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CAN PERMISSIONLESS BLOCKCHAINS BE REGULATED AND RESOLVE SOME OF THE PROBLEMS OF COPYRIGHT LAW?

Guido Noto La Diega and James Stacey[*]

Abstract. In October 2018, the European Parliament passed a resolution on distributed ledger technologies that recognised blockchains' potential to disrupt copyright and creative industries. The aim of this chapter is to examine blockchain technologies and provide an assessment of their disruptive potential upon the legal sphere of intellectual property, and in particular copyright in the music industry. In order to do so, this chapter will start off by clarifying that *the* blockchain does not exist, because there are several different types of blockchains and, accordingly, different legal and regulatory issues are involved. After identifying the type of permissionless blockchain that is analysed in this chapter – that is permissionless, Turing complete, open, distributed, peer-to-peer, transparent, tamper resistant and censorship resistant –, we move on to identify the definitional and non-definitional features of blockchain technologies. For the blockchain to unleash its disruptive potential, it must be clarified whether it complies with existing laws and whether new regulations are needed. Should existing regulations be found insufficient, only then a serious discussion around new regulations could be started and this should take into account the necessity not to stifle innovation, the level of development of the relevant technologies, the importance of involving all the stakeholders and to place the discussion at a supra-national level. The focus of the chapter is to critically assess whether public permissionless blockchains can be used to disrupt intellectual property law by resolving some of the problems in copyright law, with particular regard to the issues of copyright registration, infringement, and transactions. It will be shown how the blockchains can resolve the registration issues by allowing forms of tamper-resistant, censorship-resistant, user-friendly, and privacy-friendly copyright registration. As to infringement, the blockchains can prevent it by making it easier for copyright owners to track the use of their works and for music consumers and new intermediaries such as Spotify and iTunes to identify the owners, seek a license, and pay the royalties. Finally, smart contracts could be used to automate licensing and as forms of digital rights management, but this could be criticised from an efficient breach perspective, as well as by pointing out the difficulties of this technology in coping with copyright exceptions or defences. It is perhaps too soon to conclude that a 10-year-old technology will ultimately disrupt copyright, but there are already some indications that the Ethereum-type blockchains' features will radically change copyright by fixing some of its most urgent problems.

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1. Introduction

In October 2018, the European Parliament passed a resolution[1] on distributed ledger technologies that recognised blockchains' potential to disrupt copyright. The aim of this chapter is to examine blockchain technologies and provide an assessment of their disruptive potential upon the legal sphere of intellectual property, and in particular copyright in the music industry. In order to do so, this chapter will start off by clarifying that *the* blockchain does not exist, because there are several different types of blockchains and, accordingly, different legal and regulatory issues. After identifying the type of permissionless blockchain that is analysed in this chapter, we move on to identify the definitional and non-definitional features of blockchain technologies. For the blockchain to unleash its disruptive potential, it must be clarified whether it complies with existing laws and whether new regulations are needed. Should existing regulations be found insufficient, only then a serious discussion around new regulations could be started and should take into account the necessity not to stifle innovation, the level of development of the relevant technologies, the importance of involving all the stakeholders, and to place the discussion at a supra-national level. The focus of the chapter is to critically assess whether public permissionless blockchains can be used to disrupt intellectual property law by resolving some of the problems in copyright law, with particular regard to the issues of copyright registration and infringement. It will be shown how the blockchains can resolve the registration issues by allowing forms of tamper-resistant, censorship-resistant, user-friendly, and privacy-friendly copyright registration. As to infringement, the blockchains can prevent it by making it easier for copyright owners to track the use of their works and for music consumers to identify the owners, seek a license, and pay the royalties. Finally, smart contracts could be used to automate licensing and as forms of digital rights management, but this could be criticised from an efficient breach perspective, as well as by pointing out the difficulties of this technology in coping with copyright exceptions or defences. It is perhaps too soon to conclude that a 10-year-old technology[2] will ultimately disrupt copyright, but there seem to already emerge some indications that the blockchains' features of being

[1] European Parliament resolution of 3 October 2018 on distributed ledger technologies and blockchains: building trust with disintermediation (2017/2772(RSP)).

[2] The foundations for the blockchain were laid out by Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system.

permissionless, distributed, transparent, without a single point of failure, tamper-resistant, and peer-to-peer will radically change copyright by fixing some of its more urgent problems.

2. Does the blockchain exist?

Arguably, *the* blockchain does not exist; there are several different types of blockchains, each with different legal issues.

This said, a good starting point is the technological overview presented by the US National Institute of Standards and Technology (NIST) in October 2018.[3] Blockchains are defined as 'distributed digital ledgers of cryptographically signed transactions that are grouped into blocks.'[4] After an agreement is reached on the validation of a new block, the latter is added to the chain and cryptographically linked to the previous one. The participants will notice if someone tries to tamper with a transaction inscribed in a block (tamper evidence) and the older a block is the more difficult it is to tamper with it (tamper resistance). The distributed character of the blockchains derives from the fact that every participant has a full copy of the chain and 'new blocks are replicated across copies of the ledger.'[5] However, not all blockchains are fully distributed. Indeed, a major distinction in this field is between permissionless blockchains and permissioned ones. The main example of the former is BitCoin where every user can view all the transactions, has a full copy of the chain, and in principle has the same power as the other participants (peer-to-peer). Permissioned blockchains, in turn, are not peer-to-peer, disintermediated, and fully transparent because there are administrators or consortia granting user permissions.[6]

This chapter focuses on a permissionless blockchain that it is open, distributed, peer-to-peer, transparent, tamper resistant and censorship resistant. The resistance to censorship derives from the lack of a central point of failure; being distributed, it is virtually impossible to take down content, because even if a node

[3] Dylan Yaga, Peter Mell, Nik Roby, and Karen Scarfone, *Blockchain Technology Overview* (NIST 2018).
[4] Ibid 1.
[5] Ibid 1.
[6] Ibid 53.

goes down, the rest of the network still stands.[7] The blockchain whose legal issues we are exploring is not, however, a BitCoin-type blockchain. Indeed, even though we are referring to a permissionless technology, since we want to apply it to be multi-purpose, we have in mind an Ethereum-type blockchain.[8] The latter is Turing complete and therefore more versatile than the BitCoin, which can be used only for simple transactions and does not allow users to build smart contracts – protocols to automatically execute actual contracts[9] – on top of it.[10]

3. Core and Non-definitional Components of Blockchain Technologies

It is important to note that there are differing opinions as to which features of blockchain technology are strictly definitional and not subject to change.[11] However, this chapter is of the opinion that 'blockchain technology' is actually an umbrella term for three distinct technologies combined, not all of which will remain apparent in every deployment of blockchain-based applications.[12]

The first of those three technologies is the blockchain itself, as a way to structure data. What makes a blockchain unique is its use of cryptography. By utilising certain cryptographic functions a blockchain is able to create a persistent, tamper-evident record of any item of data, and authenticate the identity of the parties involved in each transaction.[13] Unsurprisingly, a blockchain is a definitional feature of

[7] See Sermpinis, Thomas, and Christos Sermpinis. "Traceability Decentralization in Supply Chain Management Using Blockchain Technologies." *arXiv preprint arXiv:1810.09203*(2018).
[8] Cf. Nathaniel Popper, 'Understanding Ethereum, Bitcoin's Virtual Cousin' (*The New York Times*, 2 October 2017).
[9] On the limitations of smart contracts see Mik, E. (2017). Smart contracts: terminology, technical limitations and real world complexity. *Law, Innovation and Technology*, *9*(2), 269-300.
[10] Cf. Brent, Lexi, Anton Jurisevic, Michael Kong, Eric Liu, Francois Gauthier, Vincent Gramoli, Ralph Holz, and Bernhard Scholz. "Vandal: A scalable security analysis framework for smart contracts." *arXiv preprint arXiv:1809.03981* (2018).
[11] Joshua A.T. Fairfield, 'Bitproperty' (2015) 88 (4) SCL Rev 805, 808 Considers the fact that a 'Distributed public ledger …does not require trust in other parties or in a central list authority' to be a definitional feature; Kevin Werbach and Nicolas Cornell, 'Contracts Ex Machina' (2017) 67 (2) Duke Law Journal 313, 326 also considers a 'distributed ledger of transactions' to be synonymous with a blockchain.
[12] Thijs Maas, 'What is Blockchain Technology?' (*Lawandblockhain.eu*, 21 June 2017) <www.lawandblockchain.eu/post-template/> accessed 29 January 2018.
[13] UK Government Chief Scientific Adviser, *Distributed Ledger Technology: beyond block chain* (Government Office for Science 2017) 17.

blockchain technology that will be apparent in each and every blockchain application.[14]

The second element is the network. Early applications of blockchain technology such as Bitcoin and Ethereum operate on a publicly visible, permissionless blockchain that is distributed across a peer-to-peer network.[15] In that, anything that happens on a blockchain is a function of the network as a whole. A network of computers known as 'nodes'[16] manage the network jointly, meaning that there is no central authority.[17] In this type of blockchain, anyone can become a node and the entire contents of the blockchain are publicly visible. However, this is not to say that every application of blockchain technology will be this way. Distributed peer-to-peer networks, or those that are public or permissionless may not be necessary or even permissible in certain circumstances. Alternative applications include networks that are 'private' or 'permissioned', where participation is limited to a certain group of users and can only be viewed by specified parties. It is often predicated that the blockchain is a trustless system,[18] in that participants can transact without necessarily trusting each other and without intermediaries (e.g. banks). However, this can be said only with regards to permissionless blockchains. In permissioned blockchains, conversely, there is likely to be an aspect of trust among the users required as there will be some element of 'centralisation'.[19] Venture capital-backed Ripple is one example of a blockchain application that has amended the underlying technology to operate in an environment where a degree of trust is required for transactions to be validated.[20] Governments are also exploring the idea of blockchains using a

[14] Thijs Maas, 'Blockchain: the 3 Core Components' (*LinkedIn*, 24 October 2017) <www.linkedin.com/pulse/blockchain-3-core-components-thijs-maas> accessed 29 January 2018

[15] Jean Bacon and others, 'Blockchain Demystified' (2017) Queen Mary University of London, School of Law Legal Studies Research Paper No. 268/2017 4 <https://ssrn.com/abstract=3091218> accessed 29 January 2018.

[16] These are the computers that are connected to the blockchain network. All blockchain-based applications are made up of nodes. However, who can become a node, and the level of involvement that is permissible by each node will differ depending on the type of blockchain application deployed. Nodes store a local copy of the blockchain. 'Full' nodes store a copy of the blockchain in its entirety, while 'light' nodes only hold a portion of the blockchain needed to verify transactions, Bacon (n 14) 11.

[17] Ameer Rosic, 'What is Blockchain Technology? A Step-by-Step Guide for Beginners' (*Blockgeeks*, 2016) <https://blockgeeks.com/guides/what-is-blockchain-technology/> accessed 3 February 2018.

[18] Yaga (n 2) 38 underlines, however, that trust is needed even in supposedly trustless systems, e.g. trust in the cryptographic technologies and that users are not colluding in secret. For other critical remarks, see Carl, Uggla, and Hallström Carl-Johan. "Is It as Trustless as They Say?: A Functional Analysis of the Blockchain and Trust." (2018).

[19] Bacon (n 14) 6.

[20] UK Government Chief Scientific Adviser (n 11) 18.

centralised trusted third party. Estonia for example has utilised blockchain technology since 2012 to help maintain the integrity of data across health, judicial and legislative areas.[21] For these reasons, this chapter considers public, permissionless distributed peer-to-peer networks to be a fundamental characteristic of early blockchain-based applications rather than a definitional feature that is apparent in all versions of blockchain technology. Nonetheless, when we do not specify otherwise, a reference to the blockchain must be understood as a reference to a permissionless distributed peer-to-peer network, since these characteristics have the potential to disrupt, or at least profoundly affect, the law, and copyright in particular.

The final component is the consensus mechanism, i.e. a 'process to achieve agreement within a distributed system on the valid state.'[22] Consensus is what enables the nodes in a distributed peer-to-peer network to work together without having to know or trust each other. The consensus mechanism is a set of rules that are agreed upon by the network of nodes running the software in which the rules regulate the addition of new blocks.[23] These rules ensure consistency across the network, and that participant/system behaviour is valid and appropriate.[24] Given that consensus mechanisms solve problems of trust in distributed peer-to-peer networks,[25] it follows that if the deployment of a blockchain application is anything other than distributed, such a consensus mechanism may not be required. Therefore, this chapter considers consensus mechanisms to be a fundamental characteristic of early applications that may change dependant on the purposes for which the technology is adopted, rather than a definitional feature apparent in all blockchain-based applications. Nonetheless, since the distributed character of the blockchain is likely to have a disruptive impact on the law, and on copyright in particular, we will refer to blockchains using a consensus mechanism, unless stated otherwise.

[21] 'E-Estonia — We Have Built a Digital Society and So Can You' (*e-Estonia*) <https://e-estonia.com/> accessed 7 February 2018.
[22] Yaga (n 2) 50. The main consensus mechanisms are proof of work, round-robin, and proof of stake. The latter is used in Ethereum and can be either Byzantine fault tolerant proof or chain-based.
[23] Maas, 'Blockchain: the 3 Core Components' (n 13).
[24] Bacon (n 14) 13.
[25] Consensus mechanisms, however, do not always lead to correct execution results, because participants may be affected by economic interests in the smart contracts, as pointed out by Chen, L., Xu, L., Gao, Z., Lu, Y., & Shi, W. (2018). Tyranny of the Majority: On the (Im) possibility of Correctness of Smart Contracts. *IEEE Security & Privacy*, *16*(4), 30-37.

4. Of regulation and other limitations to the blockchains' uptake

For the blockchains to unleash their potential, in the music industry and beyond, the regulatory conundrum must be untangled. Overly restrictive regulation may stifle innovation, but the lack of any regulation may lead to legal uncertainty, which in turn would slow down the adoption of the blockchains.[26] The regulatory treatment of blockchain or of some of its aspects and applications will be a major factor in determining the level of success the technology will have regarding all its use cases. Given the importance of blockchains' regulation and being music copyright highly regulated, it is necessary to dig deeper and explore the regulatory treatment of blockchain in general.

The more blockchain becomes widespread, the more lawmakers develop an interest in regulating it. Most existing regulations, policies, and case law take a top-down approach and focus on Bitcoin and, accordingly, on evidence and tax issues.[27] The most common approach, however, is to assess whether and how existing laws apply to the blockchains[28] and avoid the introduction of new regulations 'given that the technology is still evolving and practical applications are limited both in number and scope.'[29] Contrary to popular belief, blockchains are not a lawless technology; recent research underlined that we should abandon the naivety whereby blockchain

[26] On the balance between innovation and regulation with regards to the blockchains see Joel Telpner, *The lion, the uncorn, and the crown. Striking a balance between regulation and blockchain innovation* (Blockchain Research Institute 2018).

[27] For example, the EU Court of Justice exempted Bitcoin transactions from VAT because they regard 'currency, bank notes and coins used as legal tender' (*Skatteverket v David Hedqvist Skatteverket v David Hedqvist,* Case C-264/14). For the focus on evidence, see Arizona Revised Statutes, 44-7061, and

[28] In the UK, for example, the Financial Conduct Authority believe that most Initial Coin Offerings (ICOs) are unregulated, but they take a case-by-case approach to decide whether ICOs fall within their remit. Financial Conduct, *Consumer warning about the risks of Initial Coin Offerings ('ICOs')* (FCA 2017).

[29] European Securities and Markets Authority, *Report The Distributed Ledger Technology Applied to Securities Markets* (ESMA 2017) 4. In the US, a similar 'wait-and-see' approach has been taken by the Federal Reserve Board, as well as the Federal Reserve Banks of New York and Chicago; see Mills, David, Kathy Wang, Brendan Malone, Anjana Ravi, Jeff Marquardt, Clinton Chen, Anton Badev, Timothy Brezinski, Linda Fahy, Kimberley Liao, Vanessa Kargenian, Max Ellithorpe, Wendy Ng, and Maria Baird (2016). "Distributed ledger technology in payments, clearing, and settlement," Finance and Economics Discussion Series 2016-095. Washington: Board of Governors of the Federal Reserve System, https://doi.org/10.17016/FEDS.2016.095. Cf., similarly, Financial Industry Regulatory Authority, *Distributed Ledger Technology: Implications of Blockchain for the Securities Industry* (FINRA 2017).

transactions would be 'free from the travails of conventional law, thus offering the promise of grassroots democratic governance without the need for third party intermediaries.'[30] Most of existing laws apply to the blockchains, but should new regulations be introduced, a participatory and holistic approach would be preferable. Indeed, it is important to involve all the stakeholders and keep in mind all the potential socio-legal issues if one wants to ensure that the blockchain unleashes its full potential and benefits all the players involved.

Bitcoin, the first and most widely used blockchain, set out to remove state institutions influence on currency. Permissioned blockchains inherited the features of being intrinsically trans-national and (potentially) state-free, which begs the fundamental questions on whether it is at all possible to regulate them and if so, how.[31] Bitcoin and blockchain have moved on from the cypherpunk days,[32] where the community using Bitcoin and the like were mostly made up of individuals with libertarian and anti-establishment political stances.[33] Nowadays, Bitcoin has entered the mainstream, even becoming a legal payment method in Japan.[34] Blockchain, in turn, has stepped out of Bitcoin's shadow and now offers a wide variety of potential use cases, some of which promise to be revolutionary.[35] However, for blockchain to realise its full disruptive potential it will need to appease the legal and regulatory environments in which it will operate.[36] Indeed, beyond cryptocurrency, blockchain has potential application across a number of heavily regulated industries, which have been designed without blockchain in mind. This may ultimately mean that the use of blockchain could be found to be incompatible with the current regulatory

[30] Karen Yeung, 'Regulation by Blockchain: The Emerging Battle for Supremacy between the Code *of* Law and Code *as* Law' (forthcoming) Modern Law Review.

[31] These problems, however, are not new, since the internet is transnational and yet is highly regulated. Recent research has showed that most of the physical world rules can be applied in cyberspace, though there is a clear problem of which authority can legitimate regulate it (Chris Reed and Andrew Murray, *Rethinking the Jurisprudence of Cyberspace* (Elgar 2018)).

[32] See Jameson Lopp, 'Bitcoin and the Rise of the Cypherpunks' (*CoinDesk*, 9 April 2016) <www.coindesk.com/the-rise-of-the-cypherpunks/> accessed 22 March 2018.

[33] Stefan Stankovic, 'An Introductory Guide to Cryptocurrency Regulation' (*Unblock*, 15 January 2018) <https://unblock.net/cryptocurrency-regulation/> accessed 22 March 2018.

[34] Jonathan Garber, 'Bitcoin Spikes after Japan says it's a Legal Payment Method' (*Business Insider*, 3 April 2017) <http://uk.businessinsider.com/bitcoin-price-spikes-as-japan-recognizes-it-as-a-legal-payment-method-2017-4?r=US&IR=T> accessed 22 March 2018.

[35] See generally Melanie Swan, *Blockchain: Blueprint for a New Economy* (1st edn, O'Reilly &Associates 2015.

[36] 'Blockchain—Key Legal and Regulatory Issues' *Lexis PSL TMT* <LexisPSL> accessed 23 March 2018.

framework.[37] If so, the uncertainty that this incompatibility inevitably creates will no doubt restrict innovation and ultimately prevent large scale adoption of blockchain into these areas. In order to successfully navigate these heavily regulated industries, it would seem necessary that regulation is seen as a tool to provide certainty for those involved in blockchain's development and encourage innovation, rather than one used by the regulators[38] to stifle it.[39] The problem does not regard, however, only regulated industries but all sectors where personal data is processed. Indeed the EU General Data Protection Regulation (GDPR), which came into force in May 2018, introduces principles, obligations, and rights whose implementation can be difficult if at all possible in a blockchain context.[40] For example, data subjects have the right to rectify their personal data, but once the data is in the blockchain is virtually impossible to change it.[41]

Part of the literature is of the opinion that regulation of blockchain is inevitable, and in the end the community of developers will in fact welcome such regulation. According to this view, regulators will win the developers round by accepting creative solutions to achieve the right balance between protecting the relevant public interest objectives and stimulating innovation.[42] The rationale behind said opinion is based on the fact that the same scenario happened twenty years ago, at the early stages of the Internet. The more recent phenomenon of the platform economy[43] has also reinforced how this scenario plays out.[44] Uber for example, whom

[37] Michele Finck, 'Blockchain and Data Protection in the European Union' (2017) Max Planck Institute for Innovation and Competition Research Paper No. 18-01 2 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3080322> accessed 22 March 2018.

[38] Where not otherwise specified, the term 'regulators' is used generically to refer to any law-makers and regulators across jurisdictions, whether they operate a transnational, supranational, national or subnational level.

[39] 'Blockchain—Key Legal and Regulatory Issues' (n 35).

[40] See, e.g. Berberich, Matthias, and Malgorzata Steiner. "Blockchain Technology and the GDPR–How to Reconcile Privacy and Distributed Ledgers, 2 Eur." *Data Prot. L. Rev* 422 (2016): 426 and Herian, Robert. "Regulating Disruption: Blockchain, GDPR, and Questions of Data Sovereignty." *Journal of Internet Law*22, no. 2 (2018): 1.

[41] Cf. the solutions proposed by Ibáñez, Luis-Daniel, Kieron O'Hara, and Elena Simperl. "On Blockchains and the General Data Protection Regulation." (2018); and CNIL, *Blockchain. Premiers éléments d'analyse de la CNIL* (Commission nationale de l'informatique et des liberté 2018).

[42] Kevin D. Werbach, 'The Song Remains the Same: What Cyberlaw Might Teach the Next Internet Economy' (2017) 69 (3) Florida Law Review 887, 889.

[43] See generally Martin Kenney and John Zysman, 'The Rise of the Platform Economy' (2016) 32 (3) Issues in Science and Technology.

[44] Cf. Noto La Diega, Guido. "Uber law and awareness by design. An empirical study on online platforms and dehumanised negotiations." *Revue européenne de droit de la consommation/European Journal of Consumer Law* 2016, no. II (2016): 383-413.

were once notoriously reluctant to co-operate with regulators[45] have now actively sought regulatory intervention regarding insurance legislation that applies unanimously across the United States,[46] and as of March 2018, they have instructed insurance companies in order to comply with those requirements.[47]

If regulation is inevitable, the next question is how to regulate? Going forward, it would seem that successful regulation is dependent on a number of factors. First of all, the regulators need to learn from their past mistakes regarding other emerging technologies and be sure not to repeat them. Although blockchains remain an immature technology with evolving use cases, it is arguable that early regulatory acknowledgement and interest should be seen as positive as it is important to be mindful of the negative impact that delayed interest in an emerging technology can have.[48]

Second, successful regulation is not only dependent on the regulators themselves. Rather, the industry and those involved with the development of blockchain should also actively collaborate with each other and the regulators to tackle the complex challenges at hand.[49] If those involved in the development of blockchain do decide to resist regulatory attempts, it is suggested that '[i]f anything, the innovators stand to lose the most by delaying government involvement in adopting reasonable solutions.'[50]

The third factor concerns the level at which blockchain is regulated. Generally, regulators regulate the use of a technology as opposed to regulating the technology itself. However, blockchains' ever-growing use cases mean that regulators are finding it difficult to regulate.[51] Yet, some scholars suggest that this remains the best approach, and claim that a use case focused approach is supported by the

[45] Frankie Arvelo, 'RESIST – Uber and Subverting Regulations' (*The Bespoke Lawyer*, 10 March 2017) <www.bespokelawyer.com/resist-uber-and-subverting-regulations/> accessed 28 March 2018.
[46] Uber, 'Insurance Aligned' (*Uber Newsroom*, 24 March 2015) <www.uber.com/newsroom/introducing-the-tnc-insurance-compromise-model-bill/> accessed 26 March 2018.
[47] Uber, 'An Update on Insurance' (*Uber Newsroom*, 1 March 2018) <www.uber.com/newsroom/an-update-on-insurance/> accessed 26 March 2018.
[48] As noted by Michele Finck, 'Blockchain Regulation' (2017) Max Planck Institute for Innovation and Competition Research Paper No. 17-13 20 <https://ssrn.com/abstract=3014641> accessed 26 March 2018, the early stages of the Internet's development suffered the negative impact of a delayed interest.
[49] ibid.
[50] Werbach, 'The Song Remains the Same' (n 39) 889.
[51] 'Blockchain—Key Legal and Regulatory Issues' (n 35).

experience with other emerging technologies such as the Internet.[52] If such an approach is to be successfully adopted, the aforementioned collaborative effort of all the parties involved in that specific use case will be key. Not only that, the unpredictability of blockchain will require a flexible, open approach to each use case that will allow the law to develop as and when the technology does.[53]

That being said, even if flexible, agile, use specific regulation is developed, if that regulatory model is only applicable in one country, its positive impact may be limited. The distributed potential of blockchain, coupled with its intangibility means that its application could operate simultaneously over multiple jurisdictions. This may mean that it is unclear who is performing the regulated activity. If this proves to be the case, regulators may struggle to determine whether or not a particular blockchains activity's need to be regulated and if so, under which jurisdiction. Further, if something goes wrong, it may prove difficult to determine the precise location and identity of the culprit for whom is responsible for said breach or failure.[54] Therefore, successful regulation will also require regulators to engage in transnational conversation and cooperation in an attempt to formulate some sort of consistent collaborative governance.[55] Although international conventions would appear the most suitable level of regulation, practically it is unlikely that an agreement will be reached and that, if reached, the rules will be fit for the blockchains or for the particular use that will be taken into consideration.[56]

In conclusion, no regulation is better than bad regulation. More evidence is needed to clarify whether existing regulations suffice when it comes to the blockchains. Should existing regulations be found insufficient, only then a serious discussion around new regulations could be started and should take into account the necessity not to stifle innovation, the level of development of the relevant technologies, the importance of involving all the stakeholders, and to place the

[52] Julie A. Maupin, 'Mapping the Global Legal Landscape of Blockchain Technologies' (2017) 149 CIGI Papers 5.
[53] Finck, 'Blockchain Regulation' (n 45) 2.
[54] 'Blockchain—Key Legal and Regulatory Issues' (n 35).
[55] Peter Yeoh, 'Regulatory Issues in Blockchain Technology' (2017) 25 JFRC 196, 200.
[56] On the problem of 'legal hysteresis', i.e. the delay with which innovation is necessarily regulated see Roberto Pardolesi*, «Software», «property rights» e diritto d'autore: il ritorno dal paese delle meraviglie*, in *Foro it*., 1987, 3, II, 300 . The idea was applied to copyright regulation by Noto La Diega, Guido. "In light of the ends. Copyright hysteresis and private copy exception after the British Academy of Songwriters, Composers and Authors (BASCA) and others v Secretary of State for Business, Innovation and Skills case." *Diritto Mercato Tecnologia* 2015, no. II (2015): 1-16.

discussion at a supra-national level. Only this way, legal certainty may be achieved and the blockchains may unleash their disruptive potential.

Whilst regulation is one of the main issues preventing the blockchains' uptake, there are other limitations. Some are not specific to the blockchains, for example the fluctuations in the value of cryptoassets and the problem of network effects, whereby this technology is still too niche to become commercially successful.[57] However, the former has not prevented the success of BitCoin and other cryptocurrencies. The latter is true for every new technology and there are no reasons to think that blockchains will not become so widely adopted to take advantage of network effects. On the contrary, since the blockchain could provide a very advanced protection to copyright, owners of works outside the system would have a hard time securing the same level of protection, providing an incentive for all rightholders to register.[58] A major limitation of blockchain is that it cannot store the actual copyrighted document in its current form. It stores a cryptographic artefact that identifies the material as it existed at a particular point in time.[59] This leads to the problem of the possible double-spending of the asset offline:[60] the rights on a song could have been assigned to a third party outside of the blockchain and still be linked to the old owner on the blockchain. Whilst this is a problem that currently does not have a satisfactory solution, it must be said that there is growth in systems that enable the tracking of the consumption of digital contents, regardless of whether they are on the blockchain or anywhere else. An example of this is KodakOne, that uses both blockchain and AI-powered recognition technologies to make sure that nobody is using registered photographs without the owner's permission.[61] Finally, there is the problem of 'garbage in garbage out.'[62] The blockchain itself does not guarantee authenticity of

[57] Michèle Finck and Valentina Moscon, 'Copyright Law on Blockchains: Between New Forms of Rights Administration and Digital Rights Management 2.0' (2019) 50 IIC - International Review of Intellectual Property and Competition Law 77.
[58] Balázs Bodó, Daniel Gervais and João Pedro Quintais, 'Blockchain and Smart Contracts: The Missing Link in Copyright Licensing?' (2018) 26 International Journal of Law and Information Technology 311.
[59] Annabel Tresie, Jack Goldenfein and Dan Hunter, what blockchain can and can't do for copyright (2018) 28 AIPJ 2.
[60] Finck and Moscon (n 57).
[61] More information at <www.kodakone.com/> accessed 20 January 2019.
[62]Finck and Moscon (n 57). Marcus O'Dair et al., *Music On The Blockchain* (Middlesex University 2016) 9; Alexander Savelyev, 'Copyright in the blockchain era: Promises and challenges' (2018) 34(3) Computer Law & Security Review 550; Finck and Moscon (n 57).

information not native to the blockchain.[63] If incorrect information on copyright ownership is added to the chain, it will be virtually impossible to correct it. Even though also human experts are susceptible to the "garbage in, garbage out" phenomenon,[64] it can be accepted that this is the main issue preventing the widespread adoption of the blockchain. An ex-ante screening mechanism is required to ensure that the original party is the genuine owner prior to creating the timestamp.[65] This mechanism could be provided by the traditional music copyright intermediaries, e.g. collecting socities.

5. **The disruptive potential of blockchain on copyright law**

Having defined blockchain technology and set out the technical and regulatory essentials, the rest of this chapter will concern the disruptive potential that blockchain may have upon the legal sphere of intellectual property, using music copyright as a use case.

This section is focused on intellectual property and in particular copyright, i.e. the body of law that protects aesthetic and artistic creations such as literary, musical, dramatic, and artistic works.[66] Blockchain technologies can affect copyright in manifold ways, as recognised by the European Parliament's resolution of 3 October 2018 on *distributed ledger technologies and blockchains: building trust with disintermediation*. The EU institution underlines that distributed ledger technologies can be used to track and manage intellectual property thus facilitating copyright and patent protection.[67] It further acknowledges the technology's potential to develop artists' ownership through an 'open public ledger that can also clearly identify ownership and copyright'[68]. It is then recognised that in collaborative and open innovation contexts (e.g. 3D printing) the blockchains' capability to link creators to

[63] Kensuke Ito and Marcus O'Dair, 'A critical examination of the application of blockchain technology for intellectual property management' in: Horst Treiblmaier and Roman Beck (eds) *Business transformation through blockchain*, vol 2. (Palgrave 2019).
[64] RA Miller, 'Reference Standards in Evaluating System Performance' (2002) 9 Journal of the American Medical Informatics Association 87.
[65] Tom W Bell, 'Copyrights, Privacy and the Blockchain' (2016) Ohio Northern University Law Review 466.
[66] Charlotte Waelde, Abbe Brown, Smita Kheria, and Jane Cornwell, *Contemporary Intellectual Property* (OUP 2016) 3.
[67] 2017/2772(RSP), para 22.
[68] Ibid para 22.

their works is of the utmost importance.[69] Finally, authors can benefit from transparency and traceability in the use of their works, as well as the smoothening of royalty distribution and increase in revenues that can be expected by cutting down on intermediaries.[70] On the last point, it is important to critically note that the blockchain's promise to eliminate traditional intermediaries is unlikely to be fulfilled.[71] Evidence of the trend towards re-centralisation are the investments of the traditional intermediaries in the blockchain[72] and the rise of permissioned blockchains, where the disintermediation is only partial.[73]

Although it is still unclear whether the blockchains will revolutionise copyright, it can be argued that they can resolve some of the issues that affect this body of law and the relevant industries, with particular regards to copyright registration, infringement (popularly known as 'piracy'), transactions, management.[74] For the sake of brevity, this section will focus on how, if at all, the type of blockchain described in section 2 above can resolve some of the problems of copyright registration, infringement, and transactions.

5.1. Blockchains for a privacy-friendly, agile, tamper- and censorship-resistant registration

One of the main innovations brought by the Berne Convention[75] has been that copyright arises with the creation of the work (e.g. once a book has been written),

[69] Ibid para 22.
[70] Ibid para 23.
[71] In the field of copyright, this was first foreseen by O'Dair (n 61).
[72] 'PRS for Music, ASCAP and SACEM initiate joint blockchain project' (*PRS for Music*, 7 April 2017) <www.prsformusic.com/press/2017/prs-for-music-ascap-and-sacem-initiate-joint-blockchain-project> accessed 4 December 2018.
[73] Bacon (n 14).
[74] The blockchain can smoothen royalty distribution by decreasing the role of traditional intermediaries, though one can doubt that the middleman will actually be eliminated. There are a number of reasons that suggest that the blockchain will not get rid of intermediaries. These include the fact that traditional intermediaries are substantially investing in the blockchain and the fact that the enforcement of copyright online tends to target the intermediaries rather than the end-users; therefore, lawmakers and courts have a strong interest in keeping the middlemen in the loop.
[75] Berne Convention for the Protection of Literary and Artistic Works of September 9, 1886, completed at Paris on May 4, 1896, revised at Berlin on November 13, 1908, completed at Berne on March 20, 1914, revised at Rome on June 2, 1928, at Brussels on June 26, 1948, at Stockholm on July 14, 1967, and at Paris on July 24, 1971, and amended on September 28, 1979.

without the need for any formalities i.e. systems of public registration.[76] Such formalities enabled governments to control ex ante the contents of the books, thus enabling them to censor those works that went against the governmental policies or the dominant ethical values.[77] The abolition of registration formalities is positive because it favours the authors by making copyright easily obtainable and by reducing the opportunities for governments to censor them. However, without registration there are evidentiary problems in copyright infringement proceedings, because it is hard to prove who created what and in which moment in time.[78] For example, if John shares without Jerry's permission a picture the latter had posted on Instagram, how does Jerry prove that he created said work (the picture), that he did it before John, and that he is the sole legitimate author and owner? To resolve these kinds of problems, some countries such as the US effectively sidestepped the Berne Convention and *de facto* re-introduced the copyright registration. Indeed, even if copyright arises with the creation of a work, in infringement proceedings statutory damages and attorney's fees will not be awarded in the absence of registration.[79] In the UK, there is no such limitation, but without registration said evidentiary issues remain. Therefore, new registration mechanisms have been introduce to ensure evidence, however they often are a burden for the author (e.g. they are expensive and not user-friendly) and they can be forged; particularly with paper ledgers there is a 'high level of forgery.'[80] Alongside the problems of censorship, forgery, and lack of user-friendliness, existing registration systems are open to criticism from a privacy perspective. This is the case of the US, where rules of procedure of the Copyright Office and attitudes of the US District Courts make it very hard for pseudonymous and anonymous authors to be successful in infringement lawsuits.[81]

[76] Berne Convention, art 5(2).
[77] On copyright formalities and censorship see, e.g., Alastair J Mann, 'The Anatomy of Copyright Law in Scotland before 1710' in Isabella Alexander and H Tomás Gómez-Arostegui (eds), *Research Handbook on the History of Copyright Law* (Elgar 2016) 99.
[78] It should be kept in mind that copyright is not a monopoly, therefore the independent creation of identical works does not constitute infringement. For infringement to occur, the claimant need to prove that the defendant carried out a restricted act (e.g. made a copy of the book, picture, etc.) with regards to the whole or a substantial part of the work, and there is a causal connection between the claimant's work and the defendant's one. The latter requirement means that either there is direct evidence of copying or this can be inferred from the similarities between the works and the opportunity to copy. See the UK Copyright, Designs Patents Act 1988, s 16.
[79] US Copyright Office, Circular 1, *Copyright Basics*, section 'Copyright Registration.'
[80] UK Government Chief Scientific Adviser (n 11) 7.
[81] Bell (n 62) 464.

All these problems can be resolved through a blockchain-enabled copyright registration. Indeed, a blockchain platform could issue a token, which would serve as proof of authenticity, in which a timestamped copyright registration is contained. Arguably, such a disruptive system would enable a cheaper, transparent,[82] and user-friendly registration.[83] Thus, it would also be addressed the problem of forgery, being the blockchain tamper-resistant.[84] Moreover, one of the key features of permissionless blockchains is that they do not have a no single point of failure. Therefore, if an author deposited a work to register it and a government wanted to take it down for censorship purposes, this would be practically impossible[85] because '(e)ven if several nodes failed, the network would still continue to function,'[86] and the work would still be available since all data is maintained by all nodes.[87] Finally, moving on to anonymous and pseudonymous authors' privacy, a public, permissionless blockchain distributed across a peer-to-peer network may resolve their problems by providing robust digital pseudonyms, 'a mask that, while hiding (the author's) real identity, would nonetheless be unique to him or her.'[88]

A blockchain registration would be optional thus complying with the Berne Convention, and it would ensure the benefits of traditional registration in terms of evidence in infringement proceedings, whilst preventing its drawbacks in terms of costs, forgery, censorship, and privacy.

[82] As noted by Savelyev (n 61) 550, 'blockchain can introduce long-awaited transparency in matters of copyright ownership chain.'
[83] Jean-Pierre Buntinx, 'Future use cases for blockchain technology: Copyright registration' (*Bitcoin News*, 4 August 2015) <news.bitcoin.com/future-use-cases-for-blockchain-technology-copyright-registration> accessed 30 May 2018.
[84] Nonetheless, the blockchain is not absolutely immutable, as proved by The DAO breaking the rules of their blockchain in order to react to some hackers exploing a bug in the code. On this matter and its implications see O'Hara, K. (2017). Smart contracts-dumb idea. *IEEE Internet Computing*, *21*(2), 97-101.
[85] This circumstance, couple with the disintermediation that may come with the adoption of the blockchain, would make copyright enforcement very complicated, since the trend in recent years has been to target intermediaries rather than end-users. The most obvious example of this is constituted by the injunctions against ISPs for instance in the event of illegal download of music or videos.
[86] Bacon (n 14) 13. For the problems related to node failure, see Jiao Li, 'Data Transmission Scheme Considering Node Failure for Blockchain' (2018) Wireless Personal Communications 1.
[87] This depends on the type of blockchain, for instance it does not apply to permissioned blockchains.
[88] ibid. 17.

5.2. Blockchains and copyright infringement: an ambiguous relationship

Copyright infringement, popularly known as 'piracy', is a widespread issue, as exemplified by the fact that 53% of young users access music illegally[89] and by the fact that new intermediaries such as Spotify often make available music without its owners' consent, allegedly because they do not know who the owners are.[90] Copyright infringement thrive for a number of reasons, two of which can be addressed by the blockchain. The first one is the difficulty for the copyright owners to track the use of their works. Once a song is published, the owners currently have limited or no means to know who is accessing it and how. The problem is exacerbated by the sharing practices that are becoming commonplace in the time of social media. Indeed, it can be said that we live in the sharing society,[91] where sharing copyright material is easy particularly on social networking sites e.g. by retweeting someone's tweet which, in turn, had retweeted someone else's tweet.[92] This means not only that many people infringe copyright possibly without being aware of it, but also that after repeated sharing and linking it is difficult to track back who was the original owner. Ultimately, the difficulty for the copyright owner to track the use of their contents decreases the incentives to access contents legally, since end-users have the reasonable expectation that the owners cannot track the consumption of their content and, therefore, they cannot enforce their rights.

The second reason why copyright infringement is so common, particularly in the music industry, is that it is often impossible to know who the author and owner is.[93] This is because there is not a requirement to register copyright, and, more

[89] 'Share of global internet users who access music through copyright infringement as of 2017, by age group' (*Statista*, 2018) <www.statista.com/statistics/609114/music-copyright-infringement-by-age/> accessed 5 December 2018. A more general empirical analysis of intellectual property infringement can be found in European Intellectual Property Office, *Synthesis Report on IPR infringement 2018* (EUIPO 2018). This is not to say that copyright infringement is always and necessarily a negative thing, as proved by ECORYS, *Estimating displacement rates of copyrighted content in the EU* (European Commission 2017).

[90] Therefore, Spotify had to pay USD 112m to songwriters in the settlement of *Ferrick, et al. v. Spotify USA Inc., et al*., No. 16-cv-8412 (AJN) United States District Court, S.D. New York.

[91] 'All Eyes on the Sharing Society' (*World Intellectual Property Review*, March/April 2015) <www.rightsdirect.com/wp-content/uploads/sites/6/2015/04/WIPR-Kim-Zwollo-04-2015.pdf> accessed 30 May 2018.

[92] On the matter of copyright on 'tweets' and infringement by retweeting see Haas, R. (2010). Twitter: New challenges to copyright law in the Internet age. *J. Marshall Rev. Intell. Prop. L.*, *10*, i.

[93] In principle, the author is the first copyright owner of the relevant work, but there are some exceptions the main of which regards works created by employees in the course of employment. See the UK Copyright, Designs and Patents Act 1988, s 11.

importantly, because of the lack of a single updated database of music metadata. Music metadata are data about who did what in music. Music metadata are fragmented in databases that do not sync and that are owned by corporations with conflicting views about what should be public and what should, in turn, kept private.[94] Music ownership is extremely complex for legal and business reasons. On the one hand, under the Copyright, Designs and Patents Act 1988[95] – the main UK statute on copyright – a single song has at least three owners, i.e. the author of the lyrics, the author of the music, and the producer of the sound recording. From a business point of view, music is a collaborative enterprise; indeed, most 'recorded music is a collaboration between songwriters, singers, musicians, producers, recording engineers, mastering specialists.'[96] All these subjects and other new intermediaries such as Spotify and iTunes have a stake in the industry and some expectations in the distribution of music's revenues. For these reasons the artists receive only a limited share of the revenues and after a long time.[97] If artists are finally paid a slice of the 'royalties cake', this reaches them between 6 and 18 months after the publication.[98] The problem of music's attribution and royalty distribution are not new, but they are made worse by new technologies and new ways of consuming musing. While at the time of vinyl records and CDs it was easy to understand who contributed and how, iTunes, Spotify etc. create a credits conundrum where the listener knows only who is the singer and nothing else. A final reason why identifying the copyright owner (and reward them) is difficult is that even though there is a presumption the author (of the music, of the lyrics, etc.) is the owner of the relevant work,[99] this is often not the case either because the work had been made in the course of employement and therefore owned by the employer or because ownership has been transferred to third parties by means of a contract of copyright assignment. These contracts are often accompanied by the so-called paternity waiver, whereby the author gives up their right to be acknowledged as the author.[100] If copyright paternity can be waived, it is likely that it

[94] DA Wallach, 'Bitcoin for Rockstars' (*Wired*, 12 October 2014) <www.wired.com/2014/12/bitcoin-for-rockstars> accessed 1 June 2018.
[95] Copyright, Designs and Patents Act 1988, ss 3(1), 5A, and 10A.
[96] Wallach (n 85)
[97] Imogen Heap and Don Tapscott, 'Blockchain could be Music's next Disruptor' (*Fortune*, 22 September 2016) <fortune.com/2016/09/22/blockchain-music-disruption> accessed 1 June 2018.
[98] ibid.
[99] Copyright, Designs and Patents Act 1998, s 9.
[100] Copyright, Designs, and Patents Act 1988, s 87(2). In many civil law jurisdictions such waivers are not enforceable, see French *Code de la propriété intellectuelle*, art L. 121-1 and *Huston v TV5, Cour de*

will be, because the relevant relationships in many creative industries are often characterised by an imbalance of bargaining power.[101] For all these reasons, music is often consumed without the owners' permission and the system does not reward artists sufficiently and timely, if at all.

Permissionless blockchains could tackle both issues. A blockchain based music platform, such as Mycelia, can allow artists to issue a token that can be transferred only when the owner signs off on the transaction with their private key. This disincentivises end-users from accessing music illegally. As to the music metadata's conundrum, a public, permissionless blockchain distributed across a peer-to-peer network may resolve the problems of copyright infringement by enabling the creation of a global updated database of music metadata. The blockchain could be the backbone of a decentralized, open-source global platform, *controlled* by no single entity, and with the potential to contain accurate, real-time, global data encompassing credits and rights ownership.[102] As noted by some scholars, most copyright registry are territorial, but the creation of a global registry would not require governments to trust other government or third parties, '(r)ather, trust can be placed in the mathematical certain provided by blockchain technology.'[103] Moreover, blockchain could be a technological mean to prevent practically nullify the practice of imposing paternity waivers, thus contributing to fixing the structural imbalance of power of the creative industries, music included. Once recorded in a blockchain platform, no one could contest the authorship and ownership.

In making it easier to access copyright content legally, the blockchain can prevent copyright infringement. At the same time, however, it can constitute a problem because, in light of the distributed nature of the blockchain and its lack of single point of failure, infringing content cannot be taken dow: once it is on the blockchain, it is stored in every node potentially forever.[104] In recent years, the

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Cassation, Chambre civile 1, 28 May 1991, 89-19.522 89-19.725 [1991] RIDA 149, 197, where the French Supreme Court stated that moral rights are a matter of public policy and, therefore, waivers that were lawful under US copyright law were not enforceable in France.

[101] One needs to keep in mind that the industry tend to 'oblige authors and artist to enter standard-form contracts that require them to waive their integrity rights' (Lionel Bently and Brad Sherman, *Intellectual Property Law* (4th ed, OUP 2014) 290).

[102] Wallach (n 85).

[103] Aaron Wright and Primavera De Filippi, 'Decentralized blockchain technology and the rise of lex cryptographia' (SSRN, 10 March 2015) 28 <ssrn.com/abstract=2580664> accessed 1 June 2018.

[104] The difficulty of taking down content is likely to have significant consequences even beyond copyright. One need only think of the research that found child porn links on a blockchain which begs the question whether all participants can be held liable for illegal content on the blockchain (Matzutt,

prevailing way that copyright owners react to copyright infringement is not bringing lawsuits against the end-users or the actual infringer, but targeting the intermediaries that enable said infringement (e.g. the internet service providers, such as BT or Sky).[105] However, in permissionless blockchains in principle there are no intermediaries or, better, the latter have a different, more elusive identity. The virtual impossibility to take down once on the blockchain and the inherent disintermediation is likely to make it difficult to enforce copyright. However, the disruptive potential of the blockchain may manifest itself in preventing infringement altogether by allowing copyright owners to track the use of their works and by powering a global updated database of music metadata, which will make royalty distribution smoother and fairer.

5.3. Smart contracts and the right to change one's mind

The concept of smart contract predates the blockchain and was first presented in 1994 by Nick Szabo who defined it as 'a computerized transaction protocol that executes the terms of a contract.'[106] The promise of automated execution has become even more alluring with the new generation of smart contracts, that are a collection of code and data (…) that is deployed using cryptographically signed transactions on the blockchain network.'[107] Indeed, these new smart contracts inherit all the features of the underlying blockchain infrastructure, including 'the tamperproof nature (…) that anchors their automated execution.'[108] In a music copyright context, smart contracts

R., Hiller, J., Henze, M., Ziegeldorf, J. H., Müllmann, D., Hohlfeld, O., & Wehrle, K. (2018). A Quantitative Analysis of the Impact of Arbitrary Blockchain Content on Bitcoin. In *Proceedings of the 22nd International Conference on Financial Cryptography and Data Security (FC). Springer*).

[105] In the UK, the trend of addressing copyright infringement by targeting internet service providers and other intermediaries, as opposed to the end-user or the primary infringer can be seen in *Dramatico v BSkyB* [2012] EWHC 268 (Ch); *Paramount & Others v British Sky Broadcasting* [2013] EWHC 3479; *1967 Ltd v BSkyB, BT and others* [2014] EWHC 3444. In the EU, see e.g. *UPC Telekabel Wein v Constantin Film Verleih* (C-314/12) [2014] EC.D.R. 12; *Svensson & others v Retriever Sverige AB* (C-466/12) [2014] All ER 609 (EC); *GS Media BV v Sanoma Media Netherlands* (C-160/15) (8 Sept 2016).

[106] Nick Szabo, 'Smart Contracts' (1994) < http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart.contracts.html> accessed 15 May 2019; Finck and Moscon (n 58).

[107] Yaga (n 2) 54.

[108] Finck and Moscon (n 57) 92.

could be used for several purposes, such as to automate the execution of a licence[109] or as a form of digital rights management (DRM).[110]

Whilst the use of blockchain-based smart contracts in copyright can be praised or criticised for a number of reasons,[111] this chapter will assess their compatibility with a principle that we deem inherent to our legal system, i.e. the right to change one's mind. Contract law is designed to recognise such a right. This can be inferred by the compensatory nature of damages pursuant to the theory of efficient breach, and the prevalence of damages over specific performance. Since smart contracts 'prohibit or make more costly efficient breach,'[112] should their adoption be encouraged?

The English legal system is one of several systems where contractual parties can walk away from the agreement without being penalised in the form of punitive damages or prevented to change their mind in the form of specific performance remedies.[113] This can be seen as a reflection of the theory of efficient breach, whereby if a party can get better use of their resources by breaching the contract, then they should be able to without being penalised.[114] More precisely, the breach is 'efficient, and therefore desirable, if the promisor's gain from breach, after payment of the promisee's expectation damages, will exceed the promisee's loss.'[115] The theory is usually accepted as a justification for the current approach to remedies.[116]

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[109] The block can contain not only information about ownership of the material, but also the terms under which it is licensed or if it is in the public domain. See Bodó, Gervais and Quintais (n 59).

[110] A typical example of DRM is that digital lock that was introduced in CDs to prevent their unauthorised copy. On DRM and smart contracts see Finck and Moscon (n 57).

[111] See e.g. Bodó, Gervais and Quintais (n 108); Finck and Moscon (n 57).

[112] Max Raskin, 'The Law and Legality of Smart Contracts' (2017) 1 Geo L Tech Rev 305, 328. More broadly on this K O'Hara, 'Smart Contracts - Dumb Idea' (2017) 21 IEEE Internet Computing 97.

[113] For example, in Italy, whilst damages that go beyond the loss are available in the event of a infringement, they should be qualified as a form of restitution, as opposed to a punitive one. See Carlo Castronovo, 'La violazione della proprietà intellettuale come lesione del potere di disposizione. Dal danno all'arricchimento' (2003) 1 Dir ind 7; Carlo Castronovo, *La nuova responsabilità civile* (Giuffrè 2006) 644; Armando Plaia, *Proprietà intellettuale e risarcimento del danno* (Torino 2005) 62.

[114] Richard A Posner, *Economic Analysis of Law* (Ninth edition, Wolters Kluwer Law & Business 2014), cited in O'Hara (n 112).

[115] Melvin A Eisenberg, *The Theory of Efficient Breach*, vol 1 (Oxford University Press 2018) 51. The author criticises the theory because it would rest on incorrect factual predicates. i.e. that 'the expectation measure makes a promisee indifferent between performance and breach and that the promisor knows the value that the promisee places on the promisor's performance and therefore can make the calculation the theory requires' (ibid 52).

[116] See e.g. Thomas S. Ulen, The Efficiency of Specific Performance: Toward a Unified Theory of Contract Remedies, 83 MICH. L. REv. 341, 343 (1984), as cited by Ben Depoorter and Stephan Tontrup, 'How Law Frames Moral Intuitions: The Expressive Effect of Specific Performance' (2012) 54 Ariz L Rev 673, 675.

Even though the existing scheme of remedies for breach of contract in English law can be justified on non-efficiency based grounds,[117] it can be submitted that the preference for compensatory damages over punitive damage and specific performance shows adoption of a theory of efficient breach. With the exception of debt, the common law remedy for a breach is that of damages.[118] These damages have the function to compensate for the loss, whereas punitive damages – where the award goes beyond the loss in order to penalise the breaching party – have no place in the law of contract, regardless of how outrageous the defendant's conduct has been.[119] The right to change one's mind is reflected also in the fact that the jurisdiction to order specific performance is supplementary to common law damages,[120] and specific per5formance will not be granted where damages provide adequate relief.[121] It must be said, however, that injunctions can be seen as a form of indirect specific performance and yet they have become increasingly common, even in circumstances where the court would not order specific performance.[122] Although injunctions can be used to encourage performance, they are confined by a twofold restriction. First, there must be an express contractual clause whereby the party obliged themselves not to do something (an express negative stipulation).[123] Second, the injunctive relief cannot have the effect of forcing the defendant to fulfil a contract for personal service or to abstain from any business whatsoever and for too long a term.[124]

It would seem, therefore, that in light of the right to change one's mind, smart contracts' deployment is not desirable. One could object that these self-executing

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[117] Tareq Al-Tawil, 'English Contract Law and the Efficient Breach Theory: Can They Co-Exist?' (2015) 22 Maastricht Journal of European and Comparative Law 396.
[118] J Beatson, A Burrows, and J Cartwright, *Anson's Law of Contract* (30th ed, OUP 2016) 564.
[119] *Addis v Gramophone Co Ltd* [1909] AC 448; *Malik v Bank of Credit & Commerce International SA* [1998] 1 AC 20. Punitive damages may be available in tort; *Rookes v Barnard* [1964] AC 1129.
[120] Beatson (n 107) 608. For a comparison between common law and civil law jurisdiction, underlining some convergence, Ole Lando and Hugh Beale, *Principles of European Contract Law: Parts I and II* (Kluwer Law 2000) 399.
[121] *Harnett v Yelding* (1805) 2 Sch & Lef 549; *Ryan v Mutual Tontine Westminster Chambers Association* [1893] 1 Ch 116. In the US, whilst courts have granted some specific performance remedies, they have also

refused the remedy where damages would be an adequate remedy (Raymond v. Raymond Estate, 2008 SKQB 278 (CanLII), and case law cited by Paul M Perell, 'Common Law Damages, Specific Performance and Equitable Compensation in an Abortive Contract for the Sale of Land: A Synopsis' (2011) 37 Advocates' Quarterly 408.
[122] *Lumley v Wagner* (1852) De GM & G 604; *Metropolitan Electirc Supply Co Ltd v Ginder* [1901] 2 Ch 799
[123] *Mortimer v Beckett* [1920] 1 Ch 571.
[124] *Ehrman v Bartholomew* [1898] 1 Ch 671; *Warren v Mendy* [1989] 1 WLR 853.

protocols could be programmed in order to allow a party to breach them under certain circumstances and the consequent reaction could follow efficient breach principles. However, it does not seem possible to decide ex ante (and accordingly encode) when the breach is efficient,[125] and such a complexity could lead to vulnerabilities.[126] More generally, if the automated execution can be discontinued in the event of a breach, this would defeat the whole purpose of using smart contracts.

The breach of a copyright licence can be seen as both a breach of contract (e.g. the royalties have not been timely paid) and as copyright infringe. This would be the case if the licensee went beyond the limits of the licence, for instance if the work has been used beyond the agreed expiration or for purposes other than those provided in the licence (e.g. the right to copy had been licensed, but the licensee communicated the work to the public). In the former scenario, the ordinary principles of contract law will apply and, therefore, the aforementioned considerations about the right to change one's mind enshrined in contract law can be reiterated here. If copyright infringement is at issue, in turn, things may differ. Copyright in a work is infringed if the defendant carried out a restrict act (e.g. reproduction)[127] without a valid licence[128] with regards to a substantial part of the claimant's work,[129] if a causal link between the former and the defendant's work is established.[130] In an infringement action, the owner and the exclusive licensee[131] can seek damages, injunctions, accounts or any property-related remedy.[132] The latter reference has been read as including an order for specific performance.[133] Moreover, there are additional damages in the event of flagrancy,[134] injunctions against internet service providers,[135] delivery up,[136] order for disposal,[137]

[125] Patrick Dahm, 'The Efficient Breach of Smart Contracts' (*Asia Law Network Blog*, 22 February 2018) <https://learn.asialawnetwork.com/2018/02/22/efficient-breach-smart-contracts/> accessed 14 May 2019.
[126] The more complex the software, the more vulnerable it will be. See e.g. Michał Klincewicz, 'Autonomous Weapons Systems, the Frame Problem and Computer Security' (2015) 14 Journal of Military Ethics 162.
[127] CDPA, s 16(1).
[128] CDPA, s 16(2).
[129] *Designers Guild v Williams* [2000] 1 WLR 2416.
[130] *Sawkins v Hyperion* [2005] 1 WLR 3281.
[131] Except against the copyright owner, as provided under CDPA, s 101(1). Non-exclusive licensees have limited rights of action under s 101A.
[132] CDPA, s 96(2).
[133] David I Bainbridge, *Intellectual Property* (10th edn, Pearson 2018) 208.
[134] CDPA, s 97(2)
[135] CDPA, s 97A.
[136] CDPA, s 99.
[137] CPDA, s 114.

and seizure.[138] Since blockchain technologies can be used as a form of digital lock or DRM,[139] it is important to note that the circumvention of these locks is accompanied by the same remedies as copyright infringement itself.[140] Damages are based on the actual prejudice suffered by the rightholder,[141] but the Court of Justice of the EU ruled that Member States can introduce punitive damages.[142] However, in the UK, damages have a compensatory function and they will not be awarded if the defendant did not know or had no reason to believe that copyright subsisted in the works.[143] Although not technically punitive damages,[144] the claimant can seek additional damages, if the defendant of the conduct was deceitful or treacherous,[145] and having regard of the benefits accruing to the defendant by reason of the infringement.[146] Without downplaying the importance of additional damages, it should be nonetheless recognised that their relevance is limited since they are often sought but rarely granted.[147]

In addition to the damages, claimants can seek injunctions, often to prevent further infringing activities. However, being an equitable remedy, courts may exercise their discretion and not grant them, for example if there is an undue delay in commencing proceedings.[148] It is expressly provided that courts can decide to replace injunctions with damages.[149] Finally, courts will not grant an injunction if damage is an appropriate remedy.[150] Additionally, rightholders can seek injunctions against internet service providers, for example asking Sky to block access to an infringing

[138] CDPA, s 100.
[139] Finck and Moscon (n 57).
[140] CDPA, s296ZD(2).
[141] Directive 2004/48/EC of the European Parliament and of the Council of 29 April 2004 on the enforcement of intellectual property rights [2004] OJ L 157/16 (Enforcement Directive), art 13.
[142] Case C-367/15 *Stowarzyszenie "Oławska Telewizja Kablowa" w Oławie v Stowarzyszenie Filmowców Polskich w Warszawie* (CJEU, 25 January 2017); the ratio decidendi was that the Enforcement Directive lays down a minimum standard concerning the enforcement of IP rights and does not prevent Member States from laying down more protective measures. See David Serras Pereira and Carlos Madureira, 'The CJEU Decision in Stowarzyszenie "Oławska Telewizja Kablowa", C-367/15, and Punitive Damages in Copyright Law: A Portuguese Perspective' (2017) 12 Journal of Intellectual Property Law & Practice 373.
[143] CDPA, s 97(1); *Claydon Architectural Metalwork v DJ Higgins & Sons* [1997] FSR 475.
[144] Bainbridge (n 122) 212.
[145] This is the definition of flagrancy provided in *Nichols Advanced Vehicle Systems Inc v Reese & Oliver* [1979] RPC 127.
[146] CDPA, s 97(2).
[147] For an exception, see *Cala Homes (South) Ltd v Alfred McAlpine Homes East Ltd* [1995] FSR 818.
[148] Bainbridge (n 122) 214.
[149] Senior Courts Act 1981, s 50.
[150] This will be the case if the injury is small, pecuniary, can be adequately compensated with a small amount of money, and when it would be oppressive to the defendant to grant an injunction. This is the guidance laid out in *Shelfer v City of London Electric Lighting Co* [1895] 1 Ch 287.

website.[151] The questions to be asked, as summarised in *1967 Ltd v British Sky Broadcasting*,[152] are as follows: is the defendant a service provider? Do the website's users and operators infringe copyright? Do they use that website to do so? Has the defendant actual knowledge of the above? Whereas an assessment of whether damages would be more appropriate could take place when courts assess whether the sought injunctions are proportionate, effective, and dissuasive, there seems to be a clear trend of granting blocking injunctions.[153]

In conclusion, smart contracts seem to be contrary to the right to change one's mind that characterises our contract law. This affects also its use in copyright licensing, since some dispute may regard a breach of licence as breach of contract. However, when the breach is such that the defendant carried out a restricted act beyond the scope of a licence, then copyright infringement principles will apply. In the copyright sub-system, the preference for compensatory damages over specific performance is not as clear as it is in contract law. Damages themselves are compensatory, but they can be accompanied by additional damages in the event of flagrancy. These are not technically punitive, but they certainly go beyond the typical compensatory function of damages. The rise of injunctions, finally, can be seen as an indirect way to favour specific performance. If this is the case, then the right to change one's mind is less strong in a copyright context and, at least from this point of view, the adoption of smart contracts should not be resisted. However, this should be cautiously, because contracts are often used to exclude copyright exceptions or defences (e.g. text and data mining).[154] Efficient breach could be a solution, because the 'application of efficient contract remedies may alleviate the apparent tension

[151] CDPA, s 97A

[152] [2015] EWHC 3444 (Ch) per Arnold J.

[153]See e.g. *Football League Premier Division v British Telecommunications plc* [2017] EWHC 480 (ch); *Cartier v British Sky Broadcasting Ltd* [2018] UKSC 28.

[154] In certain countries, contractual terms purporting to prevent or restrict the availability of these defences are not enforceable. See e.g. CDPA, s 29(4B). However, at the EU level only some defences are binding, although the recent reform of copyright may signal a trend reversal; see Directive of the European Parliament and of the Coucil on copyright and related rights in the Digital Single Market and amending Directives 96/9/EC and 2001/29/EC, PE 51 2019 INIT, art 7. However, the text and data mining exception does not seem to be binding (art 4). On the latter see Maria Lillà Montagnani and Giorgio Aime, 'Il text and data mining e il diritto d'autore' (2018) AIDA 2017 376; Christophe Geiger, Giancarlo Frosio, and Oleksandr Bulayenko, *The exception for text and data mining (TDM) in the proposed Directive on Copyright in the Digital Single Market legal aspects* (European Commission 2018).

between the private contract and intellectual property limitation regimes.'[155] However, this new generation of smart contracts make breach virtually impossible, thus favouring the rightholders' interests over the competing public and private ones.

6. Conclusions

The blockchain, at least in its permissionless form, has the potential to disrupt copyright law by resolving two of its problems, namely registration and infringement.

Currently there are no reliable registers of copyright ownership, which creates problems of evidence because it is difficult for claimants to prove the link between them and the infringed work, as well as to prove the time of creation. Current registration systems are prone to forgery, can be used as a means of censorship, are cumbersome, and are unfavourable to anonymous authors. A blockchain-based registration mechanism would resolve this problem by providing the means for a tamper-resistant, censorship-resistant, user-friendly, and privacy friendly platform.

As to copyright infringement or piracy, this is on the rise because owners cannot track the use of their works and because it is often difficult to know who the owners are, which in turn makes it virtually impossible to seek a license and pay the royalties. However, using the blockchain, artists could decide to transfer music by transferring a token signing off on the transaction with their private key. No unauthorised use would be possible. The blockchain, moreover, would allow the creation of global constantly updated music metadata that would make it easier to find and reward the copyright owners.

Thirdly, blockchain-based smart contracts could automate the execution of licenses as well as constitute a new generation of digital locks. When a breach of licence qualifies as a breach of contract, the use of smart contracts can be criticised because it is contrary to the right to change one's own mind, which is a key principle in contract law. Conversely, when a breach of a licence qualifies as copyright

[155] Daniel R Cahoy, 'Oasis or Mirage: Efficient Breach as a Relief to the Burden of Contractual Recapture of Patent and Copyright Limitations' (2003) 17 Harvard Journal of Law & Technology 135., who refers to Bowers v. Baystate Techs., Inc., 320 F.3d 1317, 1325-26 (Fed. Cir. 2003), cert. denied, 123 S. Ct. 2588 (2003), but remains skeptical and concludes that 'efficient breach cannot always provide a fair solution to contractual restraints of important intellectual property rights limitations' (ibid 178).

infringement and when DRM is circumvented, then that argument does not apply because copyright law penalises the changing of one's ideas through additional damages and injunctions. Whilst smart contracts, therefore, could be a positive introduction in the copyright world, this should happen cautiously, because there is the risk that their use will lead to an overprotection of copyright as a consequence of undue restrictions on exceptions or defences,

It is too early to assess whether blockchains will disrupt the music industry and fix all the problems of copyright, a body of law whose inadequacy for the digital age is striking.[156] From the analysis above, however, it would seem that blockchains could contribute to the resolution to some problems encountered by copyright owners and authors. In order to succeed, these potential solutions must be accompanied by a twofold caveat. First, the immature blockchain technology must overcome its technical issues to prove, beyond doubt, that it is a better proposition than the technology it is replacing. Second, it will have to appease the current regulatory framework to allow these technological advancements to achieve large-scale adoption. Whilst new regulations are not necessarily the best way forward, regulators should work closely with law academics and industry stakeholders to clarify how existing laws apply to this new technology. Indeed, without legal certainty, the blockchains are unlikely unleash their disruptive potential.

[156] On the compatibility of the blockchain with some copyright principles see