Law, Smart Technology, and Circular Economy: All Watched Over By Machines of Loving Grace?

Dr Sean Thomas

Durham Law School, University of Durham, Durham, UK

Durham Law School, University of Durham, Palatine Centre, Stockton Road, Durham, UK, DH1 3LE, +44 (0)191 3346849, sean.thomas@durham.ac.uk

Notes on contributor

Sean Thomas is an Associate Professor at Durham Law School. His work concerns issues of ownership of personal property. He is also interested in radical property practices, and the implications of disconnected legal governance of consumption practices in historical and futuristic context. He is conflicted about the value of technological developments.

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This paper examines how circular economics addresses and uses smart technology, and demonstrates the lack of consideration given to ownership issues in such contexts. The extent to which circular economic ideals require controlling goods down-stream will be exposed. Following this is analysis of the ramifications of smart technology, illustrated with recent examples of control through smart technology. This leads to a critique of the US Supreme Court's recent decision on patent exhaustion *Impression Products v Lexmark* alongside the CJEU's decision in *UsedSoft* on copyright, addressing implications for contracting practices. The article concludes by urging close comparison of claimed benefits arising from circular economic approaches to smart technology with the potential costs of control (or lack thereof) of novel technologies.

Keywords: Circular economy, smart technology, ownership, goods

1. Introduction

This article considers law and smart technology,[1] as seen through the lens of the increasingly prominent concept of circular economy. In light of a growing body of scholarship highlighting the importance of analysing the relationship between law and technology,[2] and recognising the effect of technological developments in constructing

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[1] One useful early (hence the now rather quaint quotation marks) examination was Susan W Brenner, *Law in an Era of "Smart" Technology* (OUP 2007). See now Mireille Hildebrandt, *Smart Technologies and the End(s) of Law* (Edward Elgar 2015).

[2] See generally Donald G Gifford, 'Technological Triggers to Tort Revolutions: Steam Locomotives, Autonomous Vehicles, and Accident Compensation' (2018) Journal of Tort Law (forthcoming) <doi.org/10.1515/jtl-2017-0029>; Eric Tucker, 'Uber and the Unmaking and Remaking of Taxi Capitalisms: Technology, Law and Resistance in Historical Perspective' in Derek McKee, Finn Makela and Teresa Scassa (eds), *Law and the "Sharing Economy": Regulating Online Market Platforms* (University of Ottawa Press, forthcoming) <ssrn.com/abstract=3012558>; J Armour, 'Corporate Governance and

and enhancing the effective operation of circular economic practices, this article will consider the impact of connections and breakages between law and technology. Through exploration of the concepts, ideas, structures, and practices of circular economy, particularly as expressed in the report by the Ellen MacArthur Foundation (the leading think tank on circular economy) entitled *Intelligent Assets: Unlocking the circular economy potential*,[3] this article addresses two themes. First: circular economy requires a paradigmatic change to the nature and role of ownership and control of tangible goods, something now achievable through manipulation of intangible aspects of smart technology ie software. Second: such changes raise questions about the potential negative effects of circular economic practices. In light of considerable growing governmental interest in circular economy,[4] this analysis is particularly timely.

The next section outlines circular economic thought regarding smart technology, and shows how extending corporate control over goods is both essential to circular economics generally and a driving force behind circular economic treatment of the potential of smart technology in particular. The third section explores the practical implications of, and possible broader theoretical concerns with, smart technologies. These concerns are illustrated by real-world examples of commercial practices along with analysis of doctrinal tension between intellectual property and contract. At the heart of this analysis is a dual quandary: whether and to what extent we are willing to

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Technological Risks' (23 Feb 2017) <www.law.ox.ac.uk/business-law-blog/blog/2017/02/corporate-governance-and-technological-risks>; Lyria Bennett Moses, 'Why Have a Theory of Law and Technological Change?' (2007) 8 Minn J L Sci & Tech 589. All URLs accessed 14 August 2018.

[3] Ellen MacArthur Foundation, *Intelligent Assets: Unlocking the circular economy potential* (8 February 2016) <www.ellenmacarthurfoundation.org/publications>.

[4] The EU had announced almost a billion euros in funding for circular economy: <europa.eu/rapid/press-release_MEMO-17-4123_en.htm> (October 27, 2017).

give up (or are powerless to prevent changes to) control over tangible goods in order to access the putative benefits of smart technology and circular economics.

A final introductory point can be afforded on the question of terminology. The terms "smart technology" its cognate "smart goods" will be used throughout. Alternatives do exist: Mainwaring and Clarke have proposed the term eObjects.[5] I have previously written about 'integrated goods'.[6] Furthermore, the next section will examine the implications of the use of 'intelligent assets' in circular economic literature. But "smart goods" appears quite venerable,[7] and "smart technology" appears prevalent in general discourse.[8] What seems to be common to these different terminologies though is that they are all attempting to address the introduction of digital aspects to previously analogue objects. Additionally, whilst we can identify doctrinal division between "dumb goods", and digital products for the purposes of inter alia the Consumer Rights

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[5] Kayleen Manwaring, 'A legal analysis of socio-technological change arising out of eObjects' (5 January 2016) UNSW Law Research Paper No. 2016-15 <ssrn.com/abstract=2690024>; Kayleen Manwaring and Roger Clarke, 'Surfing the third wave of computing: a framework for research into networked eObjects' (2015) 31 Computer Law & Security Review 586.

[6] Sean Thomas, 'Security Interests and Intellectual Property: Proposals for Reform' (2017) 37 Legal Studies 214, 217: 'goods that have extensive and potentially novel forms of integration between the physical functionality of the goods and the software enabling the functionality'.

[7] Jean Braucher, 'When Your Refrigerator Orders Groceries Online and Your Car Dials 911 After an Accident: Do We Really Need New Law for the World of Smart Goods?' (2002) 8 Wash U J of L and Policy 8 (2002) 241.

[8] A Google search (2 July 2018) for "eObjects" reveals approximately 63400 hits. A search for "smart goods" reveals approximately 78800 hits. However, a search for "smart technology" gives 6710000 hits. It is acknowledged this cannot be a serious statistical point, but the prevalence for "smart technology" in advertising (as opposed to "eObjects") is revealing: see e.g. <www.pcworld.co.uk/gbuk/smart-tech/smart-tech-1072-c.html>.

Act 2015,[9] such a distinction does not help with the sort of "things" considered herein (which would sit somewhere between the two concepts employed by the 2015 Act). In the absence of legislative or judicial action identifying, clarifying and defining a particular term (whether smart goods, eObjects, or whatever), it is more productive to focus on how digitalisation (since it is that which is common to all terms) provides new routes to control of things, and the implications of such control.

2. The Circular Economy and "Intelligent Assets"

Circular economics draws on a variety of academic and intellectual antecedents.[10] According to the Ellen MacArthur Foundation a circular economy is

> characterised, more than defined, as an economy that is restorative and regenerative by design and which aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles. It is conceived as a continuous positive development cycle that preserves and enhances natural capital, optimises resource yields and minimises system risks by managing finite stocks and renewable flows. It works effectively at every scale.[11]

A number of legal issues clearly arise here; surprisingly they have not been subject to

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[9] Section 2 (8): '"Goods" means any tangible moveable items…'; (9) '"Digital content" means data which are produced and supplied in digital form.'

[10] See eg Michael Braungart and William McDonough, *Cradle to Cradle: Remaking the Way We Make Things* ([2002] Vintage 2009). See further <www.ellenmacarthurfoundation.org/>.

[11] *Intelligent Assets* (n 3) 18. See further eg Julian Kirchherr, Denise Reike and Marko Hekkert, 'Conceptualizing the circular economy: An analysis of 114 definitions' (2017) 127 Resources, Conservation & Recycling 221; Callie Babbitt, Gabrielle Gaustad, Angela Fisher, Gang Liu, Weiqiang Chen (eds), 'Sustainable Resource Management and the Circular Economy' (2018) 135 Resources, Conservation & Recycling 1-346.

much exploration.[12] Clearly, there are substantial implications for the legal frameworks dealing with waste,[13] especially the complex issues concerning digital waste. However, this article focuses on the implications of so-called 'intelligent assets' in circular economy, and examination of the *Intelligent Assets* report shows how the digital elements of smart goods will be utilised to shift towards a product-as-a-service model that is central to circular economics. Such digital elements facilitate the extension of control over goods, covering how the goods are used and even if they can be used at all. The commercial reality of the importance of digital control mechanisms, enforceable by both technological and legal methods, is plain to see. However, the precise legal form of such control, and any corresponding normative questions about the validity of such control, are far murkier issues.

The first step is to ask, what are 'intelligent assets'? An effective Internet of Things ("IoT")[14] renders more viable circular economic practices,[15] but 'intelligent assets' is a broader concept:

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[12] There heterodox intellectual foundation of circular economy means there are a wide variety of potential explanations. See eg Chris Backes, *Law for a Circular Economy* (Eleven International Publishing 2017) <www.uu.nl/sites/default/files/rgl-ucowsl-backes-law_for_a_circular_economy.pdf>. From a business perspective, see Peter Lacy and Jakob Rutqvist, *Waste to Wealth: The Circular Economy Advantage* (Palgrave MacMillan 2015).

[13] See eg Katrien Steenmans, Jane Marriott and Rosalind Malcolm, 'Commodification of Waste: Legal and Theoretical Approaches to Industrial Symbiosis as part of a Circular Economy' (9 June 2017) Working paper presented at the SMART conference 'Life-cycle based management and reporting for sustainable business', 29-30 November 2016 <ssrn.com/abstract=2983631>

[14] *Intelligent Assets* (n 3) 15: 'The networked connection of physical objects ... all objects, systems and processes that are exchanging information through the Internet'.

[15] *Intelligent Assets* (n 3) 8-9; Lacy and Rutqvist (n 12) 25. See further fn 77 and accompanying text.

> Physical objects that are able to sense, record and communicate information about themselves and/or their surroundings. This definition incorporates IoT objects but also includes assets that are not continuously transmitting information, and things that do not feature wireless communication.[16]

Thus smart technology enables a 'virtualised infrastructure that governs assets use and movements along the value chain.'[17] An initial point to make here is the use of 'assets'. This word, as opposed to goods, or objects, or things, implies a commercial conceptualisation of smart technology. This in turn is indicative of the heavily pro-commercial orientation of the Ellen MacArthur Foundation as well as other proponents of circular economy.[18] (A glance at the website for the Ellen MacArthur Foundation reveals the support provided by considerable swathes of global corporate power.[19]) Such interests will be piqued not necessarily by the environmental benefits potentially on offer, but because the changes wrought by the revolution of digitalisation have the 'the power to redefine value generation',[20] through the capacity to remove 'barriers that prevent sharing, leasing and performance models'.[21] As Stahel, one of the leaders in developing the concept of circular economy, has put it:

> A performance economy goes a step further by selling goods (or molecules) as services through rent, lease and share business models. The manufacturer retains ownership of the product and its embodied resources and thus carries the responsibility for the costs of risks and waste. In addition to design and reuse, the

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[16] *Intelligent Assets* (n 3) 15

[17] ibid 13.

[18] See also eg Lacy and Rutqvist (n 12).

[19] See eg <www.ellenmacarthurfoundation.org/about/partners>. See also Kirchherr et al (n 11) 229: '… CE's link to sustainable development is weak … most authors see CE as an avenue for economic prosperity … [especially] among practitioner definitions.'

[20] *Intelligent Assets* (n 3) 13.

[21] ibid 19.

> performance economy focuses on solutions instead of products, and makes its profits from sufficiency, such as waste prevention.[22]

Such models of commercial activity are not uncommon, especially in high-value mobile asset transactions (eg aircraft and locomotive leasing). However, intriguingly, in the context of circular economic thinking such models (a) appear to require a revolutionary approach to ownership structures and concepts, and (b) will be extended to a vast array of goods. Whilst it could be argued that there is little novelty in utilising transactional structures other than simple sale, the application of such processes to low value goods will be a step-change.

The potentially revolutionary impact on ownership structures and concepts has been recognised by the geographers Gregson, Crang, Fuller and Holmes, who argue moves towards circular economies require 'nothing short of a wholesale transformation of the basis of contemporary capitalism and consumption'.[23] Such claims might not be hyperbolic:

> [Michelin] wants to add sensors to its tyres, to understand wear over time. For customers this is great. They will learn when to rotate tyres or replace them – unique to their specific driving conditions. This saves money and improves safety. But there is more to play for. Armed with usage data, the company is even better

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[22] W R Stahel, "The Circular Economy" at <www.nature.com/news/the-circular-economy-1.19594> (23 March 2016).

[23] Nicky Gregson, Mike Crang, Sara Fuller and Helen Holmes, 'Interrogating the circular economy: the moral economy of resources recovery in the EU' (2015) 44 Economy and Society 218, 224. See also Kersty Hobson, 'Closing the loop or squaring the circle? Locating generative spaces for the circular economy' (2016) 40 Progress in Human Geography 88, 94: 'if the CE really requires a fundamental transformation of how resources are thought about and utilized, exploring the manifold – and often dispersed and experimental – ways such transformations can and are taking place constitutes a vital and missing component of CE debates.'

> equipped to shift its business model from selling tyres to leasing them (which it began before sensors made this model even more attractive). After all, GE and Rolls-Royce don't sell jet engines but lease them with service contracts on the side – why not tyres too? The data collected by the sensors tell the company how the tyres can best be maintained. The consequence of this shift in business model is profound. The tyre company now has a vital commercial interest in making tyres to last as long as possible, since the firm still owns them. And it has a new financial interest in using materials and processes that make recycling old tyres as efficient as possible. … These sort of 'triple play' wins – for consumers, companies and society – will become commonplace as the Internet of Things and big data increasingly become a part of everyday life. As such, the Internet of Things could become the 'soul' that animates objects in the circular economy.[24]

This illustration concerns not just ownership of data, but also issues concerning ownership of goods. The importance of ownership and control of goods, and not just data, is also revealed in comments by Neil Crocket, CEO of The Digital Catapult:[25]

> The coming years will see new, systematic, whole-life IoT models emerge – models that could dramatically change the way we produce, own, use, repair, and trade assets. Looking forward, IoT platforms that enable us to track our assets all the way along supply chains are emerging. This type of technology will start to allow us to establish and certify the pedigree of an asset (eg the circularity of the asset), putting us in a position where we can begin to create policy and tax incentives around how assets are being designed, utilised and managed along supply chains and across asset use cycles.[26]

Tracking and certifying the 'pedigree' of assets clearly impacts on ownership and thus value.[27]

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[24] *Intelligent Assets* (n 3) 21.

[25] <www.digitalcatapultcentre.org.uk/>.

[26] *Intelligent Assets* (n 3) 26.

[27] ibid 31.

The potential of blockchain technologies is of considerable importance here. A considerable volume of literature has accompanied blockchain developments,[28] and this article will not provide a detailed examination of blockchain. Instead a generally positive understanding of blockchain is adopted, in that whilst there are numerous problems with blockchains,[29] there is clearly immense scope for commercial application of blockchain.[30]

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[28] See eg Michael J Casey and Paul Vigna, *The Truth Machine: The Blockchain and the Future of Everything* (Harper Collins 2018); Iris H-Y Chiu, 'A new era in fintech payment innovations? A perspective from the institutions and regulation of payment systems' (2017) 9 Law, Innovation and Technology 190; Dirk A Zetzsche, Ross P Buckley, and Douglas W Arner, 'The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain' (2017-18) U Illinois L Rev (forthcoming) <ssrn.com/abstract=3018214>; Kelvin F K Low & Ernie G S Teo, 'Bitcoins and other cryptocurrencies as property?' (2017) 9 Law, Innovation and Technology 235; Lawrence J Trautman and Alvin C Harrell, 'Bitcoin Versus Regulated Payment Systems: What Gives?' (2017) 38(3) Cardozo L Rev 1041; Jean L Schroeder, 'Bitcoin and the Uniform Commercial Code' (2016) 24 U Miami Business L Rev 1.

[29] See eg *Intelligent Assets* (n 3) 11-12; 41-45 (competing interests in constructing, applying, and modifying the technical and legal codes underlying blockchain transactions need to be balanced); Government Science Office, *Distributed ledger technology: beyond blockchain. A report by the UK Government Chief Scientific Adviser* (19 January 2016) <www.gov.uk/government/news/distributed-ledger-technology-beyond-block-chain> 6-9; Adam Greenfield, *Radical Technologies: The design of everyday life* (Verso 2017) 159-191; Low and Teo (n 28) 259-264 (problem of "forking" in blockchains). See generally eg Karen Yeung, 'Algorithmic Regulation: A Critical Interrogation' (2018) Regulation and Governance (forthcoming) <doi:10.1111/rego.12158 >; Robert Brauneis and Ellen P Goodman, 'Algorithmic Transparency for the Smart City' (2018) 20 Yale Journal of Law & Technology 103; Pierluigi Cuccuru, 'Beyond bitcoin: an early overview on smart contracts' (2017) 25 International Journal of Law and Information Technology 179; Mark Giancaspro, 'Is a "smart contract" really a smart idea? Insights from a legal perspective' (2017) 33 Computer Law & Security Review 825; Robert P Bartlett, Adair Morse, Richard Stanton, and Nancy Wallace, 'Consumer Lending Discrimination in the FinTech Era' (8 December 2017) UC Berkeley Public Law Research Paper <ssrn.com/abstract=3063448>.

For the purposes of this article and focusing on circular economic practices it suffices to note two possible uses of blockchains. On one hand, using blockchain for payments will help in circular economic contexts. Nicolas Cary, co-founder of Blockchain, is quoted in the *Intelligent Assets* report: 'For intelligent assets to create value in the circular economy the development of an open and global payment protocol is required. The technology behind the Bitcoin blockchain has [this] potential'.[31] On the other hand, blockchain technologies provide a valuable potential mechanism for tracking and recording transactions and disposition of goods.[32] This information could then be utilised in order to provide more effective and directed control, through accurate identification of relevant goods.[33] In Casey and Vigna's words: 'A blockchain-based system becomes the Internet of Things' immutable seal',[34] and the circular economy 'will hinge on the transparency and information flows that blockchain systems allow.'[35] Combined, these features raise the possibility that access and use of smart goods will

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[30] *Distributed ledger technology* (n 29) 5-6; Steve Mansfield-Devine, 'Beyond Bitcoin: using blockchain technology to provide assurance in the commercial world' [2017] Computer Fraud & Security 14. See also Angela Monaghan, 'UK in strong position to be leader in crypto economy, report says' *The Guardian* (16 July 2018) <www.theguardian.com/technology/2018/jul/16/uk-strong-position-leader-crypto-economy-global-hub-blockchain-technology-report-says>.

[31] *Intelligent Assets* (n 3) 43, and also at 66-67 (expanding on this). See also, at 49, the example of Provenance (www.provenance.org), that uses blockchain to identify assets, which potentially could create 'an open, secure global registry for all material items.'

[32] See eg Casey and Vigna (n 28) 81.

[33] ibid 115: 'In their vision [ie blockchain maximalists, who consider the possible interchangeability of tokens across ledgers], all of our physical assets – our cars, boats, houses – as well as intangible assets such as brands, can be represented as secure digital assets on an immutable blockchain and traded directly with other assets, with their prices set by a matrix of billions of buyer and sellers.'

[34] ibid 126.

[35] ibid 147.

depend on the intangible record of the blockchain. We must therefore be wary of how, in Greenfield's elegant phrase, 'gradients of access will be inscribed on the physical world.'[36]

In this context we can see a dual challenge to law's institutional governance of ownership of things.[37] First is the possible divorce of ownership from any specific state or institution: ownership, such that it can be said to exist in blockchain,[38] may well become privatised. Secondly, this form of private ownership enables long-term down-stream control: goods are colonised, but not by law's empire.[39] Instead we will have a new multifaceted and diffuse imperator; law gets demoted to being a local prefect. As Reed, Sathyanarayan, Ruan and Collins point out law is an impurity in blockchains; blockchains operate most effectively when they can and do ignore law.[40] One result could be, in Fairfield's terminology, 'bitproperty', with blockchains enabling effectively costless and decentralised title registries.[41] It is not too great a conceptual distance (or

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[36] Greenfield (n 29) 155.

[37] cf James G H Griffin, 'The future of technological law: The machine state' (2014) 28 Int Rev Law, Computers & Technology 299.

[38] cf Chris Reed, Umamahesh Sathyanarayan, Shuhui Ruan and Justine Collins, 'Beyond BitCoin – legal impurities and off-chain assets' (2018) 26 Int J Law and Information Technology 160.

[39] Here the allusion is less to Ronald Dworkin, *Law's Empire* ([1986] Hart Publishing 1998), than to Sir William Jones, *Essay on the Law of Bailments* (1781) 144: 'if Law *be* a *science*, and really deserve so sublime a name, it must be founded on principle, and claim an exalted rank in the empire of *reason*; but if it be *merely* an unconnected series of decrees and ordinances, its use may remain, though its dignity be lessened'.

[40] Reed et al (n 38). Cf *Distributed ledger technology* (n 29) 42: 'distributed ledger systems differ from the conventional financial system in that they are ruled by technical code rather than legal code.'

[41] Joshua A T Fairfield, 'BitProperty' (2015) 88 So Cal L Rev 805. See also Rod Thomas and Charlie Huang, 'Blockchain, the Borg collective and digitalisation of land registries'

even a practical one) between title registries and what would be a new style of digital rights management, with the dangers there of corporate content control.[42] This techno-regulation creates a general challenge to the Rule of Law itself,[43] as well as the specific institutions of ownership. The potential effects of this are expressed well by Wright and De Filippi:

> In the case of smart property, however, ownership could be both defined and managed by source code. A person who qualifies as the technological owner (as opposed to the legal owner) of smart property enjoys absolute sovereignty over that resource, which cannot be seized by anyone unless specifically provided for by the underlying code. But code can also be used to implement a series of technological arrangements that might ultimately limit the exercise of property rights over a particular object. For instance, access to property can be programmatically limited to specific users or device, or even be limited to a person who is identified in a record on a blockchain. When brought to the extreme, every piece of property could be tied to a potential kill switch, whereby property could be disabled or divested remotely through the simple click of a button or a computer algorithm. In

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[2017] Conv 14; *Distributed ledger technology* (n 29) 69; Aaron Wright and Primavera De Filippi, 'Decentralized Blockchain Technology and the Rise of Lex Cryptographia' (10 March 2015) <ssrn.com/abstract=2580664>.

[42] Wright and De Filippi (n 41) 32-33.

[43] Mireille Hildebrandt, 'Law *as* Information in the Era of Data-Driven Agency' (2016) 79 MLR 1, 2: '[data-driven agency] will drain the life from the law, turning it into a handmaiden of governance (that fashionable term meaning anything to anybody), devouring the procedural kernel of the Rule of Law'. See also Hildebrandt (n 1) 9 (noting law's impotence in the face of smart technology). For a rich and compelling critical analysis of the dangers of technology negatively impacting on inter alia human dignity through imposition of control mechanisms, see eg Roger Brownsword, 'In the year 2061: from law to technological management' (2015) 7 Law, Innovation and Technology 1; Roger Brownsword, 'Technological Management and the Rule of Law' (2016) 8 Law, Innovation and Technology 100; Roger Brownsword, 'From Erewhon to AlphaGo: for the sake of human dignity, should we destroy the machines' (2017) 9 Law, Innovation and Technology 117.

> such a world, property ownership could vanish, replaced by a web of temporary leasehold interests governed by contracts.[44]

Here the ideological shift of the relationship between ownership and use in circular economics can be exposed. The references to blockchain's potential for circular economic practices should be understood not as a claim that circular economics is only possible through use of blockchain, or that blockchain will invariably lead to circular economies. Instead, it must be recognised that blockchain is merely one of many possible mechanisms, legal and technological, which can be used to generate the structures of control of goods down chains of transactions necessary for circular economies. The central idea underlying circular economics, especially as applied to smart goods, is that of control of use. Consider this statement from the *Intelligent Assets* report: 'Imagine a world in which all high-value assets belong to their manufacturer, who is incentivised to maintain and improve them on an ongoing basis.'[45] This is the objective for corporate participation in circular economy: exercising long-term control over tangible value-bearing assets. The reference to 'high-value assets' though diverts attention from the fact everyday goods may see the greatest impact:

> lifts, escalators, fridges, lighting and heating systems, desks, chairs, phones and laptops could be owned and tracked by their manufacturer, who will either

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[44] Wright and De Filippi (n 41) 35.

[45] *Intelligent Assets* (n 3) 37. Additionally: 'Performance-based business models – where a supplier retains ownership of the product and the customer pays on a per-use (or performance) basis – provide the supplier with a fixed contract revenue stream while offering incentives to maintain, simplify and increase the reliability and productivity of the product. Done right, it also reduces total asset costs, while increasing profitability and customer service value. The retained ownership can enable, but is not critical for, the taking back of products after use and refurbishing/remanufacturing them before taking them to market again.'

> maintain and improve them or take them back and reuse them when your company decides it wants to get new ones or move to a different location. And the family housing could be much cheaper because the construction company owns and tracks the materials to reuse or sell at the building's end of life.[46]

The *Intelligent Assets* report also refers to the printer manufacturer HP's "Instant Ink" service, which operates on a subscription-based model which reduced waste and supposedly strengthened customer relations.[47] Such models are not uncommon,[48] but they may not be welcomed by consumers. HP's model prohibited the use of generic ink cartridges, by using a unilateral software upgrade to the embedded software; clearly a functional removal of ownership and extension of corporate control. This led to an extraordinary consumer backlash,[49] forcing HP to perform a spectacular U-turn.[50]

Nevertheless, the tenor of the *Intelligent Assets* report is that such models are valuable, and this harmonises with other analyses of circular economy, such as Lacy and Rutqvist's *Waste to Wealth: The Circular Economy Advantage*.[51] They note that companies will '[enable customers] to make the most out of products; facilitate trade between users; supply services that monetize goods not in use; offer convenient buy-

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[46] ibid 61.

[47] ibid 39.

[48] Lacy and Rutqvist (n 12) 57, noting Ricoh's use of such a model. See also eg Dave Lee, 'I subscribe, therefore I am?' *BBC News* (14 July 2018) <www.bbc.co.uk/news/technology-44829976>.

[49] Alex Hern, 'HP "timebomb" prevents inkjet printers from using unofficial cartridges' *The Guardian* (20 September 2016) <www.theguardian.com/technology/2016/sep/20/hp-inkjet-printers-unofficial-cartridges-software-update>.

[50] Dave Lee, 'HP apologises for ink-blocking update' *BBC News* (29 September 2016) <www.bbc.co.uk/news/technology-37503139>.

[51] Lacy and Rutqvist (n 12).

back solutions; and sell services instead of products.'[52] This theme continues throughout: consumers will 'see how trading ownership of products for access to them can translate into greater convenience, little concern over maintenance and repair, less clutter in their homes, and more money in their pockets.'[53] Central to this revolutionary shift is the development of "Product as a Service" transactional models. As Braungart and McDonough put it:

> Instead of assuming that all products are to be bought, owned and disposed of by "consumers," products containing valuable technical nutrients – cars, televisions, carpeting, computers, and refrigerators, for example, would be reconceived as *services* people want to enjoy … When they finish with the product, or are simply ready to upgrade to a newer version, the manufacturer replaces it, taking the old model back.[54]

This is presented as beneficial to commerce and consumers: 'people could indulge their hunger for new products as often as they wish, without guilt, and industry could encourage them do so with impunity.'[55] Although such a model is generally perceived as most appropriate where goods have high acquisition and/or operating costs or are infrequently used or difficult to store,[56] technology enables more efficient ways to identify, access, use, pay for, and dispose of more mundane and low-value goods.[57]

Structuring ownership rights in a manner appropriate to circular economics therefore becomes essential: 'Companies need to find ways to control the return flow'.[58]

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[52] ibid xvii.

[53] ibid 25.

[54] Braungart and McDonough (n 10) 111.

[55] ibid 114. See also Lacy and Rutqvist (n 12) ch 8.

[56] Lacy and Rutqvist (n 12) 103.

[57] ibid 26 (a drill), 157 (jeans).

[58] ibid 61.

There may well be differences in B2B and B2C contexts: consumers 'are much more difficult to corral',[59] whilst businesses may be more reluctant to engage in certain types of transactional models that may aid circular economy (such as sharing).[60] For both types of transaction though technology provides a means by which goods can be identified and controlled in this process.[61] Circular economic practices such as "Product as a Service" need 'a blend of physical and digital channels' for dispositions.[62] The digital element will 'provide the connections needed to maintain a relationship far beyond the point of sale. [Smart technologies] enhance remote visibility and control of assets, which are especially critical [to circular economic models].'[63] By smartening up objects, through integrating and embedding software into goods, control of the use of assets becomes viable, not just technically but legally as well. Blockchain may be one way of achieving this. There are other possibilities though which can provide the necessary level of control without having to wait for widespread adaptation of blockchain recordation technologies.

This evidence about circular economic thinking towards smart goods produces a complex picture of interconnected and interacting goods and process. In light of the commercialised nature of a lot of circular economic writing, especially as exemplified in the use of the term intelligent *assets*, the emphasis on the potential for tracking and controlling smart goods beyond a point of first sale is expected. That such control can be achieved in a practical sense is examined further in the next section. The technological possibilities for control combined with the underlying policy basis for

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[59] ibid 61.

[60] ibid 88.

[61] ibid ch 6 especially.

[62] ibid 105.

[63] ibid 132.

such control provided by circular economic thinking, raises the question of what ownership of smart goods in a circular economy will actually look like. The precise nature of law's response to such challenges is difficult to foresee. What will be examined here is the capacity that law currently provides to enable circular economic practices to develop, in particular the options law provides to those wishing to extend control over goods down a chain of transactions.

3. Extending control and limiting ownership

This section shows how the growing prevalence of smart technology enables corporate control of goods. The enhanced interactivity of even mundane goods is identified in the following sub-section. However, this can raise problems in the context of security issues, potentially even enabling third party disabling of smart goods. The implications in terms of quiet possession obligations under the Sale of Goods Act 1979 are also considered. Additionally there is analysis of the effects of this increasing interactivity in terms of how we understand control of objects. The second sub-section expands on this by examining the potential for digital colonisation of goods. This is assessed through analysis of two legal mechanisms for control of goods: using intellectual property rights ("IPR") covering software, or, as is more likely, by using contractual tools to avoid difficulties thrown up by specific IP doctrines. Such combinations of legal and technological mechanisms suggest a profound alteration in ways of transacting over goods. Transactions can be framed as if they appear to be sales, whilst actually being characterised as merely licences for use (an appropriate approach to smart goods, not least due to the conceptual difficulties of leasing IPRs). Smart goods are, and will be, licensed rather than sold or leased, and how this is occurring and its implications will be scrutinized.

3.1 *Smartening up dumb objects: technological possibilities and commercial applications*

The increasingly pervasive nature of smart technology shows goods and software integrating at an exceptional rate and in deeper and more profound ways.[64] Neologism becomes necessary to describe this socio-technological revolution: Hildbrandt, for example, deploys the notion of '"softwired" interconnected "everywheres"'.[65] There is limited space to fully explore the nature of "smartness",[66] but Brenner's 2007 explanation still holds value:

> "[S]mart" technologies differ from traditional "dumb" technologies in two important respects: One is that thanks to artificial intelligence, "smart" technologies are capable of acting on their own. They can therefore work with us by anticipating our needs and fulfilling them; they can also replace us by taking over certain tasks, such as operating motor vehicles. The second difference is that "smart" technologies are meant to be, and will be, unobtrusive; as noted above, they will fade into the background and disappear from our awareness. This is why they are commonly referred to as "ambient" technologies.[67]

The combined autonomy and ambience of smart technologies simultaneously provides 'the conduit through which our choices are delivered to us, the mirror by which we see ourselves reflected, and the lens that lets others see us on a level previously

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[64] cf *Intelligent Assets* (n 3) 24 (estimating 10 billion objects with embedded information technology currently exist, with the source for this claim dating to 2014, and suggesting possible numbers of 50 billion connected objects by 2020). See also Deven R Desai, 'The New Steam: On Digitization, Decentralization, and Disruption' (2014) 65 Hastings LJ 1469.

[65] Hildebrandt (n 1) viii.

[66] See further Hildebrandt (n 1) ch 2 for a four-point taxonomy of smartness conceptualised as agency.

[67] Brenner (n 1) 6.

unimagined.'[68] The shape of the conduit, the angle of the mirror, the size of the lens will vary, meaning this mediating function invariably generates tension. Altering the shape of the conduit for choice-delivery for example, will determine not only the scope of our choices but even whether we effectively have choices. The capability of affecting, and even effecting, choice may in the future be present in very smart artefacts;[69] certainly now smart environments can affect our relationships with things.[70] Two broad "areas" of current and future goods-software integration illustrate such control possibilities. First is the application of smart technology to mundane objects, and the second is enhanced interactivity.[71]

3.1.1 *The application of smart technology to mundane objects*

Mundane objects such as washing machines,[72] cookers,[73] heating systems,[74] locks,[75] toys,[76] and so on are being smartened up as a result of technological developments. Most eye-catching is increasing connectivity between such objects, generating the

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[68] Greenfield (n 29) 6.

[69] Hildebrandt (n 1) ch 2: objects with "complete agency".

[70] ibid 11: 'Pre-emptive smart environments begin to transform our dealings with artefacts.'

[71] There are numerous other possible areas for analysis, such as human-technological fusion: see eg Muireann Quigley and Semande Ayihongbe 'Everyday Cyborgs: On Integrated Persons and Integrated Goods' (2018) 26 Medical Law Review 276. However, economy requires that those complex issues must be left for another time.

[72] BBC News, 'Hackers "could make car wash attack"' *BBC News* (28 July 2017) <www.bbc.co.uk/news/technology-40754403>.

[73] Chris Baraniuk, 'Aga app "could let hackers turn off oven" *BBC News* (13 April 2017) <www.bbc.co.uk/news/technology-39580507>.

[74] Leo Kelion, 'Schools warned over hackable heating systems' *BBC News* (15 December 2017) <www.bbc.co.uk/news/technology-42355665>.

[75] Padraig Belton, 'Lock out: The Austrian hotel that was hacked four times' *BBC News* (15 December 2017) <www.bbc.co.uk/news/business-42352326>.

[76] Alan Woodward, 'The glitch that stole Christmas: How to handle smart tech gifts' *BBC News* (22 December 2017) <www.bbc.co.uk/news/technology-42361279>.

supposed IoT.[77] There has been a considerable volume of scholarship and non-academic commentary on the IoT; what can be drawn from this is (i) the rapid expansion of connectable goods;[78] and (ii) the resulting massive volumes of data.[79] Greenfield thus accurately describes 'the colonization of everyday life by information processing.'[80]

Such developments present privacy and security issues,[81] with liability issues also recognised.[82] The 'paradigm shift' engendered by technological change enabling an

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[77] See generally Guido Noto La Diega and Ian Walden, 'Contracting for the "Internet of Things": Looking into the Nest' (1 February 2016) Queen Mary School of Law Legal Studies Research Paper No. 219/2016 <ssrn.com/abstract=2725913>.

[78] Paul Ohm and Blake Reid, 'Regulating Software When Everything Has Software' (2016) 64 George Washington L Rev 1672, 1676: this is a function of commercial choices, rather than 'the nature of the problem being solved'.

[79] W Kuan Hon, Christopher Millard and Jatinder Singh, 'Twenty Legal Considerations for Clouds of Things' (4 January 2016) Queen Mary School of Law Legal Studies Research Paper No. 216/2016 <ssrn.com/abstract=2716966>; Thomas J Farkas, 'Data Created by the Internet of Things: The New Gold Without Ownership?' (2017) 23 *Revista La Propiedad Inmaterial* 5 <ssrn.com/abstract=3012155>.

[80] Greenfield (n 29) 32

[81] See eg Andrew Guthrie Ferguson, 'The Internet of Things and the Fourth Amendment of Effects' (2016) 104 Cal L Rev 807; Melissa W Bailey, 'Seduction by Technology: Why Consumers Opt Out of Privacy by Buying into the Internet of Things' (2016) 84 Texas L Rev 1023; Lars S Smith, 'RFID and Other Embedded Technologies: Who Owns the Data?' (2002) 22 Santa Clara Computer & High Tech LJ 695. As the technology writer Evegeny Morozov tweeted: 'In case you are wondering what "smart" – as in "smart city" or "smart home" – means: Surveillance Marketed As Revolutionary Technology' *Twitter* (1 February 2016, 01:45), cited at Trevor Timm, 'The government just admitted it will use smart home devices for spying' *The Guardian* (9 February 2016) <www.theguardian.com/commentisfree/2016/feb/09/internet-of-things-smart-devices-spying-surveillance-us-government>. Department for Digital, Culture, Media & Sport, *Secure by Design: Improving the cyber security of consumer Internet of Things Report* (7 March 2018) <www.gov.uk/government/publications/secure-by-design>.

[82] Braucher (n 7).

IoT,[83] is arguably significant enough to resist legal or academic conservatism cautioning against radical responses.[84] As Ohm and Reid have noted of the US position, 2015 was a "year zero" in terms of agencies shifting heavily in the regulation of code, as an 'inevitable result of embedding software in everything. Physical functionality has been supplemented and replaced by code [meaning] … Agencies and regulators had to respond, whether or not they wanted to.'[85]

Without disagreeing, this article's focus is elsewhere. Instead of considering the regulatory challenges for governmental agencies, this article examines the potential generated by embedded software for control by producers and distributors of smart objects. In this sense, this article follows Brownsword's distinction between regulation as a function of governmental agencies, and 'controlling and channelling strategies' where corporate or commercial organisations seek 'to control and channel the purchaser's use of the product.'[86] This is an issue of sufficient importance so to justify analysis outside of intellectual frameworks of governmental regulation.[87] It is also justified by the fact that government policy appears to shift responsibility to the private sector. The very recent *Secure by Design* report's proposed Code of Practice makes clear that IoT objects should be subject to automated software updates, and unauthorised software changes should result in such objects being effectively prohibited

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[83] W Keith Robinson, 'Patent Law Challenges for the Internet of Things' (2015) 15 Wake Forest J of Business and IP Law 655, 661.

[84] Mark Fenwick, Wulf A Kaal, and Erik P M Vermeulen, 'Regulation Tomorrow: What Happens When Technology is Faster than the Law?' Lex Research Topics in Corporate Law & Economics Working Paper No. 2016-8 (4 September 2016) <ssrn.com/abstract=2834531>.

[85] Ohm and Reid (n 78) 1673.

[86] Roger Brownsword, *Rights, Regulation, and the Technological Revolution* (OUP 2008) 7-8.

[87] cf Hildebrandt (n 1) xiii (explaining her focus on state power).

from connecting to the internet.[88] Such software updates should 'not impact the functioning of a device',[89] but this clearly leaves open the possibility of enhanced down-stream control of such objects. This reliance on private sector control is likely to complement moves towards circular economy, where a similar philosophy of private-sector control predominates.

An additional complicating factor concerning the security implications of smartening up mundane objects is that there is an additional layer of control between manufacturer and user, ie internet service providers, internet exchange points and other parties in the internet infrastructure. This becomes particularly relevant following the recent introduction of regulations implementing the EU Directive on Security of Network and Information Services (the NIS Directive).[90] Regulation 10 imposes obligations on operators of essential services (OES) (such as internet exchange points),[91] to take

> appropriate and proportionate technical and organisational measures to manage risks posed to the security of the network and information systems on which their essential service relies … [and] appropriate and proportionate measures to prevent and minimise the impact of incidents affecting the security of the network and information systems used for the provision of an essential service, with a view to ensuring the continuity of those services.[92]

Such measures 'must, having regard to the state of the art, ensure a level of security of network and information systems appropriate to the risk posed.'[93]

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[88] *Secure by Design* (n 81) 18-19.

[89] ibid 23.

[90] Directive (EU) 2016/1148.

[91] The specific definition of an OES need not be dealt with here.

[92] The Network and Information Systems Regulations 2018 SI 2018 No 506, reg 10 (1), (2).

[93] ibid, reg 10 (3).

There are multiple possible implications arising due to the limited security capabilities of mundane smart goods and their susceptibility to infection by malware and being converted to operate as part of a botnet. The classic botnet operation is a distributed denial of service attack (DDoS); each individual unit within the botnet may not have any great processing power but the volumes of compromised units is what can affect the capacity to deal with data. This is 'a hacker's dream'.[94] The Regulations define the security of network and information systems as

> the ability of network and information systems to resist, at a given level of confidence, any action that compromises the availability, authenticity, integrity or confidentiality of stored or transmitted or processed data or the related services offered by, or accessible via, those network and information systems.[95]

In this sense, it may be that an appropriate method to deal with the risk of a massive DDoS is to disable individual units' ability to access the internet. This area is subject to further interim guidance from the Office of Communications as the designated competent authority for digital infrastructure,[96] though they admit that they have 'had little time and opportunity to finalise any detailed guidance'.[97] As such it merely refers to the National Cyber Security Centre's guidance in understanding the meaning of the Regulation 10 obligations.[98] This guidance, which includes the top-level objectives for cyber security (managing security risk, protecting against cyber attack, detecting cyber

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[94] Casey and Vigna (n 28) 41. They argue that blockchain technologies can eradicate this risk.

[95] The Network and Information Systems Regulations 2018 SI 2018 No 506, reg 1(3)(g).

[96] ibid, reg 10(4); sch 1.

[97] Ofcom, *Ofcom's interim guidance for Operators of Essential Services in the digital infrastructure subsector under the Network and Information Systems Regulations 2018* (08 May 2018) <www.ofcom.org.uk/__data/assets/pdf_file/0017/113750/Interim-guidance-for-OES-in-the-digital-infrastructure-subsector-under-the-NIS-Regulations.pdf> [1.2].

[98] ibid [4.35].

security events, and minimising the impact of cyber security incidents), itself then refers to information provided by two different organisations,[99] one US based (the National Institute of Standards and Technology) the other UK based (CREST), both of which set out that in dealing with a cyber security incident, it may be necessary to eradicate the threat through isolation, containment, alteration, or disabling access.[100] The dynamism of technological evolution means that stricter definitions may not be sensible. As such the most that can be said is that as it stands, the guidance available does not prevent, and may even suggest the necessity of, the restriction of access to the internet of compromised devices.

In the event of actions such as remote disconnection or disablement of smart goods, in order to meet the NIS requirements, would there be a breach of the Sale of Goods Act 1979 section 12(2)(b) warranty of quiet possession? What about the absence of a relationship between the ISP and either the user or the manufacturer? In such cases can the actions of the ISP in infringing possession generate liability under section 12(2)(b)? The case-law on quiet possession only appears to cover disputes where there has been infringement of a third parties rights by the seller, not where the third party is acting under a legislative obligation in undertaking the infringing action.

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[99] See eg <www.ncsc.gov.uk/guidance/d1-response-and-recovery-planning>.

[100] See eg CREST, *Cyber Security Incident Response Guide* (2013) <www.crest-approved.org/wp-content/uploads/2014/11/CSIR-Procurement-Guide.pdf> 38-39; NIST, *Computer Security Incident Handling Guide: Recommendations of the national institute of Standards and Technology* (August 2012) <nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-61r2.pdf> 35-38.

Not all infringements with quiet possession are actionable.[101] Thus in *The Crudesky* there was a factual infringement of possession by means of a ship being detained prior to the payment of a "fine" to a third party. This "fine" had no legal basis (it was basically a bribe) and as such this did not breach the statutory obligation.[102] However, where a third party had obtained an injunction as a result of the seller's action, this would constitute a sufficiently acceptable causal relationship so that the actions of the third party could result in the seller's infringement of the warranty of quiet possession.[103] This may reveal a limitation to the section 12(2)(b) warranty of quiet possession: Bingham J has referred to 'interference with possession or quiet enjoyment persisted in as a result of any act or omission of [the sellers] by any third party with whom they were in contractual relations'.[104] In the situation noted above, there is of course no contractual relationship between the ISP and the manufacturer. The final words of Bingham J suggest there may not be liability. On the other hand, in *The Playa Larga*,[105] the seller was involved in a decision by the seller's government to withdraw a ship loaded with goods appropriated to the contract. This was held to breach the quiet possession obligation. This might suggest liability on the part of the seller in the hypothetical botnet scenario, but would depend on the extent to which a distinction could be drawn between the nature of the relationships involved. A more expansive

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[101] cf Michael Bridge (gen ed), *Benjamin's Sale of Goods* (10th edn Sweet & Maxwell 2017) [4.025]: 'it can scarcely be intended to impose upon a seller the obligation of guaranteeing the buyer's possession against every disturbance that may occur'.

[102] *Great Elephant Corp v Trafigura Beheer BV (The Crudesky)* [2012] EWHC 1745 (Comm); [2012] 2 CLC 505 [104].

[103] *Louis Dreyfus Trading Limited v Reliance Trading Limited* [2004] EWHC 525 (Comm).

[104] *Gatoil International Inc v Tradax Petroleum Ltd* [1985] 1 Lloyd's Rep 350, 361.

[105] *Empresa Exportadora de Azucar v Industria Azucarera Nacional SA (The Playa Larga)* [1983] 2 Lloyd's Rep 171.

approach to quiet possession would suggest focusing more on the fact that there was a lawful interference not the fault of the buyer. Such an approach is suggested in *Benjamin's Sale of Goods*: 'It should also protect him against disturbance by the lawful acts of third persons, unless such disturbance is due to some act or omission on the part of the buyer or of a person deriving title from or connected with the buyer.'[106]

Favouring the wider interpretation of the warranty of quiet possession would clearly impact on the sellers of mundane but otherwise smart goods. Reducing the risk of such objects joining a botnet (or some other cyber security incident) would be a reasonable way to address the potential for liability. Indeed, this may be the only workable response, in light of the potential scope of a wide warranty of quiet possession. Nevertheless, such increased cyber security may be accompanied by more positive benefits for circular economics. Two methods of increasing the security of smart objects can be set out: one, providing continual, automated security updates for an appropriate security programme to operate; two, closing off possible access to and from the smart object to different systems (essentially, providing the object's user with only a limited operational capacity, perhaps by restricting the object to a particular corporate "ecosystem"). Both would be valuable approaches to take in circular economic contexts, as they allow corporate control of the goods over time. Moreover, as the recent *Secure by Design* report suggests the first option may well come to be the standard approach.[107] However, whilst the potential costs for the users of such goods may not be so considerable with individual goods taken alone, the combined volumes of mundane but smart goods may be such to result in significant negative impact from the effect of restrictions on the capacity and manner in which one can use the goods. In essence, the

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[106] *Benjamin's Sale of Goods* (n 101) [4.025].

[107] See text to n 88.

broad question is whether we are willing for our smart goods to be subject to such control, especially when such control is neither voluntarily bargained for nor is it readily ascertainable exactly when such control may be activated.

3.1.2 *Enhanced interactivity*

The second area concerns interaction. Smart goods interact with human users, but they also interact with other things and the environment in general. The example par excellence is the smartphone. As Roberts CJ of the US Supreme Court noted four years ago, 'modern cell phones, which are now such a pervasive and insistent part of daily life that the proverbial visitor from Mars might conclude they were an important feature of human anatomy.'[108] The increasing prevalence of smartphones, and the manner in which they are enmeshed into everyday life, only exacerbates this concern. We may arguably already have become cyborgs; it is only partly facetious to suggest that the name of one of the two dominant smartphone operating systems may imply that if we are not cyborgs, we may have android parasites.

The dematerialisation of interaction,[109] exemplified by smartphones, is fascinating and worrying at the same time. This interactivity always requires software; software is what makes things smart. Using smart technologies requires connection and interaction, whether knowingly or not, with other things and systems. In the current context of an effective duopoly between Apple and Android operating systems, smartphone users are confronted 'with a choice to make about which corporate ecosystem they wish to participate in'.[110] This makes a smartphone 'an aperture onto the interlocking mesh of technical, financial, legal and operational arrangement that

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[108] cf *Riley v California* 573 US __ (2014) 9.

[109] Greenfield (n 29) 10-11.

[110] ibid 17.

constitutes a contemporary device and service ecosystem ... that we implicate ourselves in from the moment we purchase one.'[111] Notably this is not a choice about *whether* to participate in such ecosystems; merely just *which* particular ecosystem you will have to participate in. One may of course be able to refuse to participate in any such system, by not using smart technologies. However, for the vast majority such a choice is unreasonable if not impossible. This is partly due to the ubiquity of such devices, but it is also because interactivity between objects and objects, objects and persons, and objects and the environment potentially results in controls of space, perception and action.[112] Smart technologies and augmented realities[113] may result in an 'onli*f*e', a new world both in and between on-line and off-line worlds. This raises questions about the interaction between the 'frontend (the world we see and navigate) and a backend (the largely invisible computational architecture that sustains and informs the frontend).'[114] For Hildebrandt this shift from 'use to interaction', [115] means we must 'build contestation in to the heart of the upcoming cyberphysical architectures'.[116]

Here we are concerned with how control of goods by software generates the need for such contestation. The control options arising through the integration of

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[111] ibid 17-18.

[112] cf Brenner (n 1) 9-12, distinguishing pervasive technology and pervasive effects of technology.

[113] cf Donald J Kochan, 'Playing with Real Property Inside Augmented Reality: Pokémon Go, Trespass, and Law's Limitations' (2017) 38 Whittier Law Review (forthcoming) <ssrn.com/abstract=2919109>; Mark A Lemley and Eugene Volokh, 'Law, Virtual Reality, and Augmented Reality' (2018) 166 U Pa L Rev (forthcoming) <ssrn.com/abstract=2933867>.

[114] Hildebrandt, 'Law *as* Information' (n 43) 5. See also Hildebrandt (n 1) 263 for a short definition, and ch 3 for a detailed exposition.

[115] Hildebrandt (n 1) 47.

[116] Hildebrandt, 'Law *as* Information' (n 43) 30.

software into mundane objects and the increasing interactivity of smart goods derive from two distinct (though not necessarily disparate) mechanisms. On one hand, technological control may well be built in to software, limiting the use of objects or obliging interaction with other objects or when in certain environments. On the other hand, legal control may be exercised through certain proprietary (IP law) or personal (contractual) legal mechanisms.[117]

There are thus two problems for circular economic practices. The first is the task of ascertaining who exactly owns what. Mass interactivity requires and is generative of vast quantities of data, which can cause considerable difficulty in ascertaining ownership or proprietary rights, as well as related issues of use-rights.[118] These problems are exacerbated by the failure in English law at least to even clarify what software actually is;[119] a problem unresolved by the utilisation of "digital products" in

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[117] Kieran Tranter, 'The Laws of Technology and the Technology of Law' (2011) 20 Griffith L Rev 753, 756: 'Since Lawrence Lessig's *Code*, the idea that control, order and regulation are integral to technology itself has become a basic point within law and technology scholarship. Hardwired, or potentially hardwired, into technological things are use limits.' See generally Lawrence Lessig, *Code and other laws of cyberspace, Version 2.0* (Basic Books 2006)

[118] These are not the only implications, but these are what are relevant for the purposes of this article.

[119] Compare *St Albans CDC v International Computers Ltd* [1996] 4 All ER 481 (manner of transmission); *Beta Computers (Europe) Ltd v Adobe Systems (Europe) Limited* [1996] FSR 367 (sui generis); *Gammasonics Institute for Medical Research Pty Ltd v Comrad Medical Systems Pty Ltd* [2010] NSWSC 267 (manner of transmission, following *St Albans*). For an indicative overview of the academic commentary, see eg Sarah Green, 'Can Digitised Products be the Subject Matter of Conversion?' [2006] LMCLQ 568; Sarah Green and Djakhongir Saidov, 'Software as goods' [2007] JBL 161; John N Adams, 'Software and digital content' [2009] Journal of Business Law 396; Ken Moon, 'The nature of computer programs: Tangible? Goods? Personal Property? Intellectual Property?' [2009] 31 EIPR 396; Althaf Marsoof, 'Digital content and the definition

the Consumer Rights Act 2015.[120] As such, ownership issues of smart technology (or "intelligent assets") remain problematic.[121] The need for strong down-stream control of goods in circular economics means the potential injection of rights-holders or sloughing off of use-rights at various stages raises questions about the capacity to control circular economies of smart goods with any degree of consistency or strength.

The second problem for circular economies is the potential for, indeed the actuality of, corporate control of smart goods and the ways we can act with and through such things. As shown, circular economics demands control of goods, which can be effected by smart technology and implemented through control mechanisms inherent in

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dilemma under the Sale of Goods Act 1979: Will the Consumer Rights Bill 2013 remedy the malady?' (2014) 9 J of Int Com L and Tech 285; Benjamin Hayward, 'What's in a Name? Software, Digital Products, and the Sale of Goods' (2016) 38 Sydney L Rev 441; Pheh Hoon H Lim and Louise Longdin, 'The smartphone wars: patents and copyright as swords and shields' (2016) 38 EIPR 280; Robert Clark, 'Software agreements, sales law and commercial agents' (2017) 23 CTLR 16; Noam Shemtov, *Beyond the Code: Protection of Non-Textual Features of Software* (OUP 2017). Recent proposals regarding Canadian personal property security treats software as goods for the purposes of financing transactions: Ronald C C Cuming et al, 'Proposals for Changes to the Canadian Personal Property Security Acts' (2017) 59 Canadian Bus LJ 145.

[120] cf Christian Twigg-Flesner, Richard Canavan and Hector MacQueen, *Atiyah and Adams' Sale of Goods* (Pearson 2016) 10 (only a 'partial remedy'); Marco B M Loos and Chantal Mak, 'Remedies for Buyers in Case of Contracts for the Supply of Digital Content' (20 June 2012) Amsterdam Law School Legal Studies Research Paper No. 2012-71 <ssrn.com/abstract=2087626>. For analysis of the incoherent EU approaches to digital products, see eg Janja Hojnik, 'Technology neutral EU law: digital goods within the traditional goods/services distinction' (2017) 25 Int J Law and Information Technology 63.

[121] See eg Sean Thomas, 'Security Interests and Intellectual Property: Proposals for Reform' (2017) 37 Legal Studies 214; Sean Thomas, 'Sale of Goods and Intellectual Property: Problems with Ownership' (2014) Intellectual Property Forum 25; Sean Thomas 'Goods with embedded software: obligations under Section 12 of the Sale of Goods Act 1979' (2012) 26 International Review of Law, Computers & Technology 165.

smart technology. However, creating a viable environment for the effective functioning of circular economic practices may result in a digital colonisation of goods, especially when legal control methods are combined with the technological mechanisms described above.

3.2. *The digital colonisation of goods*

The potential uses and dangers of hard (eg prohibiting copying) and soft digital rights management (eg allowing copying at the price of surveillance) has been long recognised, [122] and smart technology presents further such opportunities for control of goods in light of the ease of vertical integration of software and hardware.[123] The effectively costless nature of replication of digital information reduces the relevance of scarcity, with Lemley suggesting this this may lead to attempts to control goods by IPR holders.[124] The flip side of costless replication of digital information is a far greater capacity to introduce replicable control mechanisms into digital data (and thus embedded into smart objects): 'as soon as digitization offers a method of control, it will be exerted.'[125] Goods are becoming subjected to a form of legally-enforced imperialism of ownership: tangible things are controlled far down-stream of any production and/or retail of such things by means of functional control of software supported by legal

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[122] Christopher May, 'Digital rights management and the breakdown of social norms' (November 2003) 8 (11) *First Monday* <firstmonday.org/issues/issue8_11/may/index.html>. See also Aaron Perzanowski and Jason Schultz, *The End of Ownership: Personal Property in the Digital Economy* (MIT Press 2017) ch 5.

[123] Greenfield (n 29) 275.

[124] Mark A Lemley, 'IP in a World Without Scarcity' (2015) 90 NYU L Rev 460.

[125] Desai (n 64) 1481.

regimes structured around a concept of powerful and practically un-contestable IPRs.[126]

This imperialism can be seen in numerous recent commercial actions, sometimes accidental and sometimes more deliberate. Earlier the cautionary tale of HP's ink service was noted; further illustrations are instructive. In August 2017, a leading drone manufacturer informed owners they would be obliged to allow an update or the goods would be in effect stopped from working.[127] In December 2017, a row broke out between Amazon and Google over the interaction and interoperability of different smart products as between the two platforms.[128] At the same time, Apple admitted to deliberately slowing down older models of its iPhone, using software upgrades to modify battery performance;[129] user backlash led to Apple providing the option to reject

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[126] See eg Christopher May, 'The denial of history: reification, intellectual property rights and the lessons of the past' (2006) 88 Capital & Class 33 (arguing that IPRs are reifications as a result of interest group economic dominance).

[127] BBC News, 'DJI drone owners told to update or be grounded' *BBC News* (22 August 2017) <www.bbc.co.uk/news/technology-41011659>.

[128] Leo Kelion, 'Google Amazon row leads to restricted YouTube access' *BBC News* (6 December 2017) <www.bbc.co.uk/news/technology-42251531>; Samuel Gibbs, 'Google v Amazon: YouTube app pulled from Fire TV and Echo Show' *The Guardian* (6 December 2017) <www.theguardian.com/technology/2017/dec/06/google-amazon-fight-youtube-app-pulled-echo-show-fire-tv-home-smart-speakers-chromecasts-nest-products>; BBC News, 'YouTube app removed from Amazon Fire TV Kit early' *BBC News* (29 December 2017) <www.bbc.co.uk/news/technology-42511363>.

[129] Chris Foxx, 'Apple's iPhones slowed to tackle ageing batteries' *BBC News* (21 December 2017) <www.bbc.co.uk/news/technology-42438745>; Patrick Greenfield, 'Apple apologises for slowing down older iPhones with ageing batteries' *The Guardian* (29 December 2017) <www.theguardian.com/technology/2017/dec/29/apple-apologises-for-slowing-older-iphones-battery-performance>.

such changes.[130] Along similar lines, April 2018 saw reports that a new operating system update to iPhones had the effect of stopping the devices working if the screens had been repaired by third parties.[131] Both these examples clearly demonstrate how control of the software can be utilised in order to exercise a form of ex post facto control over the use of the physical aspects of smart goods. Arguably, this is something akin to punishment for those users who dare to move outside the corporate ecosystem. The extent to which legal regimes can resolve such issues in favour of consumers or corporations is not entirely clear. Later it will be seen how Apple's attempts to stop iPhones that had third party repairs has not been successful in Australia;[132] the fact Apple appear to be attempting the same control in the UK arguably demonstrates that these instances of corporate control of smart goods is truly a salient issue.

More accidentally, in 2017 Samsung sent an update to televisions which stopped them working.[133] At the other end of the scale, the rise and fall of the Kodi box demonstrates the considerable power granted to IPR holders who are able to introduce technological rights control mechanisms, breach of which can lead to criminal liability.[134] However, the breadth of this offence is such that a device which can

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[130] Alex Hern, 'iPhone users to be given option to turn off feature that slows down devices' *The Guardian* (18 January 2018) <www.theguardian.com/technology/2018/jan/18/iphone-apple-users-turn-off-feature-battery-slow-down-devices-ios-tim-cook>.

[131] Samuel Gibbs, 'iOS 11.3 update breaks iPhone 8 devices with third party-repaired screens' *The Guardian* 10 April 2018) <www.theguardian.com/technology/2018/apr/10/iphone-8-ios-113-breaks-smartphones-third-party-repaired-screens-apple>.

[132] See n 165.

[133] Miles Brignall, 'Samsung TV owners furious after software update leaves sets unusable' *The Guardian* (24 August 2017) <www.theguardian.com/technology/2017/aug/24/samsung-tv-buyers-furious-after-software-update-leaves-sets-unusable>.

[134] Copyright, Designs and Patents Act 1988, sections 296 – 296ZF. See eg Press Association, 'Trader who sold TV Kodi boxes enabling free streaming of paid content avoids jail' *The*

primarily be used for circumventing copyright protection mechanisms, but is not actually used for such a purpose, leads to liability.[135] This illustrates a considerable power imbalance in favour of IPR holders. However, criminal enforcement may not even be necessary for IPR holders to exercise their considerable powers and substantially impact on the use of goods. This type of behaviour can be understood as part of a 'strategy of vertical integration … to control the network, as well as the platforms, applications, physical devices and content that run on and are connected by it.'[136]

This was demonstrated in 2009 by Amazon, who remotely deleted e-books (amusingly including Orwell's *1984* and *Animal Farm*) from the Kindle e-readers they had been downloaded to.[137] This was on the grounds that the e-books infringed copyright. This was without any consent or even knowledge on the part of the readers. In the decade since this incident, little appears to have been made of the implications of such behaviour. In 2010 Bradgate briefly suggested that such actions might be a breach of the Sale of Goods Act 1979 section 12(1), for infringing the owner's quiet possession

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Guardian (20 October 2017) <www.theguardian.com/tv-and-radio/2017/oct/20/trader-who-sold-tv-kodi-boxes-enabling-free-streaming-of-paid-content-avoids-jail>. See further Intellectual Property Office, *Guidance: Illicit streaming devices* (20 November 2017) <www.gov.uk/government/publications/illicit-streaming-devices/illicit-streaming-devices>.

[135] Lionel Bently and Brad Sherman, *Intellectual Property Law* (OUP 2014) 360.

[136] Greenfield (n 29) 275: this is the strategy of 'a small number of commercial enterprises … Apple, Amazon, Google and Facebook, with Microsoft trailing a considerable distance behind'.

[137] See eg Brad Stone, 'Amazon Erases Orwell Books From Kindle' *The New York Times* (17 July 2009) <www.nytimes.com/2009/07/18/technology/companies/18amazon.html>. See further Lukas Feiler, 'Separation of ownership and the authorization to use personal computers: Unintended effects of EU and US law on IT security' (2011) 27 Santa Clara Computer & High Technology Law Journal 131.

of the e-reader.[138] I have also previously argued that the complications in this area are enough to justify reforming section 12 in order to protect sub-purchasers.[139] There is also no specific case-law, unsurprising considering the generally shallow pool of authority on section 12 generally. What perhaps comes closest is an unreported decision of the Court of Appeal from 1999, in *Rubicon Computer Systems Ltd v United Paints Ltd*.[140] That case (which was decided ten years after the events) involved the installation of a 'computer system'.[141] There is no further detail on the nature of this system. The parties' relationship broke down prior to payment of the full price. After this point, someone acting for the appellant 'placed a device in the computer … called a time lock'.[142] Whether the timelock is a physical device or part of the code was not considered. The timelock was activated some time later, rendering the computer useless and, by the time it was unlocked, obsolete. Mantell LJ, giving the judgment of the Court, held that this was an infringement of the buyer's quiet possession and thus a breach of the sale of Goods Act 1979 section 12(2)(b).[143]

The implications for an Amazon-style deletion of e-books are not clear. One approach might be that since section 12 only applies when there has been a sale, then if the acquisition of the e-book is by some other method then the section 12 protection is limited. This is of particular importance in light of the recent decision of the Supreme

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[138] Robert Bradgate, *Consumer rights in digital products: A research report prepared for the UK Department for Business, Innovation and Skills* (September 2010) <www.bis.gov.uk/assets/biscore/consumer-issues/docs/c/10-1125-consumer-rights-in-digital-products> 20 fn 25.

[139] Thomas (2012) (n 121).

[140] (2000) 2 TCLR 453.

[141] *Rubicon Computer Systems*, transcript p2.

[142] ibid.

[143] ibid, 4-5.

Court in *Bunkers*, which showed the relative ease with which parties can contract out of the Sale of Goods Act 1979 in general.[144] If this is possible, then it may allow for parties to get out of the obligations on quiet possession despite the general prohibition against contracting out of the section 12 obligations.[145] In the event that the section 12 obligations do carry over regardless of the type of contract, it may be possible to distinguish the sort of activity involved in the Amazon situation from that in *Rubicon*. The latter involved an unlawful interference, but the former is harder to characterise in the same way. The e-reader was not rendered inoperable. There is also the possibility that the terms of use may provide exceptions to any quiet possession warranty, for authorised interferences.[146]

Differences in doctrine as well as policy may well pull legal regulation of smart technology in circular economy in different directions.[147] However, another possible direction might be in terms of convergence, brought about by the borderless nature of digital information and thus of smart technology. For this reason it is worth considering various jurisprudential structures enabling IPR holders to control goods from different jurisdictions.[148] From a US perspective, Fairfield argues the power of IPR holders raises the danger of a digital serfdom, and suggests a stronger and broader application of doctrine from tangible personal property law to prevent digital control through contracts

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[144] *PST Energy 7 Shipping LLC v OW Bunker Malta Ltd* [2016] UKSC 23; [2016] AC 1034.

[145] Unfair Contract Terms Act 1977, section 6(1). It is worth noting that his prohibition does not apply to international transactions: section 26.

[146] *Rubicon Computer Systems*, transcript p4-5, citing *Healing (Sales) Property Ltd v Inglis Electrix Property Ltd* [1968] 121 CLR 584, 591 (Barwick CJ and Menzies J): 'it being common ground that the circumstances of the contract did not exclude the implication of this warranty.'

[147] Brexit also raises problems, which are too complex to be entered into here.

[148] For analysis focused on English law, see generally Thomas (n 121).

and IP law.[149] Similarly, there is the provocative argument by Banta, who suggests that digitalisation has led to a development of a form of 'digital feudalism'.[150] She argues digital assets are generated by means of contractual agreements, and as such are subjected to contractual terms which may (often) impose obligations and prohibitions on use and alienation. These terms generate a feudal relationship between the relevant parties:

> Like the peasants under a true feudal system, account holders of today's digital assets lack power over their digital assets. They receive what corporations allow them to receive and nothing more. In this sense, corporations are the true owners of digital assets and when account holders die, assets revert back to the companies from which account holders purchased or accumulated them. In present possessory estate terms, corporations own a fee simple interest in digital assets and lease these assets to customers for their limited use or for a limited time. Individuals own some kind of lesser interest like a leasehold or a life estate in digital assets.[151]

The relationships between corporations and users of digital assets are characterised by absolutism (the users have no or minimal control over the terms of the agreement) and hierarchy and concentrated power ('Companies are able to control the use of digital assets long after an individual has purchased it'[152]). She concludes by noting that this form of digital feudalism is extending towards goods:

> Beyond software and digital media, the trend is even beginning to apply to physical devices. Recently, Apple and cell phone carriers decided to license their physical

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[149] Joshua A T Fairfield, *Owned: Property, Privacy, and the New Digital Serfdom* (CUP 2017). See also Pascale Chapdelaine, *Copyright User Rights: Contracts and the Erosion of Property* (OUP 2017).

[150] Natalie B Banta, 'Property Interests in Digital Assets: The Rise of Digital Feudalism' (2017) 38(3) Cardozo L Rev 1099.

[151] ibid 1150.

[152] ibid 1153.

> devices instead of sell them outright. Individuals pay an installment fee every month but do not own their phones. Rather, they lease the phones like they would expensive automobiles. … users will all be serfs in the system of ownership.[153]

This connection between tangible and intangible rights and obligations, generated and then enforced by smart technology, provides the capacity to control the material by means of the immaterial.[154] In the words of Kessler from 75 years ago, law may allow 'powerful industrial and commercial overlords . . . to impose a new feudal order of their own making upon a vast host of vassals.'[155] As such, the centrality of this sort of corporate control to circular economy may require a radical reaction, or it may require us to drastically alter current notions of ownership or control of things because we have no control over the smart technology embedded in those things.

The implications of these control possibilities can be discerned in a number of recent practical examples. In February 2017, it was reported that the virtual reality headset sold by Oculus may be prohibited as a result of action concerning code used in the goods.[156] July 2017 saw a report that Qualcomm was asking for a prohibition on

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[153] ibid 1056, citing: V Luckerson, 'Why Apple Wants to Lease You Your Next iPhone' *Time* (9 September 2015) <time.com/4028327/apple-iphone-upgrade-program>.

[154] cf Brownsword (2015) (n 43) 26: 'Where environments are technologically controlled … the regulatory signal is no longer normative. In other words, in place of (normative) prescription, we have only (non-normative) possibility and impossibility.' See also Mireille Hildebrandt, 'Legal and Technological Normativity: More (and Less) than Twin Sisters' (2008) 12 *Techné: Research in Philosophy and Technology* 169, 174.

[155] Freidrich Kessler, 'Contracts of Adhesion—Some Thoughts About Freedom of Contract' (1943) 43 Columbia L Rev 629, 640. Oddly, this is not mentioned in Banta's article.

[156] Jane Wakefield, 'Oculus facing legal ban on VR code used in its products' *BBC News* (24 February 2017) <www.bbc.co.uk/news/technology-39076771>.

sales of iPhones for breach of their IPR by Apple.[157] These disputes illustrate the potential for a binary use/non-use control option in the hands of IPR holders. From a circular economics perspective, the ideal result in such disputes would be the maintenance of such a control option, as it provides a potential mechanism for controlling the use of goods down a chain of transactions.

On a slightly different path, considerable efforts have been made by corporate bodies to prevent users from repairing smart technologies. In the US, there have been numerous instances where companies such as Apple and John Deere have lobbied against the introduction of state level right to repair legislation, resulting in a fightback on the part of consumers and, importantly, non-consumers (farmers, in the case of John Deere).[158] In a case, currently pending before the US Court of Appeals for the 11th Circuit, a computer refurbisher Eric Lundgren was found guilty of copyright infringement for replicating restore discs for Windows computers.[159]

This area is likely to be the scene of considerable disputation in the future, as the extent of rights of repair, particularly in the case of smart technology, are worked out in

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[157] BBC News, 'Qualcomm seeks Apple iPhone sales ban' (7 July 2017) <www.bbc.co.uk/news/technology-40535711>.

[158] See eg Jason Koebler, 'Apple Will Fight "Right to Repair" Legislation' (15 February 2017) <www.vice.com/en_us/article/apple-will-fight-right-to-repair-legislation?utm_content=inf_10_3687_2>; Olivia Sohn, 'A right to repair: why Nebraska farmers are taking on John Deere and Apple' *The Guardian* (6 March 2017) <www.theguardian.com/environment/2017/mar/06/nebraska-farmers-right-to-repair-john-deere-apple>.

[159] Tom Jackman, 'Eric Lundgren, "e-waste" recycling innovator, faces prison for trying to extend life span of PCs' *The Washington Post* (15 February 2018) <www.washingtonpost.com/news/true-crime/wp/2018/02/15/eric-lundgren-e-waste-recycling-innovator-faces-prison-for-trying-to-extend-lifespan-of-pcs/?noredirect=on&utm_term=.c5537ce35a6f>.

courts and legislatures. This is especially so in light of the limited contemporary right to repair legislation. Thus the EU's right to repair and maintain vehicles,[160] is merely a right to access, and is time and purpose limited,[161] and is not necessarily free.[162] More generally, there no longer appears to be a common law right to repair in copyright law,[163] a profound lacuna for those repairing software. This is especially important if there is no obligation on manufacturers of smart technologies to update such technologies over a long period of time to maintain their security. In May 2018 it was reported that the Dutch consumer group Consumentenbond are failed to convince a court to require Samsung to update phones for at least four years after initially being sold.[164]

A more repair-friendly approach can be possible, though it requires a broad understanding of a right to repair. Evidence of this comes from Australia. In April 2017 the Australian Competition and Consumer Commission took action against Apple's

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[160] Regulation (EC) No 566/2011.

[161] The history of this right (Regulation (EC) No 715/2007 and Regulation (EC) No 692/2008) shows its limitation to vehicle repair and maintenance in the context of emissions. Thus aesthetic repairs are excluded: Jane Cornwell, 'Case Comment: *BMW v Round & Metal*: first UK decision on the Community design "repair clause"' (2013) 35 EIPR 548. For critical analysis of this right, see eg Carl Wetter, 'Sweden: market court orders Kia to amend its car warranties' [2013] 6 Global Competition Litigation Review R-5; Aleksander Maziarz, 'Block exemption for sale of the new motor vehicles: a major change ahead?' (2014) 35 ECLR 63, 65-66 (noting possible competition law implications); Erika Ellyne, 'What the difference between making versus repair can teach us on the scope of exclusive rights' [2015] EIPR 525.

[162] Regulation (EC) No 566/2011, art 2(2).

[163] See eg Gavin Llewellyn, 'Case Comment: Does copyright law recognise a right to repair?' [1999] EIPR 546. See further *United Wire Ltd v Screen Repair Services (Scotland) Ltd* [2001] FSR 24; *Schutz (UK) Ltd v Werit UK Ltd* [2013] UKSC 16.

[164] BBC News, 'Samsung won't be forced to update old phones' *BBC News* (31 May 2018) <www.bbc.co.uk/news/technology-44316364>.

refusal, contrary to Australian consumer law, to repair faults where devices had been subject to otherwise unconnected third-party repairs.[165] On 18 June 2018 Lee J of the Federal Court of Australia found that this practice was against Australian consumer law, fining Apple nine million dollars.[166] This approach is to be applauded, especially in light of reports (noted above) that such practices are still occurring.[167] Likewise, the US Federal Trade Commission has warned companies that "warranty void if removed" stickers are likely to be breaches of US consumer protection law.[168] However, it remains to be seen whether it is applicable beyond the consumer-law context, for such rights are clearly of considerable value for commercial organisations, especially in circular economic contexts.

It might be countered that the rules on exhaustion, or first sale, may demonstrate a fundamental weakness in IPR holders' capacity to control goods. This particular issue has recently been considered by the US Supreme Court, first in the context of first sale of copyright in *Kirtsaeng v John Wiley & Sons, Inc* in 2013,[169] and then concerning exhaustion of patents in *Impression Products, Inc v Lexmark International, Inc* in

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[165] <www.accc.gov.au/media-release/accc-takes-action-against-apple-over-alleged-misleading-consumer-guarantee-representations>; Christopher Knaus, 'Court action against Apple shows companies "can't flout consumer rights"' *The Guardian* (7 April 2017) <www.theguardian.com/technology/2017/apr/07/court-action-against-apple-shows-companies-cant-flout-consumer-rights>.

[166] *Australian Competition and Consumer Commission v Apple Pty Ltd* (FCA, Victoria Registry) VID339/2017. See also <www.accc.gov.au/media-release/iphone-and-ipad-misrepresentations-cost-apple-inc-9-million-in-penalties>.

[167] See n 131.

[168] <www.ftc.gov/news-events/press-releases/2018/04/ftc-staff-warns-companies-it-illegal-condition-warranty-coverage>.

[169] *Kirtsaeng v John Wiley & Sons, Inc* 568 US 519; 133 SCt 1351 (2013).

2017.[170] It is worth considering these decisions, not least because of the likely impact on business practices in general, but also because of how the issue of control of goods through IPRs, via software, was considered. Thus, in *Kirstaeng*, the majority worried that refusing to extend the first-sale principle to goods sold abroad (in this case, textbooks) would have a chilling effect on sales generally.[171] Breyer J (for the majority) wrote that first sale 'frees courts from the administrative burden of trying to enforce restrictions upon difficult-to-trace, readily movable goods.'[172] Furthermore, he said

> '[t]echnology companies tell us that "automobiles, microwaves, calculators, mobile phones, tablets, and personal computers" contain copyrightable software programs or packaging … Many of these items are made abroad with the American copyright holder's permission and then sold and imported (with that permission) to the United States. … A geographical interpretation would prevent the resale of, say, a car, without the permission of the holder of each copyright on each piece of copyrighted automobile software. Yet there is no reason to believe that foreign auto manufacturers regularly obtain this kind of permission from their software component suppliers.'[173]

Thus it would seem that the law would prevent parties from exercising control over goods through the software.[174] But this would be too broad a conclusion; rather, it

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[170] 581 US ___ (2017); 137 S Ct 1523.

[171] 568 US 519, 538-539 (following Coke's prohibitions on restrictions on alienation of chattels)

[172] ibid 539.

[173] ibid 542.

[174] Cf Ginsburg J's dissent at 568 US 519, 557, arguing (at 579) that the majority's identification of situations where excluding foreign-made copies from the first sale rule might mean 'copyright owners could exercise perpetual control over the downstream distribution or public display of such copies … [and would] prevent the resale of a wide range of consumer goods, from cars to calculators' was misplaced. She suggested (at 584) that fears about transactions involving goods involving software being constrained dissipate in the face of 'principles of fair use and implied license (to the extent that express licenses do not exist)'. Furthermore (at 585-586) she notes that 'no court, it appears, has

should be noted that the courts have in fact provided an alternative mechanism for such control, based on treating the transaction as something other than a sale. Thus Breyer J noted that '[17 US Code Annotated § 109(a)] now makes clear that a lessee of a copy will *not* receive "first sale" protection but one who *owns* a copy *will* receive "first sale" protection, *provided*, of course, that the copy was "*lawfully made*" and not pirated.'[175] This aspect would be repeated in *Impression*,[176] which more clearly shows that whilst IPRs may not succeed in providing post-sale protection, contracts can.

Impression had worked around digital rights management software embedded into Lexmark printer cartridges. This was to enable the unauthorised resale of such cartridges. Lexmark argued that this infringed its patent rights. The Supreme Court held that Lexmark's sales of the cartridges would exhaust its rights.[177] This meant that it could not bring an action for patent infringement. However, as Roberts CJ, giving the opinion of the majority, stated: 'The single-use/no-resale restrictions in Lexmark's contracts with customers may have been clear and enforceable under contract law, but

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been called upon to answer any of the Court's "horribles" in an actual case … not a single case in which the owner of a consumer good authorized for sale in the United States has been sued for copyright infringement after reselling the item or giving it away as a gift or to charity. The absence of such lawsuits is unsurprising. Routinely suing one's customers is hardly a best business practice. Manufacturers, moreover, may be hesitant to do business with software programmers taken to suing consumers. Manufacturers may also insist that software programmers agree to contract terms barring such lawsuits.'

[175] 568 US 519, 535.

[176] 137 S Ct 1523, 1535-1536 (Roberts CJ): 'Applying patent exhaustion to foreign sales is just as straightforward [as first sale in copyright, as per *Kirtsaeng*.]'

[177] Ginsburg J dissented (137 S Ct 1523, 1538-1539) which was unsurprising given her earlier dissent in *Kirtsaeng*.

they do not entitle Lexmark to retain patent rights in an item that it has elected to sell.'[178] Furthermore, the

> smooth flow of commerce would sputter if companies that make the thousands of parts that go into a vehicle could keep their patent rights after the first sale. Those companies might, for instance, restrict resale rights and sue the shop owner for patent infringement. And even if they refrained from imposing such restrictions, the very threat of patent liability would force the shop to invest in efforts to protect itself from hidden lawsuits. Either way, extending the patent rights beyond the first sale would clog the channels of commerce, with little benefit from the extra control that the patentees retain. And advances in technology, along with increasingly complex supply chains, magnify the problem.[179]

It might therefore seem impossible to argue that IPR could control goods downstream. The Supreme Court in *Impression Products* and *Kirtsaeng* justified their decisions on a supposed common-law rule against alienation, drawing on Lord Coke.[180] However, as Hovenkamp clearly shows, this alleged rule is much narrower than the Court supposed, and is probably irrelevant to the IP context (being more concerned with price maintenance in personal property, and perpetuity situations).[181] Hovenkamp argues in favour of a restrictive approach to exhaustion rules, on the grounds that they can be socially beneficial. This may well be the case, though not in all situations (which I assume to be Hovenkamp's position also); here I imply that the problem is not so much IP exhaustion or first sale rules, but the ways in which alternative forms of governance

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[178] 137 S Ct 1523, 1531.

[179] ibid 1532.

[180] ibid: 'As Lord Coke put it in the 17th century, if an owner restricts the resale or use of an item after selling it, that restriction "is voide, because ... it is against Trade and Traffique, and bargaining and contracting betweene man and man."' 1 *Coke, Institutes* § 360.

[181] Herbert Hovenkamp, 'Reasonable Patent Exhaustion' (2018) 35 Yale J Regulation (forthcoming) <ssrn.com/abstract=2995751> 23-27.

and control of things can be imposed. The key is thus in the fact that the Supreme Court denied the possibility of an IPR action, and expressly left open the possibility of a contractual claim.[182] On the face of it, this is cold comfort for IPR holders. Claims would be against the initial purchaser: resellers such as Impression would not be privy to such agreements and would avoid liability. Nevertheless, a more subtle process of control can be utilised, one which involves controlling the goods by virtue of controlling the software that makes smart technology work. Such behaviour would involve controlling the *digital* data, where exhaustion does not apply. This point, deriving from *Capitol Records LLC v ReDigi Inc*,[183] was not mentioned in *Impression Products* and surely therefore remains US law.[184]

This still leaves the problem that the US Supreme Court appears to expressly allow sales to counter any attempt to control by licence:

> a license is not about passing title to a product, it is about changing the contours of the patentee's monopoly: The patentee agrees not to exclude a licensee from making or selling the patented invention, expanding the club of authorized producers and sellers … Because the patentee is exchanging rights, not goods, it is free to relinquish [by license] only a portion of its bundle of patent protections. A patentee's authority to limit licensees does not, as the Federal Circuit thought, mean that patentees can use licenses to impose post-sale restrictions on purchasers that are enforceable through the patent laws. So long as a licensee complies with the license when selling an item, the patentee has, in effect, authorized the sale. …

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[182] ibid 1533: 'whatever rights Lexmark retained are a matter of the contracts with its purchasers'.

[183] *Capitol Records LLC v ReDigi Inc* 934 FSupp2d 640 (USDC SD NY 2013) (no exhaustion/first sale rule for digital products); cf *Kirtsaeng v John Wiley & Sons, Inc* 568 US 519; 133 SCt 1351 (2013) (the first sale rule applies to copyright material sold overseas).

[184] cf Casey and Vigna (n 28) 235: blockchains may provide a mechanism whereby first sale can apply to digital assets.

> The purchasers might not comply with the restriction, but the only recourse for the licensee is through contract law, just as if the patentee itself sold the item with a restriction.[185]

This appears comprehensive, but there is a limitation recognised by the Supreme Court itself: 'the modest principle that, if a patentee has not given authority for a licensee to make a sale, that sale cannot exhaust the patentee's rights [where 'the purchaser participated in the licensee's infringement'].[186] Similarly, in the context of dismissing a claim about international patent exhaustion, the Supreme Court reiterated 'the basic premise that only the patentee can decide whether to make a sale that exhausts its patent rights in an item.'[187] The question that arises is whether or not this is just a 'modest principle' as the Court put it.

In a recent exhaustive analysis of the potential for conflict between copyright and contract, Rub claims, with considerable force, that despite a tendency towards allowing contracts to dominate (by the process of avoiding any pre-emption in favour of Federal copyright law), there has not been a commensurate 'doomsday scenario of countless standard-form agreements … that would significantly restrict users' rights' in the US.[188] He notes that there is only limited evidence from reported case-law of contracts being utilised as a means of getting around copyright's limitations, with the additional factor that challenges may be rigorously defended not least by users' rights

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[185] 137 S Ct 1523, 1534-35.

[186] ibid 1535, following *General Talking Pictures Corp v Western Elec Co* 305 US 124 (1938).

[187] ibid 1537, following *Boesch v Graff* 133 US 697 (1890).

[188] Guy A Rub, 'Copyright Survives: Rethinking the Copyright-Contract Conflict' (2017) 103 Va L Rev 1141, 1202.

groups and the like.[189] Furthermore, he suggests contract law is too inefficient a mechanism even if creators wished to control users.[190]

There is a distinction to be drawn here though. Rub focused on 'standard-form agreements with "no parody," "no criticism," and "no usage of ideas" clauses', where the absence of litigation shows contract cannot effectively 'exercise tight control on a large scale over information and information goods.'[191] There is a considerable difference between using contract (however unsuccessfully) to attempt to control parody or criticism, and using contracts to structure the use of smart technology. Technological developments may be a reason why decisions over the last couple of decades may not reveal disputes; it must be acknowledged that corporate disputes continue to brew on these issues.[192] Thus in the Apple and Qualcomm dispute mentioned above,[193] the effect of *Impression Products* is that there is an incentive on the patentee to *avoid* exhaustion, by claiming that the disputed technology is *not* covered by the disputed patent:[194] doing so provides a stronger claim for down-stream control.[195]

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[189] ibid 1209 fn 287.

[190] ibid 1210-1221.

[191] ibid 1211.

[192] cf BBC News 'Disney loses in Redbox copyright row' *BBC News* (22 February 2018) <www.bbc.co.uk/news/technology-43154671>. This dispute concerns the capacity of Redbox to use access codes for digital services that Disney attempted to protect using words like 'not for sale or transfer'. At the US District Court, California, Central Division, District Judge Pregerson refused Disney's claim for a preliminary injunction. The report is at <www.courthousenews.com/wp-content/uploads/2018/02/Disney-Redbox-TRO-DENIAL.pdf.> This report indicates though that Redbox failed to make out that there had been a first sale, on the grounds that there was no material object in existence at the relevant time.

[193] See n 157.

[194] Hovenkamp (n 181) 28, citing *Apple, Inc v Qualcomm Inc.*, Case No. 17-cv-0108-GPC-MDD (S.D. Cal. June 20, 2017) (Redacted First Amended Complaint…).

The potential negative implications here become clear, in circular economy contexts, where control mechanisms focusing on software that gives smart technology its functionality are of considerable value. They enable the tracking of material that is essential to circular economy practices, but they also enable determination of how goods are *used* (if they are used at all). On this matter there appears to be a divergence of opinion as to the implications of *Impression Products*. Barnett and Sichelman suggest that *Impression Products*

> impedes the efficient design of technology supply chains … The Court's formalistic reasoning stands far removed from the transactional intricacies of 21st-century technology markets. As a result, it overlooks the perverse consequences that a blanket application of the exhaustion doctrine is likely to cause for the multi-step supply chains that link innovators with consumers.[196]

On the other hand Perzanowski suggests that *Impression Products* is a good decision, showing that

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[195] cf Frederick M Abbott, 'Case Comment: Comment on the US Supreme Court decision *Impression Products v Lexmark International*' (2017) International Review of Intellectual Property and Competition Law 889, 891: 'Advances in technology and increasingly complex supply chains magnify the potential problems created by post-sale patent restrictions. The Supreme Court put an end to them. … A foreseeable consequence of the distinction drawn by the Supreme Court between sales and licenses is to encourage efforts by patent owners to characterize transactions as licenses where they intend to restrict the activities of technology users. … Here in *Impression Products* the Supreme Court may have set itself up for revisiting the sale/license distinction once the consequences of this new decision are played out.' Claiming that such disputes as these are ended, yet at the same time a revisiting of such disputes will occur, is contradictory.

[196] Jonathan Barnett and Ted Sichelman, 'Does The Supreme Court Understand The Innovation Economy?' *Forbes* (12 July 2017) <www.forbes.com/sites/realspin/2017/07/12/does-the-supreme-court-understand-the-innovation-economy/#79239d432a2b>.

> restrictions on alienation and use of the patented good are not enough to overcome a sale … Unless the Supreme Court's full-throated embrace of patent exhaustion was nothing more than an exercise in empty formalism … Lexmark may actually help clarify the longstanding murkiness in copyright law over the license/sale distinction.

Also, he suggests that

> at least until 3D printing becomes a widespread reality, the distribution of most patented goods will remain decidedly tangible. If so, leasing models won't be very appealing, especially for low-dollar-value goods. Patent holders would need to create and enforce systems for collecting ongoing payments and expired products from consumers, an expense likely not justified by the harm of secondary markets.[197]

However, as shown above, this sort of behaviour *is* happening, and is part of the circular economic ideal. The focus in *Impression Products* is clearly on 'the club of authorized producers and sellers'; *users* (which would include commercial as well as non-commercial users) seem to be outside the analysis presented by the Supreme Court. Such control of use is best enforced by avoiding sales,[198] and as has been shown circular

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[197] Aaron Perzanowski, 'Lexmark and the future of sales' (1 July 2017) <www.theendofownership.com/blog/2017/6/1/thoughts-on-impression-products-v-lexmark>.

[198] Licences are used by software companies precisely because they provide a way around first sale doctrines: Christian H Nadan, 'Software licensing in the 21st century: Are software "licenses" really sales, and how will the software industry respond' (2004) 32 AIPLA Quarterly Journal 555; Jean Braucher, 'Contracting out of Article 2 Using a License Label: A Strategy That Should Not Work for Software Products' (2006) 40 Loy L A L Rev 261; Lucas S Osborn, 'Regulating three-dimensional printing: the converging worlds of bits and atoms' (2014) 51 San Diego L Rev 553, 575; John F Duffy and Richard Hynes, 'Statutory Domain and the Commercial Law of Intellectual Property' (2016) 102 Va L Rev 1, 64-73; Rub (n 188) 1158 fn 69 (suggesting that judicial restriction of IPRs holders using

economic thought strongly favours non-sale transactions.[199]

In England, the position is (notwithstanding the future implications of Brexit) governed by the *UsedSoft v Oracle* decision of the CJEU.[200] There it was held that there can be exhaustion of digital software provided that certain requirements are met. There has to have been a sale, which encompasses licences of unlimited duration.[201] It has also been indicated that changing the medium does not translate the exhaustion to the new medium if there is no authorisation from the copyright holder.[202] Everything will thus turn on the extent of authorisation and the nature of the inevitable licence.[203] The full meaning of *UsedSoft* is unclear, and it has not been considered by UK courts in depth, though as Savič has noted German courts have taken a restrictive approach.[204] Most recently the questions have been set in the *Tom Kabinet* case before the CJEU.[205] This

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exhaustion doctrine may lead to such holders resorting to 'other means of control'). For a general critique of this issue, see eg Perzanowski and Schultz (n 122).

[199] See above n 45 and accompanying text.

[200] [2012] Case C-128/11 *UsedSoft GmbH v Oracle International Corp*.

[201] [2016] Case C-166/15 *Ranks v Microsoft*; Sanna Wolk, 'Case Comment: CJEU holds that reproduced copies cannot be resold' (2017) 39 EIPR 125.

[202] *Ranks*, in light of [2015] Case C-419/13 *Art & Allposters Int'l BV v Stichting Pictoright*. See Simon Geiregat, 'Digital exhaustion of copyright after CJEU judgment in *Ranks* and *Vasiļevičs*' (2017) 33 CLS Rev 521, 525

[203] Bill Batchelor and Daniel Keohane, 'UsedSoft - where to now for software vendors?' (2012) 33 ECLR 545, 551.

[204] Maša Savič, 'The legality of resale of digital content after *UsedSoft* in subsequent German and CJEU case law' (2015) 37 EIPR 414.

[205] C-263/18 *Nederlands Uitgeversverbond and Groep Algemene Uitgevers v Tom Kabinet BV* (at <www.gov.uk/government/publications/references-to-the-court-of-justice-of-the-european-union/references-to-the-court-of-justice-of-the-european-union-2018#c263> (22 June 2018)).

case concerns the application of *UsedSoft* to the resale of digital books.[206] It is hoped that clarification as to the applicability of the exhaustion principles to digital books will result. However, it is unlikely, on the basis of the questions set, that there will be clarification as to the applicability of exhaustion to smart goods. Moreover, the framing of the questions in *Tom Kabinet*, focusing on situations where there has been a download for an unlimited time at a commercial price ('remuneration equivalent to the economic value of the work'), suggests that the need to focus on the characterisation of the transaction (as a licence or something more akin to a sale) will continue.

The importance of the character of the transaction has recently been demonstrated by the Supreme Court in the *Bunkers* decision.[207] There it was held that a retention of title clause could have the effect of taking a transaction outside the scope of the Sale of Goods Act 1979; instead there could be a sui generis sale. The implications of this decision are as yet unclear, but Gullifer is surely right to suggest there will be 'far reaching consequences'.[208] What does seem likely, in light of the non-applicability of the Sale of Goods Act 1979 framework, is that transactions where title is retained will require very specific negotiation at the outset, or very close post-contractual analysis in the event of breach, in order to accurately set out or ascertain the respective rights and duties. This becomes important in light of the general notion, expressed by

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[206] Saba Sluiter, 'The Dutch courts apply UsedSoft to the resale of eBooks' (28 January 2015) at <copyrightblog.kluweriplaw.com/2015/01/28/the-dutch-courts-apply-usedsoft-to-the-resale-of-ebooks/>.

[207] *PST Energy 7 Shipping LLC v OW Bunker Malta Ltd* [2016] UKSC 23; [2016] AC 1034.

[208] Louise Gullifer, '"Sales" on retention of title terms: is the English law analysis broken?' (2017) 133 LQR 244, 254. See also Andrew Tettenborn, 'Of Bunkers and Retention of Title: When is a Sale Not a Sale?' [2016] LMCLQ 24.

the Supreme Court in *Marks & Spencer v BNP Paribas*,[209] that where parties obtain the benefit of legal advice in negotiating bargains, they are to be held to such bargains.

Developments in circular economy, along with other technological changes that enabled more effective control of use of tangibles, provide both a policy justification and the technological capacity to practically achieve outcomes meeting that policy. These factors must be viewed in combination with doctrinal frameworks allowing for sale-like transactions to be formally categorised as non-sales, and the recognised impact of having professional advice on negotiated bargains.[210] This is because whilst retention of title clauses are ordinarily utilised in order to provide security for supplies of goods on credit terms,[211] this is not the only possible use for such terms. There is nothing in the doctrine that prevents retention of title clauses from being used for other purposes alongside, or even regardless of, the provision of credit.

Therefore, in such commercial contexts, we may be able to see the beginnings of a radical shift in the use of contracted-control, specifically a substantial increase in the use of licences at the expense of sale. It may be countered that such changes are acceptable as means of effectively delineating the various rights (use-rights as well as rights to the value in assets) and obligations between competent commercial parties. However, adopting such a position must necessarily be accompanied by acceptance that licensing provides an opportunity for considerable down-stream control to be exercised, and as can be seen with the jurisprudence on either side of the Atlantic, such moves may

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[209] [2015] UKSC 72; [2016] AC 742.

[210] cf Rub (n 188) 1225: 'Focusing just on the text of the agreements ignores the company's practices in enforcing—or not enforcing—its contractual rights, which might be significantly more important to consumers.'

[211] See generally Hugh Beale, Michael Bridge, Louise Gullifer and Eva Lomnicka, *The law of Security and Title-Based Financing* (3rd edn OUP 2018) ch 7.

actually result in protections devised for down-stream purchasers against up-stream IPR holders being avoided.

It is acknowledged that consumer law may prohibit the introduction of contractual terms of the sort necessary to obtain this down-stream control. The Consumer Rights Act 2015 provides both a general good faith obligation (section 62) and the "grey list" (section 63 and schedule 2) of prohibited terms. However, it is not entirely clear what the possible application of that doctrine might be, or indeed whether circular economy policy would justify alteration or escape from such prohibited terms. Detailed analysis of this issue must be left to another time, but it is worth noting that Hoffman has argued that some firms have benefited from creating contractual terms of use that attempt to manage or influence consumer behaviour by means other than strict and exhaustive prohibitions of the sort usually found in end-user licensing agreements.[212] However, as Perzanowski and Schultz put it: 'Private actors should not be in a position to define what owners can do with their property, even if they write the next generation of license agreements in a more consumer-friendly way.'[213]

4. Conclusion

Circular economy requires long-term control of products along chains of transactions. Identifying, locating, and controlling goods down-stream is easier in light of developments in digitalisation and embedded software leading to smart goods. However, Greenfield's elucidations of the dangers of smart cities can be applied equally

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[212] David A Hoffman, 'Relational Contracts of Adhesion' (13 Sept 2017) U Chicago L Rev (forthcoming) <ssrn.com/abstract=3008687>.

[213] Perzanowski and Schultz (n 122) 187.

to circular economies,[214] and is worth citing in full:

> There is an implicit theory, a clear philosophical position, even a worldview, behind all of this effort. We might think of it as an unreconstructed logical positivism, which among other things holds that the world is in principle perfectly knowable, its contents enumerable and their relations capable of being meaningfully encoded in the state of a technical system, without bias or distortion. As applied to the affairs of cities, this is effectively an argument that there is one and only one universal and transcendentally correct solution to each identified individual or collective human need; that this solution can be arrived at algorithmically, via the operations of a technical system furnished with the proper inputs; and this that solution is something which can be encoded in public policy, again without distortion. (Left unstated, but strongly implicit, is the presumption that whatever policies are arrived at in this way will be applied transparently, dispassionately and in a manner free from politics.) Every single aspect of this argument is problematic.[215]

Whilst circular economy has a laudable policy goal, an uncritical approach to its application cannot be justified. Law's approach to smart technology, resting on archaic conceptualisations of software and the tangible-digital relationship, as well as proprietary and contractual regimes that impact heavily on the capacity to use and dispose of smart objects, raises significant problems which circular economy advocates appear to elide over or misunderstand. A further complication arises by the very nature of the combinatory interactivity that is generated and enforced by smart technology.

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[214] See also eg Jane Wakefield, 'Tomorrow's cities - nightmare vision of the future?' *BBC News* (22 February 2017) <www.bbc.co.uk/news/technology-37384152>.

[215] Greenfield (n 29) 52-53. See further eg Julia J A Shaw, 'From homo economicus to homo roboticus: an exploration of the transformative impact of the technological imaginary' (2015) Int J Law in Context 245.

Escaping this control may be more complex than simply "bricking" goods,[216] as control options provided by smart technology are both outward and inward facing. My smartphone gathers data about me. It can also gather data about other smart technology. And other smart technology can gather data about me, regardless of whether I am at that point using any smart technology. Engagement with smart technology and its control possibilities is vast and increasing with technological envelopment of social life. What matters thus is not just what I allow in terms of smart technology, but what others can achieve vis-à-vis my onli*f*e, and more importantly, that I may not even know what it is that such others know and can do about my onli*f*e.[217]

What is really going to be radical is not a new form of smartphone, or a new process for making stuff, or a new type of networked software or blockchain ledger. Instead it will be some combination of different technologies.[218] Yet circular economic thought progresses as if these combinations can be effectively planned and controlled: it is as if we can truly be in

> a cybernetic ecology
> where we are free of our labors
> and joined back to nature,
> returned to our mammal
> brothers and sisters
> and all watched over

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[216] Altering, removing or destroying the technology (invariably the software) that makes objects smart.

[217] Hildebrandt (n 1) 74. A/B testing is a good illustration of this: Hildebrandt (n 1) 87-97. See further Michelle N Meyer, 'Two Cheers for Corporate Experimentation: The A/B Illusion and the Virtues of Data-driven Innovation' (2015) 13 Colorado Tech L J 273.

[218] Greenfield (n 29) 273.

by machines of loving grace.[219]

The naivety of such a view may not however prevent its actualisation. Different regulatory and doctrinal structures generating and enforcing jurisprudential silos for different areas of law allows for control mechanisms to reach through to users. As such, any moves towards circular economy must be accompanied by critical analysis of an ideological foundation that presupposes the beneficial status of down-stream corporate control of tangibles through manipulation of intangible rights and obligations.

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[219] Richard Brautigan, 'All Watched Over by Machines of Loving Grace' (1967) <www.brautigan.net/graphics/machines/machines-loudspeaker.gif>.

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