologies have on the narratives that shape our lives. As Agre (2003) argues, technological developments are usually "wrapped in" stories, or narrative structures that are not just technical but also encompass collective ideas of how should build our societies, our institutional reality. In this article, we focussed on blockchain technologies and showed that they are not merely "narrative" in the sense that they are part of the stories that we—as persons, communities and societies—tell *about* them. Blockchain technologies do much more: they configure the narratives through which we understand our social reality. To arrive at this claim, we offered an original interpretation of Ricoeur's narrative theory: applying his notion of narrative configuration to our understanding of technological mediation. Utilising the resulting framework of narrative technologies, we came to the following analyses concerning the ways in which blockchain technologies configure our social reality:

- Blockchain technologies actively configure our understanding of social reality. They do so by enforcing the chronological temporal dimension in the organisation of characters and events. This renders social relations increasingly rigid, at the cost of a loss of dynamism and consequently of a sense of freedom and responsibility.
- Blockchain technologies configure narrative structures that abstract from the realm of action. They do so by constructing quasi-entities in quasi-plots that stand for events as they actually happened. This leads to a forgetting of the configuration of first-order entities, which can be recovered through retrodiction.
- Blockchain technologies configure distances between second-order narratives about the technology and first-order narratives arising from the active configuration by the technology. This can lead to distances in understanding and power between people

only involved in the second-order narratives and those—especially people belonging to the developer communities—involved in the first-order narratives.

These analyses reveal the normative implications of blockchain technologies by making explicit how they configure our social reality. However, they do not amount to a full-fledged ethical or political evaluation of blockchain technologies: we did not confer a judgement on the types of configurations brought about (whether they can be said to be positive or negative). To conclude, we engage in some initial suggestions that could inform future investigations into the ethical and political implications of blockchain technologies.

First, we should stress that even though our analyses show that we should be critical about the ways in which blockchain technologies are applied, they do have the capacity to bring about certain distinctly positive contributions to our societies. In line with Simmel, we argue that the positive implications of abstracting monetary technologies such as cryptocurrencies lie in their capacity to emancipate and empower people. If social relations become less personal, then this also renders them more free: relations become a matter of choice and technologies like cryptocurrencies become a guarantee for people's inclusion in the realm of economic exchange, regardless of their personal, racial or cultural background and status. This ties in with the promise of decentralisation that is configured by the blockchain. Decentralisation of a currency entails a "de-personalisation" of power: the technology makes it difficult for single human agents to subject others to their will within the system. Moreover, the blockchain technology enables people to communicate and transact with one another from any location; they firmly reduce physical-geographical boundaries. For this reason, it is said that cryptocurrencies could empower people to gain the benefits from financial services in developing countries that have so far been secluded from access to banking services (Clegg 2014).

Secondly, we should discuss the potential of blockchain technologies for bringing about negative ethical and political implications. As we argued, the potential for emancipation brought about by blockchain technologies comes with a price, namely that even though entering into social relations becomes more of a question of choice, the social relations themselves become rigid. This can be beneficial in some social contexts, notably those that require rigid interactions (e.g. in the contexts of financial services and property registers), but would arguably be very harmful in other contexts (e.g. in the contexts of human care and education). Especially for social contexts in which there is a necessity for human freedom and responsibility in shaping social interactions, the application of blockchain technologies will probably be very undesirable.

Moreover, we argue in line with Simmel that the abstraction from the narrative of inter-human exchange comes with a cost. By delegating the trust in transactions from first-order entities to quasi-entities, the intentions of people acting through the system are delegated to the level of the system itself—thereby hiding the realm of action that is affected. Whatever kind of transaction one performs through the system, the primary normative check is whether the system accepts or declines it. What kind of transaction is performed (which can be a "good" or a "bad" transaction) becomes irrelevant. This can have significant effects on power-relations between people and institutions. With trust being delegated to the quasi-entities of the cryptocurrency system, power struggles might arise, first between cryptocurrency networks and states but more importantly perhaps between new and existing systems. While already banks are investing huge

sums of money in blockchain technology (Samman 2015) and cryptocurrencies might be viable forms of state currencies (Malefijt 2014), it is uncertain whether the decentralised features of the technology will also result in decentralisation of institutional power. Since the ability for social control (by means of active configuration by the technology) is optimised within a cryptocurrency system, the question of who controls the system remains of pivotal ethical and political importance.

What our investigation shows is that our understanding of blockchain technologies is not merely a technical matter, but that it strongly relates to the ways in which we normatively construct, or rather configure our social world. Future discussions of these technologies should therefore explore how we can implement them in a way that empowers people but that also leaves room for mitigating the potential dangers they bring about. This will require investigating how the governance of the design and use of these technologies can be improved, for instance by looking at ways in which the design process can be organised in a more democratic way.

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