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Ease of repair as a design ideal: A reflection on how open source models can support longer lasting ownership of, and care for, technology

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The hacker ethos around repair

Last spring, a series of online newspaper and magazine articles highlighted the story of the American farmers, who were hacking their tractors using Ukrainian software bought online (Naughton, 2017). After buying tractors from the well-known brand John Deere, the world's biggest manufacturer of agricultural machinery and products, the farmers were all facing the same problem. They realized that when their machine breaks they are not only legally obliged to call Deere's customer service centre, which is the only entity entitled to *analyse* the tractor's breakdown, but they also became aware that even when the service is slow, inefficient and overpriced, they cannot do much without violating the Digital Millennium Copyright Act (US Copyright Office, 1998). This legislation rules over the way people use a host of digital devices. and amongst other things, legally restrained the farmers from suing the company for loss of profit if the software results in non-performance.

How has a tractor become comparable to a digital device? Like so many of our everyday devices most agricultural machinery now runs on copyright-protected software, which due to software limitations induced by business driven product development makes many machines difficult or even impossible to fix, even for minor maintenance upkeep. To overcome these limitations, farmers started purchasing and using an application downloadable from the website of an Eastern European software house. Together with the software, they began accessing and participating in an online forum that featured shared

specifications, thereby allowing them to acquire the knowledge needed to perform 'unauthorized' fixes. The same farmers became allies with independent repair shops and together collaborated in lobbying hardware manufacturers, aiming to force them to drop software-based monopolies and make diagnostic tools available to a wider range of people, like owners and local shops.

In this case, hacking practices overlap with the realm of piracy practices, where there is no empowerment of the user but rather an induced condition resulting in the temporary resolution of a problem. Piracy becomes the only way to fix the inefficiency of a business model, and to balance the relation between those who produce goods and those who buy and use them. While piracy at least offers one solution, at the same time *it prevents the possibility of redefining the very concept of product ownership because it lacks a legal framework*. In this context, ownership is something people need to fight against in order to get *'it'* back for themselves. This is in contrast to the context of open source product development, discussed below, where openness and user-ownership is inscribed in the DNA of the product.

This battle over property has just started. On one side there are 'prosumers' associations, blue-collar Republicans, hackers, makers, activists all reclaiming their rights to modify the things they paid for and, on the other, big opponents like Apple, GM and manufacturers like Deere accusing them of pirating. Some successes in this property battle are being won, for example in 2014 the 'Right to Repair' movement made progress when the Massachusetts Right to Repair Initiative (Noonan, 2017) passed in the state's 2012 general election with 86% voter support and was later brought to the signature of a Memorandum of Understanding based on this law. This particular law commits vehicle manufacturers to meet the requirements of the Massachusetts law in all fifty states, requiring amongst other things all vehicle owners to have access to the diagnostic and repair information made available to the manufactures and also to authorized repair facilities.

It is interesting to note that the idea of 'hacker ethics' came to life in the same State of the first Right to Repair law – Massachusetts – as journalist Steven Levy sets out in his 1984 book *Hackers: Heroes of the Computer Revolution*. Levy describes the scene around Massachusetts Institute of Technology since the 1950s as one that fosters the belief that information-sharing is a powerful positive good, and that it is an ethical duty of hackers to share their expertise, facilitating access to information and to computing resources wherever possible, especially by writing open-source code.

Renovating the right to repair is a relevant topic in United States today and while it finds its roots in the hacker ethos and also in a sort of traditional tinkering attitude as a means of self-expression, it finally is a constitutive part of the genesis of social communities that gather around diverse practices, from car fixing to HAM radios making, from bicycles hacks to furniture manufacturing.

From do-it-yourself to do-it-together: The maker movement view on repairing

The maker movement can be seen as a novel global community that pays attention to the need of repairing technological products. It is doing so because it sits with the wider aims of lowering the barriers to technology to a wider public, from kids to elderly people, and of supporting open source design mottos such as 'If you can't open it, you don't own it' (van Abel, 2012). Since the first half of the '00s, the concept of 'maker' and 'maker movement' was inspired by the European hacker community, which gathered around the Chaos Computer Club in Germany in the 1990s and various hacker spaces in Europe. Yet unlike other hacker communities in Europe – that also differ from each other in both approach and general mission (Alberts and Oldenziel, 2014) – the maker movement is a global community that focuses on the development of new attitudes towards making things that is more based on sharing enabled by the internet and hardware.

In the same period, Dale Dougherty – co-founder of O'Reilly Media – was planning to start a new magazine: initially titled 'Hack', his daughter suggested the name 'Make', now adopted, for its connotations as a positive action and with the idea that everyone can and might like to make stuff (Corcocan, 2016). Until today Make magazine features dozens of DIY technology projects and promotes a series of local community events called 'Maker Faires'. The magazine is also a cultural reference in that it contributes to discussions about bottom-up and open approaches to technology. In 2005, Make magazine published a list of '17 commandments' that manufacturers should follow in order to make their products repairable and/or hackable under the title of a 'Maker's Bill of Rights'[I].

[I] 'Meaningful and specific parts lists shall be included; Cases shall be easy to open; Batteries shall be replaceable; Special tools are allowed only for darn good reasons; Profiting by selling expensive special tools is wrong, and not making special tools available is even worse; Torx is OK; tamper proof is rarely OK; Components, not entire subassemblies, shall be replaceable; Consumables, like fuses and filters, shall be easy to access; Circuit boards shall be commented; Power from USB is good; power from proprietary power adapters is bad; Standard connectors shall have pinouts defined. If it snaps shut, it shall snap open; Screws better than glues; Docs

This manifesto contains a series of wider issues which are discussed among grassroots communities as well as policy makers. First of all, the bill addresses the issue of the large amount of electronic waste created by the inability to repair broken electronics affordably. This issue is strictly related to the induced obsolescence which is becoming a fact more than a conspiracy concept (Agi.com, 2018): the case of Apple's declaration on the programmed slowdown of iPhone operative systems (Warren and Statt, 2017) shows how technology optimization creates a conflict between the usability and the durability of a device. In other terms, finding a balance between the performance of the operating system and the duration of an old battery allows a company to save money on the implementation of repairing services, on the replacing of parts, on the updates of the product's warranties, etc. On one side, companies such as Apple save money on the implementation or redesign of their services and they keep earning from the inevitable purchase of new devices and by offering replacement services at reduced costs (Morris, 2017). On the other, consumers can only choose to fix their devices via piracy, by buying replacement parts, joining the communities of DIY fixing and/ or accessing online tutorials and instructions.

Platforms such as iFixit respond to this consumer need. iFixit have supported the growth of the hardware and electronics repairing community by proposing 'do it yourself' strategies as a solution to the lack of repair-friendly business models, namely the ones offering free repair services or official networks of repair facilities. However, we cannot state that those new internet platforms necessarily provide a sustainable and long-lasting solution to the problem. The 'do-it-yourself' approach proposed by those platforms emerges as more a pragmatic choice rather than a stable and conscious alternative: the DIY repair of electronic devices, in fact, generates the proliferation of unofficial repairing services feeding electronics manufacturing ecosystems that might not be certified as slavery-free or socially fair businesses.

For this reason, we suggest reflecting on how the DIY repair culture could be enhanced by the practices proposed by the maker movement and that by focusing on the processes of opening knowledges around technology, it could help facilitate a systemic change of technology production. We support this perspective particularly in light of the recent decisions of the US Copyright Office, who ruled that consumers and repair professionals have the right to legally hack the firmware of 'lawfully acquired' devices for the 'maintenance' and 'repair' of that device (Koebler, 2018). This new legal framework supports the

and drivers shall have permalinks and shall reside for all perpetuity at archive.org; Ease of repair shall be a design ideal, not an afterthought; Metric or standard, not both; Schematics shall be included.' (Makezine, 2006)

hacking of many electronic devices (beyond tractors) and, as consequence, we highlight the need to look at novel models for repair culture that more closely align to those applied in the maker movement.

Maker companies, by which we mean companies that produce maker-friendly technologies and products such as Adafruit, Arduino, Sparkfun, Bare Conductive, opened the field of electronics by providing user-friendly platforms that help non-experts to retrieve and buy components to create their own projects. The practice of releasing open hardware products together with their assembly instructions and bill of materials (BOM) – the list of all components used to make the product – has become the pillar of any initiative addressing the needs of the maker community. The makers' answer to the problem of repairing technological products is turned into a practice of open-sourcing both the knowledge and resources that make every product reproducible and thus repairable.

This is the beneficial side-effect of a movement practice, which is simultaneously experiencing many internal contradictions not least the interference of big tech companies, or the interaction with 'startup' cultures. In both cases, we believe that when open source approaches are applied, those interferences favoured the diffusion of repair-friendly design requirements, such as modularity, open standards and 3D printing.

In particular, 3D printing represents a key technology for repairing. Individuals can use 3D printers to print replacement parts of devices as well as to improve the parts in such a way they are less likely to break in the future (Weinberg, 2010). Moreover, printing replacement parts does not infringe, in many cases, copyright law and gives life to old devices by repurposing them through the assembly and combination of new printed parts. The impact of 3D printing on repairing is always underestimated, particularly when compared with the discourse on 'innovation' in manufacturing and how makers are seen to be the key actors in a new industrial revolution (Anderson, 2014). Thanks to makers' commitment to the development of open source and low cost 3D printers, which in some cases can print up to 80% of their own components, makers rather become the actors of a new repairing age, relying on existing legal frameworks and shared practices, rather than the protagonists of a start-up culture that sees low cost 3D printing merely as a more accessible production technology to be marketed.

What we have learnt is that increasing the ease of which things can be repaired via 3D printing should be a possible as a choice within the design process and should constitute an ideal in every project. Nevertheless, we are aware that repair-

friendly design and business models are not easily implemented, even if 3D printers are becoming increasingly accessible. We are also aware that 3D printing technologies, as a means of production and manufacture of products, are not always open source[2] and here lies one of the main controversies around 3D printing. We do not have space to address this specific debate here and rather turn our attention to open source approaches in design.

Open design approaches

Open design adopts licences that enable everyone to modify, build upon and appropriate a technology or a project freely (Open Design + Hardware Working Group of the Open Knowledge Foundation, 2016). When a designer or company engages with an open design approach, it means that the design blueprints are: published in an online repository; licensed under open-access terms; distributed digitally in a specific file format together with fabrication and assembly instructions. As Michel Avital explained, Open design allows the transition from 'Push models' to 'Pull models', whereas the former points to companies that push their products to customers, the latter rather create a connection with the customer in such a way that s/he demands the products and reciprocally supports the company (Avital, 2011). According to this model, products become more comparable to service platforms where repair practices and the engagement of a products users are embedded in the design (van Abel, 2012). Open design is directed toward consumers and local producers who can engage in fabrication processes that are seen as alternative to the ones of the conventional manufacturing and distribution channels (Dexter and Jackson, 2012). These processes allow making products that cannot be produced or distributed otherwise because they respond to the needs of a small group of people. In the health and care sector, for example, open design combined with digital fabrication has empowered makers and designers to release customizable and highly fixable solutions for small groups of users. One example of this type of work is 'Too Wheels', a low-cost and adaptable, DIY alternative to more expensive, ready-made sports wheelchairs. Anyone can download the blueprint of the open source wheelchair design; they can adjust that design based on unique measurements, and build the finished product from cheaper and easily available materials such as plywood, metal tubing, and bicycle wheels. The cost of the kit is €200 for a product whose performance is comparable to a €2,000 sport wheelchair. Too Wheels' design embeds the capability of being manufactured at

[2] RepRap and Prusa Research are successful case studies of open source solutions in the 3D printer industries, but they are competing with many other non-open source solutions.

local fabrication site, which in turn can also become a place to fix and repair it after purchase (Cangiano and Romano, 2016).

In the last fifteen years, on one side, people have been losing the right to repair their own things, on the other, thanks to the internet, they have been accessing and creating the necessary knowledge and documentation to lower the barriers, not only to repair, but to the realization of their own devices from scratch. This became possible thanks to the rise of an ecosystem of initiatives and companies such as Arduino and RepRap 3D printers, able to scale by applying open design and open hardware models as well as by using digital platforms for the on-demand distribution of small batches of customized goods. This ecosystem encourages the development of practices and the rise of new professional designers. It also represents, in our opinion, the key elements of convenient, replicable models to support the growth of the repair culture: the professional use of open licenses and the release of the documentation materials are at the core of innovative business models which entitle people to experience a world in which repairing is no longer a critical choice nor a pirate action, but a *common* use by people who buy and own a product.

references

Agi.com (2018) 'L'Antitrust italiana multa Apple e Samsung per obsolescenza programmata. Di cosa si tratta'. [https://www.agi.it/economia/antitrust_obsolescenza_programmata_apple_samsung-4525578/news/2018-10-24/]

Alberts, G. and R. Oldenziel (eds.) (2014) *Hacking Europe: From computer cultures to demoscenes*, London: Springer-Verlag.

Anderson, C. (2014) *Makers: The new industrial revoloution*. New York: Crown Business.

Avital, M. (2011) 'The generative bedrock of open design', in B. Van Abel, L. Evers, R. Klaasson and P. Troxler (eds.) *Open design now: Why design cannot remain exclusive*. Amsterdam: BIS Publishers.

Cangiano, S. and Z. Romano (2017) 'Digital social innovation toolkit', Nesta, Waag Society and SUPSI for the European Union's funded project 'DSI4EU'. [https://dsi4eu.github.io/toolkit/assets/downloads/DSIToolkit-complete.pdf]

Corcocan, B. (2016) 'Harnessing the maker spirit: Dale Dougherty's new book, "Free to make"'. [https://www.edsurge.com/news/2016-11-01-harnessing-the-maker-spirit-dale-dougherty-s-new-book-free-to-make]

Dexter, M. and C. Jackson (2012) 'Making space: The future places, tools and technologies for open design', paper presented at the 8th Conference of the International Committee for Design History & Design Studies, Sao Paulo, Brazil, September 4-6. [www.proceedings.blucher.com.br/article-details/making-space-the-future-places-tools-and-technologies-for-open-design-8610].

Koebler, J. (2018) 'In groundbreaking decision, Feds say hacking DRM to fix your electronics is legal', *Motherboard Vice*. [https://motherboard.vice.com/en_us/article/xw9bwd/1201-exemptions-right-to-repair]

Levy, S. (1984) *Hackers: Heroes of the computer revolution*. New York: Anchor Press.

Lomas, N. (2017) 'Fairphone ends support for first repairable-by-design smartphone'. [https://techcrunch.com/2017/07/24/fairphone-ends-support-for-first-repairable-by-design-smartphone/].

Makezine.com (2006) 'The maker's bill of right'. [https://makezine.com/2006/12/01/the-makers-bill-of-rights/]

Maxigas, P. (2012), 'Hacklabs and hackerspaces – tracing two genealogies', *Journal of Peer Production*, 2. [http://peerproduction.net/issues/issue-2/peer-reviewed-papers/hacklabs-and-hackerspaces]

Open Design + Hardware (OD+H) Working Group of the Open Knowledge Foundation (2016) 'Open design definition'. [https://github.com/Open Design-WorkingGroup/Open-Design-Definition/blob/master/open.design_definition/open.design.definition.md].

Morris, I. (2017) 'Apple responds to iPhone slowdown complaints and offers solutions', *Forbes*. [https://www.forbes.com/sites/ianmorris/2017/12/28/apple-responds-to-iphone-slowdown-complaints-and-offers-solutions/#5d7c3f3e79ee]

Naugthon, J. (2018) 'Why American farmers are hacking their own tractors', *The Guardian*, 26 March. [https://www.theguardian.com/commentisfree/2017/mar/26/why- american-farmers-hacking-own-tractors]

Noonan, A. (2017) 'Massachusetts considers digital right to repair'. [https://clinic.cyber.harvard.edu/2017/10/12/massachusetts-considers-digital-right-to-repair/]

US Copyright Office (1998) 'The Digital Millennium Copyright Act of 1998 U.S. Copyright Office Summary'. [https://www.copyright.gov/legislation/dmca.pdf]

Van Abel, B., L. Evers, R. Klaasson and P. Troxler (eds.) (2011) *Open design now: Why design cannot remain exclusive*. Amsterdam: BIS Publishers.

van Abel, B. (2012), 'If you can't open it, you don't own it'. [https://www.watershed.co.uk/opencity/wp-content/uploads/2012/03/Bas-van-Abel_if-you-cannot-open-it_July-2012.pdf]

Warren, T. and N. Statt (2017) 'Apple confirms iPhones with older batteries will take hits in performance'. [https://www.theverge.com/2017/ 12/20/16800058/apple-iphone-slow-fix-battery-life-capacity]

Weinberg, M. (2010) 'It will be awesome if they don't screw it up: 3D printing'. [https://www.publicknowledge.org/news-blog/blogs/it-will-be-awesome-if-they-dont-screw-it-up-3d-printing]

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