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A *Digital* Right to Repair? How new EU legislation could open up data and software in connected products to enhance their lifespan

1 Fighting e-waste with a right to repair (R2R) hardware and software

All over the world, the overwhelming majority of electronic devices that are no longer used end up being incinerated, dumped in a landfill, or hibernating in private homes. Only 20% of such items are recycled.[1] Combined with the short longevity of many devices, sometimes due to planned obsolescence, this is unsustainable, given limited natural resources and geopolitical challenges in obtaining raw materials. The amassment of discarded, unused and wasted electronic devices also runs counter to ambitions, in waste and sustainability policies, to achieve a circular economy. According to the European waste hierarchy, recycling is good, but not throwing away is even better.[2] Over the last couple of years, the "Right to Repair" (R2R) has surged as a possible panacea for extending the life of electronics. The R2R holds the promise to mitigate the negative environmental impact that e-waste has on the environment

[1] R. Guy and Z. Houlin. (2019). How a circular approach can turn e-waste into a golden opportunity. Available: https://www.weforum.org/agenda/2019/01/how-a-circular-approachcan-turn-e-waste-into-a-golden-opportunity/.

[2] J. Hultman and H. Corvellec, "The European Waste Hierarchy: From the Sociomateriality of Waste to a Politics of Consumption," Environment and Planning A: Economy and Space, vol. 44, no. 10, pp. 2413–2427, 2012.

and to decrease the high demand for raw materials that are getting scarcer due to ecological and geopolitical circumstances. In short, the R2R is meant to remove any barriers that currently limit the possibility of repairing a product. In other words, the R2R is not a right given to the consumer; instead, it is a duty placed on the manufacturers to remove barriers that are put in place by manufacturers, such as lack of information, unrepairable designs, lack of spare parts, etc. At the moment, the R2R is characterised by multiplicity: it is a social movement,[3] a design principle,[4] and a regulatory ideal,[5] all at once; however, in each of these versions, its scope and meaning are fluctuating.

In this chapter, we look at the R2R in relation to a particular subcategory of electronics, namely *digital* devices, which we define as ICT devices with software, notably smart and connected ones. Digital devices pose particular challenges for the creation of R2R. One reason is that the notion of *repair* fits better in the context of hardware, and mechanical analogue repairs: a wire is reconnected, a battery or screen is replaced, and *voilà* – the device is as good as ever. The dichotomy between broken and functioning is less clear in the realm of software. What about the smart fitness tracker, smartphone or laptop that are gathering dust in a drawer, having been replaced by a newer, possibly better, product? Most of these are not necessarily "dead" or broken but were instead discarded and disposed of because they were not *good enough* – too slow, too old, lacking updates, incompatible with newer software and systems, etc. What would the digital "repair" of such a device entail?[6] In order for the R2R to have real bite, it is not enough to just focus on hardware repair: if we create a regulatory, cultural and design climate that enables hardware repair but the software on a device is outdated, the device will remain obsolete. As a regulatory ideal, it is clear which problem the digital R2R answers, namely that the lifetime of electronic devices should be extended to prevent waste and save resources. The idea is powerful. Who, apart from the manufacturer, would be in favour of unrepairable devices with an unnecessary short life cycle (planned obsolescence)? However, *what* the digital R2R should solve and *how* it should do it are still up in

[3] For example, https://repair.eu/ and https://www.ifixit.com/.

[4] T. Elkington, "Right to Repair: 6 Design for Reparability principles," Available: https://www.linkedin.com/pulse/right-repair-6-design-repairability-principles-tony-elkington.

[5] Letter by the European Commission, State of the Union 2021 Letter of Intent, 15 September 2021.

[6] See below, section 4.

the air. How to combine resource-efficiency and climate neutrality with an intensive and innovative digital economy is not obvious. Globally, most legislation on the R2R, in relation to electronics, focus on hardware repair, or simply do not specify the kind of repair that the right relates to. The UK[7] and France[8] recently adopted R2R legislation. Both countries' laws, however, have a limited regulatory scope in the sense that they only apply to a small group of electronics, and merely focus on hardware repair or consumer awareness. The UK law requires that from mid-2023, manufacturers will have to make spare parts available to consumers; the French law made it obligatory from 2021 onwards for manufacturers to inform consumers about the level of repairability of their product on a scale of 1 to 10.

At the EU level, there is a range of legislative initiatives that try to stimulate the digital repair of electronic devices. One initiative, the proposed *Data Act*[9], builds on the idea that a consumer or third-party has to be granted *access* to data and be allowed to *tinker* with it. In an age where software and data are jealously protected as trade secrets, access and tinkering rights are highly controversial and contested. Another initiative, the proposed updated *Product Liability Directive*[10], builds on the idea that a digital R2R requires the existence of clear *liability* rules for software malfunctioning that occurs after a patch, alteration or upgrade. No manufacturer wants to be liable for a product whose software has been substantially altered, and no user or third-party is keen on doing software repair if even a minor repair could result in full liability. However, the worst scenario is when who is liable is legally unclear; then, nobody dares to do anything at all.

[7] UK "Right to Repair"-law: The Ecodesign for Energy-Related Products and Energy Information Regulations 2021 (SI 2021 No. 745); T. Espiner and R. Wearn (2021). Right to repair rules will extend the lifespan of products, the government says. Available: https://www.bbc.com/news/business-57665593.

[8] French Law n° 2020-105 of 10 February 2020 against waste and for the circular economy.

[9] Proposal for a Regulation of the European Parliament and Council on harmonised rules on fair access to and use of data (Data Act), Brussels, 23 February 2022 COM(2022) 68 final 2022/0047 (COD).

[10] Proposal for a Directive of the European Parliament and of the Council on liability for defective products (revised PLD), COM/2022/495 final, Brussels, 28 September 2022.

In this chapter, we discuss how these two new legislative initiatives, namely the proposed *Data Act*[11] (on access to data gathered in smart devices) and the proposed updated *Product Liability Directive*[12] (clarifying that software also falls within its scope, and the implications of digital repair), stimulate digital repair of electronic devices. We assess these two proposed instruments building on our respective fields of expertise, namely law relating to information technology (De Vries) and the social science of waste and repair (Abrahamsson). One issue around which we converge is that *repair* is a word that is, both conceptually and practically, misguiding in relation to software and data. To clarify this, we first discuss four cases where digital repair became a matter of concern (section 2). We then contrast software repair with digital repair (section 3) and later present a more structured overview of the practical and conceptual complexities that can follow from the notion of digital repair (section 4). We then discuss the EU policy background of the digital R2R and show that it moves at the intersection of green and digital legislation (section 5). In the consecutive two sections, we introduce the new proposals, the *Data Act*[13] (section 6) and the updated *Product Liability Directive*[14] (section 7). In the final section (section 8), we assess these new legal instruments and point to further research that is needed.

2 Four cases where digital repair became a matter of concern: a smart tractor, an amicable house robot, a surgical robot and an iPhone

In this section, we discuss four cases where digital repair became a matter of concern. Specifically, it gives the reader some examples of situations in which a digital R2R can actualise as a matter of concern. In some of these cases, the law became involved; in others, it did not. Several of the cases are US-based, but the situations described could equally have taken

[11] Proposed Data Act (n. 9).
[12] Proposed revised PLD (n. 10).
[13] Proposed Data Act (n. 9).
[14] Proposed revised PLD (n. 10).

place in the EU. Thus, they are helpful in providing a sense of the kind of circumstances in which a digital R2R could play a role.

2.1. John Deere tractors. Deere & Company is the largest producer of farming technology and farming machines globally. Their tractors are equipped with sensors that 'track soil moisture, equipment performance, and even the pressure with which seeds are pushed into the ground during planting' and 'connect directly to John Deere's cloud'.[15] Deere & Company has a monopoly on the repair of their products, which means transportation and reparation at excessively high costs. From 2018 onwards, several class-action lawsuits were filed in the US against the company over alleged violations of federal antitrust laws,[16] which, in turn, inspired proposals for federal and state R2R legislation.[17] In some cases, they ended up as promises[18] for adjustments in Deere & Company's repair policy. In June 2022, Russian looters stole 27 pieces of John Deere farm equipment from the beleaguered Ukrainian city Melitopol, with a worth of $5m, only to discover later on in Chechnya that the manufacturer John Deere had remotely disabled all equipment so that it could no longer even be turned on.[19] While in this case, the remote off-switch resulted in a cheerful twist, the events also point to a fundamental change in what it means to own something and the introduction of an external dependency that is absent in "dumb" devices. This is especially relevant as

[15] K. T. Tofel, "The "right to repair" movement grows, but the devil's in the details," Stacey on IoT, 2022.

[16] Sherman Antitrust Act, 26 Stat. 209, 15 U.S.C. §§ 1–7.

[17] Exec. Order No. 14036 on Promoting Competition in the American Economy, 86 Fed. Reg. 36,987 (9 July 2021), section 5, h(ii): 'To address persistent and recurrent practices that inhibit competition (…) in areas such as unfair anticompetitive restrictions on third-party repair or self-repair of items, such as the restrictions imposed by powerful manufacturers that prevent farmers from repairing their own equipment'. See also: L. Matsakis and O. Solon (1 February 2022), Senate introduces bill to allow farmers to fix their own equipment, NBC News, https://www.nbcnews.com/tech/new-senate-bill-farm-equipment-right-to-repair-rcna13961.

[18] J. Koebler and M. Gault (18 February 2021), John Deere Promised Farmers It Would Make Tractors Easy to Repair. It Lied., Motherboard, https://www.vice.com/en/article/v7m8mx/john-deere-promised-farmers-it-would-make-tractors-easy-to-repair-it-lied.

[19] John Naughton (4 June 2022), Why your ability to repair a tractor could also be a matter of life and death, The Guardian, https://www.theguardian.com/commentisfree/2022/jun/04/why-your-ability-to-repair-a-tractor-could-also-be-a-matter-of-life-and-death.

similar issues are also likely to appear outside of agriculture, for example, in relation to the growing number of high-tech cars.[20]

2.2. Anki/Vector Robots The robotics company *Anki* launched the $250 *Vector* Home Robot in 2018. This friendly-looking device rolling around on rubber bands, combining elements of a toy, a digital pet and a smart speaker in the style of *Alexa* or *Siri*, was marketed on the online crowd-funding site *Kickstarter* with the following comments from two of its creators:

> 'I think for Kickstarter, especially being able to have access to more technical users that understand a little more about what's going on and can give us really critical feedback that we can then use to incorporate it in updates. We expect over the next few years to develop function after function after function, making a deeper character, implement more characterful utility functions, and so forth'.[21]

One of the purported strengths of the robot was its ability to become better and more advanced through software updates facilitated by the cloud. However, in 2019, *Anki* went out of business, meaning that the *Vector* robots risked facing digital death as the *Vector* servers would no longer be maintained.[22] In 2020, another company, *Digital Dream Labs,*[23] stepped in, purchasing *Anki*'s assets relating to *Vector*, restoring the platform, and creating a modality for *Vector* to function without external servers and an open source development kit allowing for the design of new functionalities for the bot. In order to keep using *Vector's* broad functionality, *Digital Dreams Labs* offers users a cloud-based subscription for $10 per month, or a $125 lifetime membership. Needless to say, many of those who supported the initial campaign, a campaign that did not include payment or continuous subscription to services to keep the robot alive, were far from content with the solution offered by the new owners. Nonetheless,

[20] A. Marshall (20 October 2022), High-Tech Cars Are Killing the Auto Repair Shop, Wired, https://www.wired.com/story/high-tech-cars-killing-the-traditional-auto-repair-shop.

[21] Anki (2020), Vector by Anki: A giant roll forward for robot kind, promotional video on Kickstarter, minute 3:47-4:08. https://www.kickstarter.com/projects/anki/vector-by-anki-a-giant-roll-forward-for-robot-kind?gclid=CjwKCAiA3KefBhByEiwAi2LDHLVrjQAxsmaTad7U7rZRtwNivUjDmLfrqdvHjAiE_YVZEsljHZI8FxoCUkEQAvD_BwE.

[22] Tofel (n. 15).

[23] https://support.digitaldreamlabs.com/collection/6-vector.

this Anki/Vector case shows the strength of how digital R2R can be realised through open-source software, a subscription model and an engaged community in relation to a niche product.

2.3. Da Vinci Surgical Robots. In the case of medical equipment, both a faulty third-party repair and a too slow official repair can have potentially disastrous impacts for patients. During the Covid-pandemic, for example, 'hospital technicians became exasperated when they found they could not quickly fix ventilators in overflowing intensive-care units because they did not have immediate access to manuals and parts',[24] and unorthodox methods like volunteers designing and 3D-printing valves became acceptable.[25] At the same time, medical branch organisations have been extremely focal about the fact that allowing others to repair products could endanger patient safety and result in cybersecurity concerns.[26] One particularly salient case is when a *Da Vinci* Surgical Robot was allegedly remotely switched off mid-surgery by its manufacturer *Intuitive Surgical*, after the hospital had said it was considering a service contract with a third party. Two lawsuits have been filed against *Intuitive Surgical* over alleged violations of antitrust laws.[27] The debates for a R2R of the Da Vinci robot raise questions of product safety, the allocation of liability, and digital repair in devices whose main functionality is steered from the cloud.

2.4. Apple iPhone Up until very recently, Apple stood out as one of the ICT companies strongly opposed to any form of third-party repair of their devices. This position was, for example, crystallised in a trademark case that made it to the Norwegian Supreme Court (2020), where three

[24] Why is the "right to repair" gadgets and machines spreading?, The Economist (2021) https://www.economist.com/the-economist-explains/2021/11/19/why-is-the-right-to-repair-gadgets-and-machines-spreading.

[25] Naughton (n. 19).

[26] Hayhurst, C. (2021) The Ground has Shifted in the 'Right to Repair' Debate. What's Next?, AAMI, https://www.aami.org/news/article/the-ground-has-shifted-in-the-right-to-repair-debate.-what-s-next.

[27] B. Herman, "Hospitals are taking on a surgical robot "monopoly"," Axios, 2021; C. Rizzi (2022), da Vinci Maker Intuitive Surgical Facing Antitrust Class Action Over Alleged Market-Control Tactics for EndoWrists, Class Action Newswire, https://www.classaction.org/news/da-vinci-maker-intuitive-surgical-facing-antitrust-class-action-over-alleged-market-control-tactics-for-endowrists; Da Vinci Surgical Robot Complaint (10 September 2021), http://srkattorneys.com/da-vinci-surgical-robot-complaint/.

years of legal proceedings resulted in Apple crushing a one-man repair shop for using screens from another manufacturer to repair iPhones.[28] In 2021, Apple decided on a partial policy change, now allowing users to perform certain repairs themselves, on the condition that tools and spare parts are rented or bought from Apple. Repair tools, which come in a box weighing 36 kilograms, can be rented for $49 and a $1,200 deposit. One interesting aspect here is that the repair allowed by Apple focuses completely on the hardware, and that software is used for so-called pairing of parts,[29] meaning that when a battery or screen is replaced with one produced by another manufacturer, the software will react and disable certain functionalities and prompt the user to service the device. This self repair of iPhones raises questions about what the extent and form of a R2R should be in order to have any bite, how the integration of hardware and software can impact repair, and how to combine the R2R with novelty-driven business models.

3 Digital repair: repair based on software or data or both

In order to prevent smart tractors, amicable house robots, surgical robots and iPhones from being wasted, it seems obvious that affordable and reliable possibilities for digital repair are equally important as those for hardware repair. Yet, what is *digital repair* exactly? Digital repair can mean that the functioning of a product is improved through its software, the data it gathers during its operation, or both. In contrast to other authors, such as Gomulkiewicz,[30] we prefer the term *digital* repair over *software* repair to underline that the AI-revolution of the last decade, based on machine learning and resulting in evolving and personalised devices, means that repair can also involve the gathered data and not just the software initially created by a manufacturer.

[28] C. Mikolajczak (5 June 2020), Apple crushes one-man repair shop in Norway's Supreme Court, after three-year battle, Right to Repair, https://repair.eu/news/apple-crushes-one-man-repair-shop/.

[29] S. Goldheart (11 May 2022), Apple Self Service Repair: Is This the End of iFixit?, iFixit Tech News, https://www.ifixit.com/News/59751/apple-self-service-repair-is-this-the-end-of-ifixit.

[30] Gomulkiewicz, Robert W., Considering a Right to Repair Software, 37 Berkeley Tech. L.J. 941, 2023.

Gomulkiewicz[31] argues that software repair is not a novel matter and that in the end, it boils down to the debate about the pros and cons of open software, that is, about balancing the benefits of a large community tinkering with and ameliorating software with those of reaping the economic benefits of jealously protecting software through copyright or as a trade secret. Framing the right to digital repair in terms of open software places it strongly in the field of intellectual property (IP) law, and the stakes of industry. Gomulkiewicz discusses software repair from a US legal perspective. IP law is also undeniably relevant in an EU legal context. The recent case of *Top System v Belgium*[32] has been interpreted as supportive of a right to software repair, as the European Court of Justice ruled that a lawful purchaser of a computer programme (in this case: the Belgian State) is entitled to decompile a software programme in order to correct errors affecting its operation without the consent of the holder of the copyright (in this case: Top System). The concrete impact of the case should not be exaggerated. Firstly, its impact will depend on how restrictively 'only in so far as those acts are necessary for the use of the computer program in accordance with its intended purpose' (paragraph 74) is interpreted. Secondly, the lawful purchaser is only entitled to decompile the software to correct errors 'in the absence of specific contractual provisions to that effect' (paragraph 68), and the cases where such contractual provisions are absent are rare. Normally, a connected, smart device will be accompanied by an end-user license agreement (EULA) specifying conditions and forms of software repair.

However, digital repair is not exhausted by software repair, IP law and the debate about open software. Digital repair is not only a matter of software but also about *data*. For example, when a chatbot displays a racist bias or an AI-assisted car is drifting consistently too much to one side, it might be necessary to open up the data it has gathered under its course of operation. A manufacturer, however, might be equally reluctant to disclose software as gathered data, because both are likely to represent substantial economic value when kept as a trade secret. This is an aspect that is recognised by the EU legislator in the proposal for a *Data Act,*[33] namely that digital repair can require manufacturers, users and certain

[31] Gomulkiewicz (n. 30).
[32] Top System v Belgium, C-13/20, 6 October 2021.
[33] Proposed Data Act (n. 9).

third parties to have the right to access and use the data. In Recital 6 of the proposed *Data Act,* it says:

> 'Data generation is the result of the actions of at least two actors, the designer or manufacturer of a product and the user of that product. It gives rise to questions of fairness in the digital economy, because the data recorded by such products or related services are an important input for aftermarket, ancillary and other services. In order to realise the important economic benefits of data as a non-rival good for the economy and society, a general approach to assigning access and usage rights on data is preferable to awarding exclusive rights of access and use'.

The fact that digital repair can concern both software and data means that fields like cybersecurity law also become relevant, as well as data protection (when personal data are involved), and possibly even certain fundamental rights (portrait rights, right to respect for private life).

4 Practical and conceptual challenges in digital repair

Despite its intuitive, attractive ring, there are several barriers that make digital repair challenging.

First, digital repair is not a simple binary transition from a broken to a repaired state. Instead, it is a set of upgrading and downgrading actions on a continuous scale, not unlike Penelope's extended scheme of weaving and unweaving Ulysses' burial shroud to keep unwanted suitors at bay. One reason is that repairing bugs in software is almost never a free lunch: a patch might solve one problem while simultaneously introducing a new one: 'as a large software program evolves, the cumulative effect of all the changes tends to degrade the structure of the program so that, as time goes by, the software becomes less and less well ordered', which means that at some stage 'repairing a defect can become one step forward and one step back'.[34] Another reason is that software has an extremely *fast-paced development*, which is accompanied by a marketing-induced *desire for novelty*.[35] The moment a new device is bought, it is already on

[34] Gomulkiewicz (n. 30), p. 949.

[35] C. Campbell, "The desire for the new," in Consuming technologies: Media and Information in domestic spaces, E. Hirsch, Ed. London: Routledge, 1992, pp. 48–64.

its way to being outdated. This raises the larger question of whether it is even appropriate to speak of *repair* in the context of data and software. Often, software and data repair is not just restoring to a former state, but *upgrading to a better state* (i.e. up-cycling). Only when the upgrade results in undesirable consequences, a *downgrade* can be considered as a form of software repair. Sometimes the interests of the manufacturer and end-user align when they both want an improved, updated product. Sometimes the interests do not align, for example, because the manufacturer does not want to spend money and energy on maintaining a product and, rather, would like the end-user to buy a new product. Gomulkiewicz[36] argues that a right to software repair could be reformulated without the misguiding notion of repair, which falsely points to a broken-repaired binary, as three separate rights to help consumers when interests do not align:

1. a right to revert to prior versions of a software product;
2. a right to refuse updates; and
3. a right to receive repairs for a certain period of time.

A *second* point complicating digital repair is that *software and hardware are often interdependent*. For software to work, often a specific type of hardware is needed. If the hardware of a device is repaired to the functionality that it had when it was first produced, the fact that it does not support more novel software still risks making it obsolete.[37] There can also be more subtle interactions, for example, when a software upgrade suddenly drains battery life. A *third* difficulty is that digital repair can be *very complex and requires a specific type of expertise* that many consumers do not possess. For most consumers, empowerment is more likely to lie in rights to downgrade and refuse updates, than in rights to actively tinker and upgrade.[38] When devices are enhanced with software, this will also require a different type of repair professional. The advent of high-tech cars will mean that the stereotypical 'grizzled and grimy auto repair tech with a wrench in his hand' will have to make a place for 'people more like Star Trek engineer Geordi LaForge',[39] and that repair costs will go up.

[36] Gomulkiewicz (n. 30).

[37] M. Cohn, "Keeping Software Present. Software as a Timely Object for STS Studies of the Digital," in Digital STS: A fieldguide and handbook, J. Vertesi and D. Ribes, Eds. Princeton, NJ: Princeton University Press, 2019, pp. 423–446.

[38] Gomulkiewicz (n. 30).

[39] Marshall (n. 20).

A fourth complication with digital repair is that software and data can be copied and disseminated very easily, which can lead to quick value loss for the producer of a digital device. By providing transparent information, producers also risk giving away a valuable part of the device that can easily live on without its hardware container. A final, *fifth*, challenge with a digital R2R is that most smart, connected devices are *not stand-alone devices;* instead, they are out of bounds, that is, they are not limited by their hardware container, and their immaterial tentacles of data and software can stretch out deeply into surroundings controlled partly by their users, and partly by their producers. There are at least three challenges that follow from this "out-of-boundedness":

1. The software of smart devices needs *continuous maintenance* through updates, and often part of their functionality is dependent on external servers, in "the cloud". The subsistence of smart devices is largely dependent on continuous support from the producer, and if the producer discontinues that support or goes out of business, the device risks becoming obsolete.
2. In many smart devices, the *division between producer and consumer is muddled*, and the user of a device is a prosumer personalising a device by using it and supplying the producer with feedback data that can help further development of updates, patches and new generations of the smart device. Smart devices are not just tools for local goals, such as playing music (smart speaker) or self-tracking bodily effects of a workout (fitness smart watch). On the contrary, they can also be windows for companies to offer additional services, a testbed and data gathering hub for the producer and a personalised gadget cultivated by the user.
3. The networked nature of smart devices makes them *vulnerable from a data security perspective*. Tinkering with a smart device can thus create risks that come on top of the basic risk of malfunction (with a "dumb" device).

These three aspects (external maintenance, muddled producer-consumer relationship and data security vulnerability) following from the "out-of-boundedness" of digital devices mean that the ownership of such digital devices becomes muddled. The fact that the manufacturer of a "dumb" electronic device, like a toaster, goes bankrupt will not affect the functioning of the device. However, if the manufacturer of a "smart" toaster goes bankrupt or decides to discontinue software support and

maintenance for some other reason, the device is likely to become partly or wholly dysfunctional. This means that buying and owning a John Deere tractor or a Da Vinci surgical robot does not guarantee that the device will continue to function over time, as there is always a risk that somebody remotely turns the off-switch or discontinues support. In a recently published book, Perzanowski states that the R2R is a way to reclaim the things we own.[40]

5 The birth of EU policy on repair of electronic devices: the tensions and synergies of green and digital innovation policy

Currently, e-waste is the fastest growing waste stream globally.[41] What would it take to create a European market and society where electronic devices that are defective or outdated are not so easily discarded? As argued above (section 1), given that an ever-increasing group of electronic devices is becoming connected and "smart", in order for R2R to have real bite, it should not only concern material (screws, batteries, etc.) repair but also digital (software and data) repair, patching and updating. However, conceptually and practically, digital repair is (see above, sections 3 and 4) a complex aspect of the R2R. It is relatively straightforward to create legislation that forces a manufacturer to design products that are easier to repair and to provide consumers with spare parts and instruction manuals about *hardware* repair. It is more complex to come up with legislation that incentivises *digital* repair – as mentioned above (section 3), such legislation easily ends up in value conflicts and complex legal interactions with IP,[42] data protection, competition (monopolistic repair tactics), consumer,[43] product safety, liability and cyber security law. At the level of EU legislation, this complexity gets further intensified by the fact the policy rationales for a R2R mix *digital* and *sustainability* regulation.

[40] A. Perzanowski, The right to repair: reclaiming the things we own, 2022.

[41] Forti V., Baldé C.P., Kuehr R., Bel G. The Global E-waste Monitor 2020: Quantities, flows and the circular economy potential. United Nations University (UNU)/United Nations Institute for Training and Research (UNITAR), Bonn/Geneva/Rotterdam.

[42] Gomulkiewicz (n. 30).

[43] M. Johnson et al., "Engaging with the general public on critical raw materials through the medium of electronics repair workshops," in Plate 2019 Conference, 2019.

"A European Green Deal"[44] from 2019 and "A European Strategy for Data"[45] from 2020 are top prioritised fields by the European Commission in 2019–24, where both are currently characterised by a high level of legislative activity. In both the *Green Deal* and the *Strategy for Data,* the Commission made it clear that the Circular Economy regarding electronics is a top priority, and that repair was an important tool in the realisation of this policy ideal.

In the *Green Deal,* it says:

> 'The circular economy action plan will also include **measures to encourage businesses to offer, and to allow consumers to choose, reusable, durable and repairable products.** It will analyze the need for a 'right to repair', and curb the built-in obsolescence of devices, in particular for electronics. Consumer policy will help to empower consumers to make informed choices and play an active role in the ecological transition'.[46]

Both the *Green Deal* and the *Strategy for Data* stress the importance of information about products, conceptualised as a "product passport", in order to facilitate repair.

In the *Green Deal,* it says:

> 'Reliable, comparable and verifiable information also plays an important part in enabling buyers to make more sustainable decisions and reduces the risk of 'green washing'. (…) Digitalisation can also help improve the availability of information on the characteristics of products sold in the EU. For instance, an electronic product passport could provide information on a product's origin, composition, repair and dismantling possibilities, and end of life handling'.

In the *Strategy for Data,* it says:

[44] Communication from the Commission to the European Parliament, The European Council, The Council, The European Economic and Social Committee and the Committee of the Regions – The European Green Deal COM/2019/640 final, Brussels, 11 December 2019.

[45] Communications from the Commission to the European Parliament, The European Council, The Council, The European Economic and Social Committee and the Committee of the Regions – A European strategy for data COM/2020/66 final, Brussels, 19 February 2020.

[46] Green Deal (n. 44), p. 8.

> 'Establish a common European data space for smart circular applications making available the most relevant data for enabling circular value creation along supply chains. A particular focus will be concentrated at the outset on the sectors targeted by the Circular Economy Action Plan, such as the built environment, packaging, textiles, electronics, ICT and plastics. Digital 'product passports' will be developed, that will provide information on a product's origin, durability, composition, reuse, repair and dismantling possibilities, and end-of-life handling'.[47]

The importance of repair is a topic that has been popping up in various legislative proposals during the last few years. In September 2021, the Commission announced that a separate 'legislative proposal on the right to repair'[48] was one of the *Green Deal* key initiatives to realise during 2022. In early 2022, the Commission held a public consultation on sustainable consumption of goods by promoting repair and reuse.[49] In February 2022, the Commission presented the proposed *Data Act*[50] (see below, section 6) as part of the *Strategy for Data*. The *Data Act* aims to dilute the monopoly of many manufacturers on data generated by smart devices and grant access rights more fairly and broadly to other actors as well, where one of the explicit goals is to support the circular economy and the repair and maintenance of smart devices (recital 14). In September 2022, the Commission presented a proposal for an updated *Product Liability Directive*[51] (PLD, see below, section 7), which, in its explanatory memorandum, explicitly refers to both the new green and digital transitions and their enormous benefits, 'be it by extending the life of materials and products, e.g. through remanufacturing, or by increasing productivity and convenience thanks to smart products and artificial intelligence', as one of the main reasons for the need to update the PLD. The proposed update aims to 'ensure liability rules reflect the nature and risks of products in the digital age and circular economy'.[52] The proposal

[47] A European strategy for data (n. 45), p. 27.

[48] European Commission, State of the Union 2021, (n. 5).

[49] European Commission DG Justice and Consumers (2022), Sustainable consumption of goods. Promoting repair and reuse. Factual summary report Open Public Consultation, Brussels. Online available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13150-Sustainable-consumption-of-goods-promoting-repair-and-reuse/public-consultation_en.

[50] Proposed Data Act (n. 9).

[51] Proposed revised PLD (n. 10).

[52] Idem.

confirms that manufacturers of AI systems and software affecting how a product works also fall under the scope of the Directive, as well as any entity making "substantial modifications".

Meanwhile, the EU Parliament (EP) also pushed for R2R legislation. On 7 April 2022, the EP adopted a *Resolution on the Right to Repair,*[53] with an overwhelming majority of 509 votes in favour, 3 against and 13 abstentions, giving the Commission the task to come up with a proposal for the R2R legislation. In the Resolution, which consists of 27 paragraphs, only paragraph 10 is devoted to the special challenges of the R2R in relation to *digital* devices. In this short paragraph, the EP proposes that software updates have to be made available for a minimum period, that consumers should be fully informed about the availability of updates at the time of purchase, that functionality updates should be reversible and not lead to diminished performance, and that practices that unduly restrict the right to repair or lead to obsolescence could be considered unfair commercial practices.

In short, at the EU level, the digital R2R is brought into existence through a scattered bouquet of regulatory tools, ranging from a proposal for product passports, increased data access, clarification of product liability for substantial software modification, to requirements to provide software updates for a minimum period and make updates reversible. Given the practical and conceptual complexity of digital repair, the scattered and implicit nature of the proposed legal provisions is not surprising. As we argued above, the notion of "repair" might suggest a misguiding binary of "Broken v. Repaired" in relation to data and software. Moreover, the word "right" might also give a false idea that R2R is a real "right", such as the "right to respect for private life" or the "right to a fair trial", while, in fact, all legislative initiatives in the field of R2R are no more than regulatory tools to stimulate digital repair. At the same time, if the EU legislator really wants to stimulate digital repair, a more coherent, comprehensive and explicit manner of addressing this would be helpful. Despite the ambivalences in the notion of a digital R2R, it is a catchy term that could unify the now mainly scattered and implicit proposals.

In the two following sections, we will take a closer look at the two proposed legislative instruments where digital repair is currently discussed most explicitly: the *Data Act* (section 6) and the updated *PDL* (section 7).

[53] European Parliament, Resolution on the Right to Repair, 7 April 2022, 2022/2515 (RSP).

6 Enhancing access to data and software (proposed *Data Act*)

What is the proposed *Data Act*?[54] 'The Data Act is a key pillar of the European strategy for data' and its 'main objective is to make Europe a leader in the data economy by harnessing the potential of the ever-increasing amount of industrial data, in order to benefit the European economy and society'.[55] To paraphrase it more bluntly: it is a regulatory tool that tries to break the monopoly of large, non-SMEs,[56] manufacturers on data gathered by connected devices in order to create a fair access and use of data which will stimulate a more flourishing digital economy and society. Reinforced rights to data portability and increased access and usage rights for consumers of connected products (business-to-consumer: B2C) act as one stone to hit several regulatory goals at once: to promote repair and sustainability, as well as digital innovation and fair competition between producers and aftermarket service providers. Next to the users of connected products, the proposed *Data Act* also aims to stimulate data sharing between businesses (B2B) by requiring that contractual clauses should be fair and not exploit power imbalances, and between businesses and governments (B2G) if there is an 'exceptional need for the performance of a task carried out in the public interest' (Article 2d), such as managing a pandemic or another public emergency, which necessitates this. However interesting and controversial, the measures facilitating B2B and B2G sharing go beyond the scope of this chapter, and we will not discuss them any further. Instead, we only focus on the extended user access to the data (B2C), especially for self-repair and maintenance and the use of third party aftermarket services.

In Recital 14 on the material scope of the proposed *Data Act,* it is described:

[54] Proposed Data Act (n. 9) See also: Council compromise (Czech Presidency) text, Proposal for a Regulation of the European Parliament and of the Council on harmonised rules on fair access to and use of data (Data Act), 12169/22, Brussels, 9 September 2022.

[55] European Commission (2022), A European Strategy for data, https://digital-strategy.ec.europa.eu/en/policies/strategy-data#:~:text=The%20strategy%20for%20data%20focuses,and%20societal%20progress%20in%20general.

[56] Article 7(1) clarifies that the data sharing obligations from the data holder towards the user (or a 3rd party designated by the user) 'shall not apply to data generated by the use of products manufactured or related services provided by enterprises that qualify as micro or small enterprises'.

> 'Physical products that obtain, generate or collect, by means of their components or operating system, data concerning their performance, use or environment and that are able to communicate that data via a publicly available electronic communications service (often referred to as the Internet of Things) should be covered by this Regulation. (…) Such products may include vehicles, home equipment and consumer goods, medical and health devices or agricultural and industrial machinery'.

In the Czech Presidency Compromise text[57] in Article 2(2), "product" is defined as:

> 'a tangible, movable item, including where incorporated in an immovable item, that obtains, generates or collects, data concerning its use or environment, and that is able to communicate data via a publicly available electronic communications service and whose primary function is not neither the storing and processing of data nor is it primarily designed to display or play content, or to record and transmit content'.

The main tenet of the proposed *Data Act* is that there should be fair access to and use of data generated by such products (i.e. connected devices), as they are not merely the result of actions of the designer or manufacturer, but also of the user. Article 3(1) of the Czech Presidency Compromise text[58] formulates an obligation to give users access:

> 'Products shall be designed and manufactured, and related services shall be provided, in such a manner that data generated by their use that are accessible to the data holder are, by default and free of charge, easily, securely and, where relevant and appropriate, directly accessible to the user, in a structured, commonly used and machine-readable format'.

In those cases, where the data or metadata cannot be directly accessed by the user, the data holder shall make the data available 'without undue delay, free of charge, easily, securely, in a structured, commonly used and machine-readable format and, where applicable, continuously and in real-time'. Where technically feasible, this 'shall be done on the basis of a simple request through electronic means' (Article 4(1)). The data holder also has to comply with user requests to make generated data and meta-

[57] Czech Presidency Council compromise on the proposed Data Act (n. 54).
[58] Idem.

data available to a third party (Article 5(1)), which should happen under the same conditions as access provided to the user (Article 4(1)).

The data that should be made accessible 'include data recorded intentionally by the user' and 'data generated as a by-product of the user's action, such as diagnostics data' (Recital 17). Recital 14 clarifies that such data 'represent the digitalisation of user actions and events and should accordingly be accessible to the user' and mentions explicitly that user access to these data is supposed to facilitate, among other things, maintenance and repair:

> 'Such data are potentially valuable to the user and support innovation and the development of digital and other services protecting the environment, health and the circular economy, in particular though facilitating the maintenance and repair of the products in question'.[59]

Recital 28 explicates that the user should be free to use the data for a repair or market service that is in competition with the service offered by the manufacturer:

> 'The user should be free to use the data for any lawful purpose. This includes providing the data the user has received exercising the right under this Regulation**,** to a third party offering an aftermarket service that may be in competition with a service provided by the data holder, or to instruct the data holder to do so. The data holder should ensure that the data made available to the third party is as accurate, complete, reliable, relevant and up-to-date as the data holder itself may be able or entitled to access from the use of the product or related service.'

However, Recital 28 also specifies that the manufacturer should not be the one consistently pulling the short end: 'Any trade secrets or intellectual property rights should be respected in handling the data. It is important to preserve incentives to invest in products with functionalities based on the use of data from sensors built into that product'. Finding the right balance of interest is challenging and in the Czech Presidency Compromise text,[60] an additional explanation has been added in Recital 28a:

> 'For this reason, data holders can require the user or third parties of the user's choice to preserve the secrecy of data considered as trade secrets, includ-

[59] Idem.
[60] Idem.

> ing through technical means. Data holders, however, cannot refuse a data access request under this Regulation on the basis of certain data considered as trade secrets, as this would undo the intended effects of this Regulation. The aim of this Regulation (…) (is) to avoid undermining the investment incentives for the type of product from which the data are obtained, for instance, by the use of data to develop a competing product'.

This prohibition to make a competing product is formulated in Article 6(2)e. Moreover, Article 6(1) states that a third party

> 'shall process the data made available to it pursuant to Article 5 only for the purposes and under the conditions agreed with the user, and subject to the rights of the data subject insofar as personal data are concerned, and shall delete the data when they are no longer necessary for the agreed purpose'.

Summarising, the proposed Data Act aims to force larger manufacturers to make data generated by connected products accessible for self or third-party repair, while at the same time not unnecessarily interfering with the economic interests of those manufacturers by creating limits to what is considered lawful use.

7 Creating clear rules for who is liable for products that have undergone digital repair (proposed updated *Product Liability Directive*)

The Product Liability Directive (PLD) was first adopted in 1985 in order to provide for an EU-level safety net 'for compensating people who suffer physical injury or damage to property due to defective products'.[61] The PLD makes manufacturers strictly (no-fault) liable for harm caused by their defective products: such strict liability makes it easier for consumers to claim damages because they do not have to prove that the manufacturer made a fault that caused the harm. The main reason to revise the PLD is to adjust it to a modern digital and circular economy. The revision clarifies that the notion of "product" also covers intangible digital products, 'like a medical health app for a smartphone' and the software

[61] Explanatory Memorandum, p. 1, in: Proposed revised PLD (n. 10).

or AI system 'embedded in a cleaning robot'[62] or 'the navigation service in an autonomous vehicle'.[63] Another important aspect clarified is that 'manufacturers can be held liable for changes they make to products they have already placed on the market, including when these changes are triggered by software updates or machine learning'.[64] While the PLD does not explicitly mention the R2R, it clearly aims to create 'the legal clarity that industry needs in order to embrace circular business models'.[65] In recital 29 of the PLD, it says:

> 'In the transition from a linear to a circular economy, products are designed to be more durable, reusable, reparable and upgradable. The Union is also promoting innovative and sustainable ways of production and consumption that prolong the functionality of products and components, such as remanufacturing, refurbishment and repair'.

The clarification that software, 'including 3rd-party software added to a product or standalone software that itself may cause harm (such as a medical device smartphone app)' can be a product in its own right in the meaning of the PLD, means that businesses 'that substantially modify a product and place it back on the market would also be liable under the Directive'.[66] When is a modification "substantial"? Recital 29 says:

> '…products allow for modifications through changes to software, including upgrades. When a product is modified substantially outside the control of the original manufacturer, it is considered to be a new product and it should be possible to hold the person that made the substantial modification liable as a manufacturer of the modified product, since under relevant Union legislation they are responsible for the product's compliance with safety requirements. Whether a modification is substantial is determined according to criteria set out in relevant Union and national safety legislation, such as modifications that change the original intended functions or affect the product's compliance with applicable safety requirements. In the interests of a fair apportionment of risks in the circular economy, an economic operator that makes a substantial modification should be exempted from liability if it can prove that the damage is related to a part of the product not affected

[62] Questions and answers on the revision of the Product Liability Directive (28 September 2022), https://ec.europa.eu/commission/presscorner/detail/en/QANDA_22_5791.
[63] Explanatory Memorandum, p. 5, in: Proposed revised PLD (n. 10).
[64] Idem.
[65] Questions and answers on the revision of the PLD (n. 62).
[66] Explanatory Memorandum, p. 9, in: Proposed revised PLD (n. 10).

> by the modification. Economic operators that carry out repairs or other operations that do not involve substantial modifications should not be subject to liability under this Directive'.

This exemption can also be found in Article 10(1)g of the revised PLD. The Directive thus creates a window for minor digital repair to be performed without risking becoming liable for defects under the revised PLD. Damages resulting from product defects occurring after substantial digital repair also do not necessarily mean that the repairing party is liable under the revised PDL: the party would only be liable if she/he cannot prove that the damage is related to a part of the product not affected by the modification. If this would be the case, and the 'the modification is considered substantial under relevant Union or national rules on product safety and is undertaken outside the original manufacturer's control' (Article 7(4)), a repairing third party shall be considered a 'manufacturer of the product'.

On the other hand, the revised PLD also clarifies that manufacturers

> 'should remain liable for defectiveness that comes into being after that moment as a result of software or related services within their control, be it in the form of upgrades or updates or machine-learning algorithms. Such software or related services should be considered within the manufacturer's control where they are supplied by that manufacturer or where that manufacturer authorises them or otherwise influences their supply by a third party'. (Recital 37)

Overall, the revised PLD will make it easier for both consumers and businesses to assess the risks of software updates, patches and third party repairs of digital products.

8 Concluding thoughts and the need for further empirical research on the digital R2R in practice

To repair or not to repair – that is the question. Or, in the context of this chapter, the question is more precisely: to do digital repair or not do digital repair? The answer to this question will depend on a multiplicity of economic, cultural, personal and infrastructural and other, sometimes

serendipitous, considerations. Legislation can try to nudge human actors towards repair. Will the proposed *Data Act* and revised *PLD* be successful in nudging towards digital repair? To even try to answer that question is almost impossible. One reason is that both proposals can still change significantly until they reach their final shape. In particular, the proposed *Data Act* is highly controversial. Unsurprisingly, many large businesses are not overjoyed by the prospect of other actors gaining more extensive access and usage rights over data that they currently monopolise. In the European Parliament, over 1,000 amendments to the original proposal were put forward. Another reason why it is difficult to predict how successful the proposed *Data Act* and revised *PLD* will be in nudging towards increased digital repair is that these legal instruments have a multiplicity of broad regulatory goals that they aim to achieve, such as stimulating the circular economy and digital innovation. Both instruments engage with matters that have to do with digital repair, but nowhere do they explicitly mention digital repair as their goal. The success of these legal instruments will be assessed in terms of how well they contributed to harmonising liability rules, stimulating digital innovation, decreasing the need for raw materials for electronic devices and contributing to the circular economy. Nobody will measure their success in terms of how well they contributed to the digital R2R – and given the complexity and ambiguity of that term, it might, in fact, be good news. As we argued in section 4, repair in relation to the digital is a somewhat misguided notion that suggests a clear binary state of broken versus repaired that is absent in reality. Take, for example, the events surrounding the amicable Anki/Vector robot (see section 2.2.). The main story surrounding Anki/Vector seems to be a happy one: manufacturer *Anki* goes bankrupt, but *Digital Dream Labs* steps in to enable the Vector robots to continue to function. Yet, a closer look at the process shows many unhappy users. People got annoyed by the additional costs as well as by the new functionality – far from everyone was happy with what the new software support allowed their robot pet to do. One user writes: "I paid a year ago for what? Now I have a nice doorstop".[67] Another states: "Am I the only one that wants to throw Vector out the windows sometimes? He does not shut up. (…) He has several times attempted to attack my keyboard while I am work-

[67] https://www.kickstarter.com/projects/anki/vector-by-anki-a-giant-roll-forward-for-robot-kind/posts/2724085.

ing".[68] The comments point to a fundamental complexity about digital repair, namely that what should be qualified as successful functioning is up for debate. If we hypothetically imagine that all the Anki/Vector users would live in the EU and that the proposed *Data Act* and *PLD* in their current form had been in force in 2018 – what impact would these legal instruments have had in the Anki/Vector case? An owner of the robot might definitely be helped by the *Data Act* that gives access to data generated in their interactions with virtual assistants, and under this legislation the owners of such devices would have to be less concerned that years of interaction, training and personalisation would disappear. The *PLD*, which clarifies that products also include software and AI systems, could help to sue the manufacturer if the Vector robot would cause material physical harm. A crucial question is who would be liable: the initial manufacturer or the company that took over with software support? Were the changes made by *Digital Dream Labs* substantial, in the meaning of Article 7(4) PLD? The changes were definitely 'outside the control of the original manufacturer' (Article 7(4) PLD), given that *Anki* was already bankrupt. However, whether the modifications are to be considered substantial according to 'relevant Union or national rules on product safety' (Article 7(4) PLD) might turn out to be a difficult question to answer. This relates, again, to the non-binary, gradual ways in which software and data can function (see section 4): in the same way as it is challenging to draw a hard line between software and data that are *broken* and those that *function as they should*, it is also difficult to identify when the data and software have been altered so much that we should call it a *new product*. Obviously, these distinctions can also be challenging in relation to hardware. As the R2R movement has grown, a subtle vocabulary[69] has been developed to distinguish, for example, between *repair* ('extends the life of a product during its first use by retaining or restoring functionalities with minor repairs'), *refurbishment* ('extends the life of a product by replacing a few major components which restores functionality and provides good or acceptable performance for a second hand user') and *remanufacturing* ('enables a full new service life of a product via a standardized industrial process that takes place within industrial or fac-

[68] Idem.

[69] J. Luth Richter (29 June 2020). The ubiquitous Rs – what are they really?, blog post at: Creating a Repair Society. Policies, networks and people (CREACE project blog), https://repairsociety.blogg.lu.se/the-ubiquitous-rs-what-are-they-really/.

tory settings, in which cores are restored to original as-new condition and performance, or better'). While these distinctions add a layer of subtlety to debates on hardware repair, they are still insufficiently granular to be successfully transposed to the field of the digital. Distinguishing digital repair from refurbishment or remanufacturing is less obvious than in the case of hardware.

Another complexity of digital repair that stays unresolved in the light of the proposed *Data Act* and *PLD* is the pairing of hardware and software (see section 4), and other hardware-software interactions. Pairing means that hardware repair is limited by software restrictions. In section 2.4, we mentioned the *iPhone*, where software will detect unauthorised hardware replacements and prevent the device from working. Similar tactics are used in many smart devices. For example, in the John Deere tractor (section 2.1), hardware repair also often needs to be authorised by software. When a hardware repair is done by an unauthorised mechanic, the tractor will stop driving: 'Deere charges $230, plus $130 an hour for a technician to drive out and plug a connector into their USB port to authorize the part'.[70] What is digital repair in these scenarios? The software here functions as a sort of Digital Rights Management (DRM) applied to hardware repair. The manufacturer will consider that the protective software works as it should, while the user will want to "repair" this unnecessary and costly hurdle. Again, the meaning of "repair" is up for debate.

Similarly, the culture of fast-paced technological innovation and marketing-induced desire for novelty (section 4) does not suddenly disappear by clarifying the liability rules for defective software updates or making data access and usage rights more fair. Legal interventions that could have an impact in this context are the ones proposed by Gomulkiewicz[71] (a right to revert to prior versions of software, to refuse updates and to receive software updates for a certain period of time) or the European Parliament Resolution on the R2R[72] (which also names the two latter rights proposed by Gomulkiewicz).

A final aspect that is not addressed in any of the new EU proposals is the "out-of-boundedness" of connected devices. In spite of whatever le-

[70] J. Koebler (21 March 2017), Why American Farmers Are Hacking Their Tractors With Ukrainian Firmware, Motherboard, https://www.vice.com/en/article/xykkkd/why-american-farmers-are-hacking-their-tractors-with-ukrainian-firmware.

[71] Gomulkiewicz (n. 30).

[72] European Parliament, Resolution on the Right to Repair (n. 53).

gal safeguards might be put in place, this creates the practical threat that a device can be remotely switched off, as was the case with the surgical robot (section 2.3) and the John Deere tractor.

In summary, the proposed *Data Act* and revision of the *PLD* hold a promise to make a positive impact on digital repair.

However, before such legislation can have any real bite, one first has to rethink the word "repair" in the context of software and data – and what kind of cultural, technical and infrastructural shifts it would require for consumers to keep the same digital devices for decades, instead of merely a few years. Which shifts would be helpful in this respect is an empirical question that can only be answered by more detailed empirical research on the digital R2R in practice and concrete repair decisions (to repair or not to repair). Such research would trace the conflicts and negotiations relating to a digital R2R through empirical studies, which help to develop empirical material and conceptual tools that make it possible to understand the parallel and sometimes intersecting legal, economic, cultural and ecological valuations involved in digital R2R.

Moreover, as we argued in section 5, the current legislative initiatives that facilitate digital repair are scattered and implicit. There are currently no legislative instruments that are explicitly or solely devoted to digital repair. When R2R is mentioned explicitly, rarely is there a distinction made between the different measures needed to stimulate hardware or digital repair – both are lumped together under a bigger umbrella, which, in its formulation, seems more oriented towards hardware repair. Despite the ambivalences in the notion of a digital R2R, it is a catchy term that could unify the now mainly scattered and implicit proposals, and thus facilitate digital repair in a more coherent, comprehensive and explicit manner.