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"My Store is a Laboratory": Knowledge Produced by Smartphone Repairers

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Abstract

Focusing on the documents produced by Swiss smartphone repairers working in independent stores, this paper highlights the "knowledge trajectories" undertaken by the information these practitioners uncover by disassembling phones, annotate and sometimes share with peers, competitors or customers. Based on ethnographic vignettes, this visual essay shows and discusses the ways such stores can be seen as a counterpoint to academic or private research & development (R&D) laboratories—because of the situated knowledge they produce against manufacturers, and their goal that is not simply to understand how smartphones work and behave, but to help customers whose phones are broken or corrupted.

Keywords

repair; maintenance; smartphone; repair-shop; knowledge; know-how; procedure

Introduction

> *My store is a laboratory.* (F., male, repairer, Geneva)

This is how one of the participants in our investigation of Swiss smartphone repair stores described his workplace to us (Nova and Bloch 2020). When we asked him to elaborate, he argued that a big chunk of his time was devoted to grasp how smartphones where designed, and how they work. He also explained that his store constantly buys new devices all the time in order to understand how they differ from earlier models:

> *As soon as a new model comes out, we have to update our knowledge. We bought an iPhone 7, our technicians broke it. It cost us 1000 CHF but it was an opportunity to learn.* (F., male, repairer, Geneva)

This quote makes us aware of the relationship between the production of knowledge, described here as a learning process, and the metaphor of the laboratory, associated with the dismantling and reconstitution of the smartphone's mode of operation—a prerequisite to the maintenance services of this object that customers bring to them. And this "requirement" consists in breaking other smartphones. This operation of

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intentional destruction of a technical object is important as it testifies to the fundamental asymmetry faced by anyone who wants to repair a mobile phone: device manufacturers rarely provide resources or support for repairs made by users or uncertified third parties. Most of them have enacted strategies to make maintenance operation difficult (e.g. by using non-standard security screws), and critical information about product designs or repair processes are generally kept private. Official tools or spare parts are also strictly limited to "certified" repairers. Facing such difficulty, repairers combine multiple DIY practices (individual and shared) to learn how to fix smartphones, such as tearing-down phones, reverse engineering, or discovery by trial and error. In addition, dismantling smartphones is of interest to us because of the frequency of this task among repairers, carried out in order to know these technical objects and to set up maintenance procedures, as we will show in this article. Disassembly activities also matter insofar as they are another way of producing knowledge and know-how described in the literature on DIY practices; for instance described as "Critical Making" by Matt Ratto in order to refer to knowledge generation operations emerging through material engagement with technology (Ratto 2011, 253).

This paper discusses how the maintenance and repair of smartphones requires more or less formalized knowledge and know-how, and how they materialize in the context of Swiss repair stores we investigated between 2016 and 2018. Adopting the format of a visual essay, we focus here on "gestures," formed by the reverse engineering of the functioning of the devices, the setting up of intervention processes, and the sharing of the documentation produced in doing so.

This two-years ethnographic investigation of smartphone repair shops and hackerspaces in Geneva, Lausanne and Zurich is based on 42 interviews and in-situ observation sessions, completed by sixty visits to stores; the participation of one of us in a four-month internship in a store in Lausanne. We also conducted thirteen interviews and observation sessions in hackerspaces, as well as repeatedly participating in repair cafés held in these places. While hackerspaces and repair cafés were always organized by people between 25 and 60-years-old with Swiss Citizenship and a degree in higher education (engineering school, university), the store repairers were all young foreigners (France, Algeria, Tunisia, Syria, Russia, Thailand) in their twenties, with almost no formal training. In both cases, they were generally male, with few exceptions. This article compiles a series of photography, field drawings and notes we took on the field. The participants in our fieldwork were not comfortable with the idea of being photographed, particularly because of their sometimes illegal social status, as well as their discomfort with a documentation of their work. This is why we supplemented the photos with drawings and sketches, in addition to the field notes and interview excerpts.

From a theoretical standpoint, this research sits within the wider framework of maintenance & repair studies (Graham and Thrift 2007; Jackson 2014; Denis and Pontille 2017). More specifically, it addresses such issues about technical knowledge in relation to the various ethnographies on the maintenance of cell phones and other electronic objects in anthropology and STS (Jackson et al. 2012; Jackson et al. 2014; Ahmed et al. 2015; Bell et al. 2018; Houston 2019).

Figure 1. Illustration of an uncredited smartphone repair shop in Geneva (Switzerland). Owned by a woman from the French Caribbean, who is in charge of customer contact, this store also has a repair technician. The presence of women in this kind of place is rather limited, and usually in the positions of managers or owners of the premises. Repairers tend to be men, most of the time from foreign origins (French, French-Tunisian, French-Moroccan, Lebanese or Syrian) and who take care of most of the work (changing screens, batteries or buttons, data recovery, software adjustments). In this store, typical of those we surveyed, there are three part-time repairmen, who take

turns working alongside the owner. Although the store front focuses on repairs, it is in fact a hybrid store, selling smartphone accessories (headsets, protective shells) as well as phones and tablets. All this to balance out their rather precarious business model. Clientele in Geneva is quite diverse, with a mix of locals and foreigners, all attracted by the low prices and the amount of time to fix devices. (Source Bloch).

Tear-down and its Documentation

As described by the repairer mentioned in the opening of this paper, as well as Lara Houston's work on phone repair (2019), disassembling smartphones is a recurring task for technicians. This results in several forms of documentation, sometimes official, sometimes reconstructed, and can eventually be shared with colleagues, competitors or customers (see figures 2, 3, and 4).

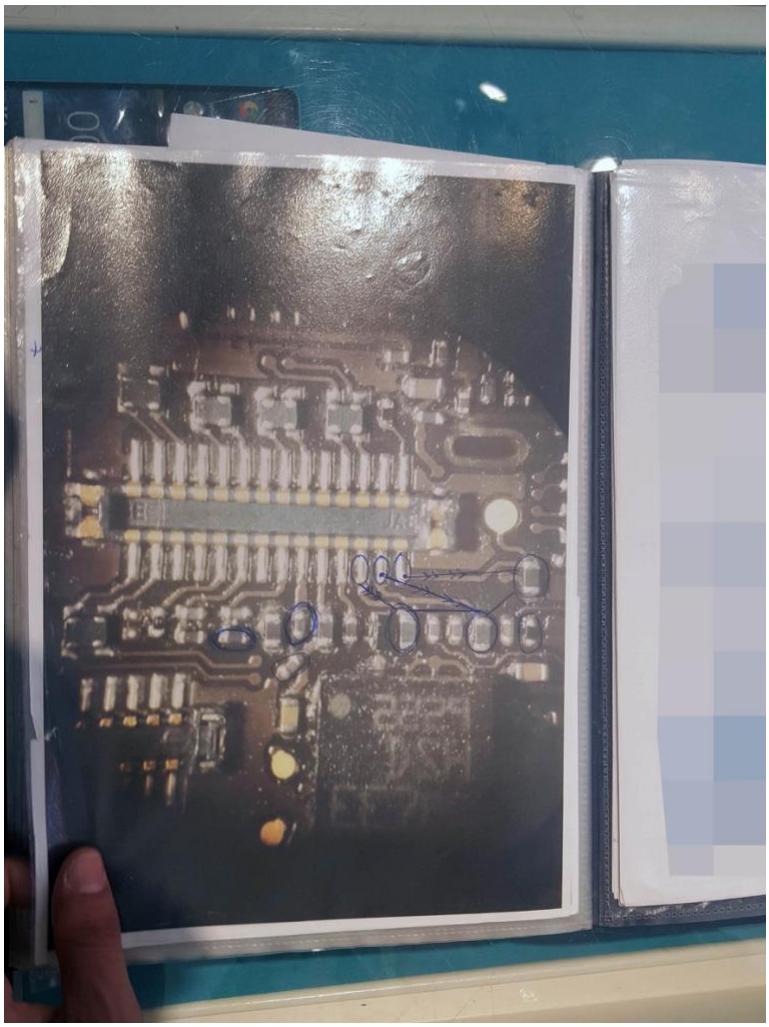

Figure 2. Close-up photograph of an iPhone 5C motherboard made using a microscope by a technician. The image was printed and filed in a transparent plastic sleeve with other similar documents (such as the one shown in figure 4). While this screenshot is annotated with circles and arrows to designate specific parts, there is no title nor additional texts, since such picture is only meant to be used by its author. In this case, the motivation of this

document was to remind him where to operate on the motherboard (e.g. finding potential test points to check voltage). (Source Bloch).

Figure 3. A series of hand-drawn iPhone 7C schematics reconstituted by a repairer on A5 sheets of paper after disassembling the smartphone. The size of the document corresponds to the actual dimensions of the phone model placed on the sheet of paper, with notes about the location of screws as well as specific connections to the motherboard by ribbon cables. Here again, the annotations are made only for the repairer and mostly focus on how to open the device. (Source Bloch).

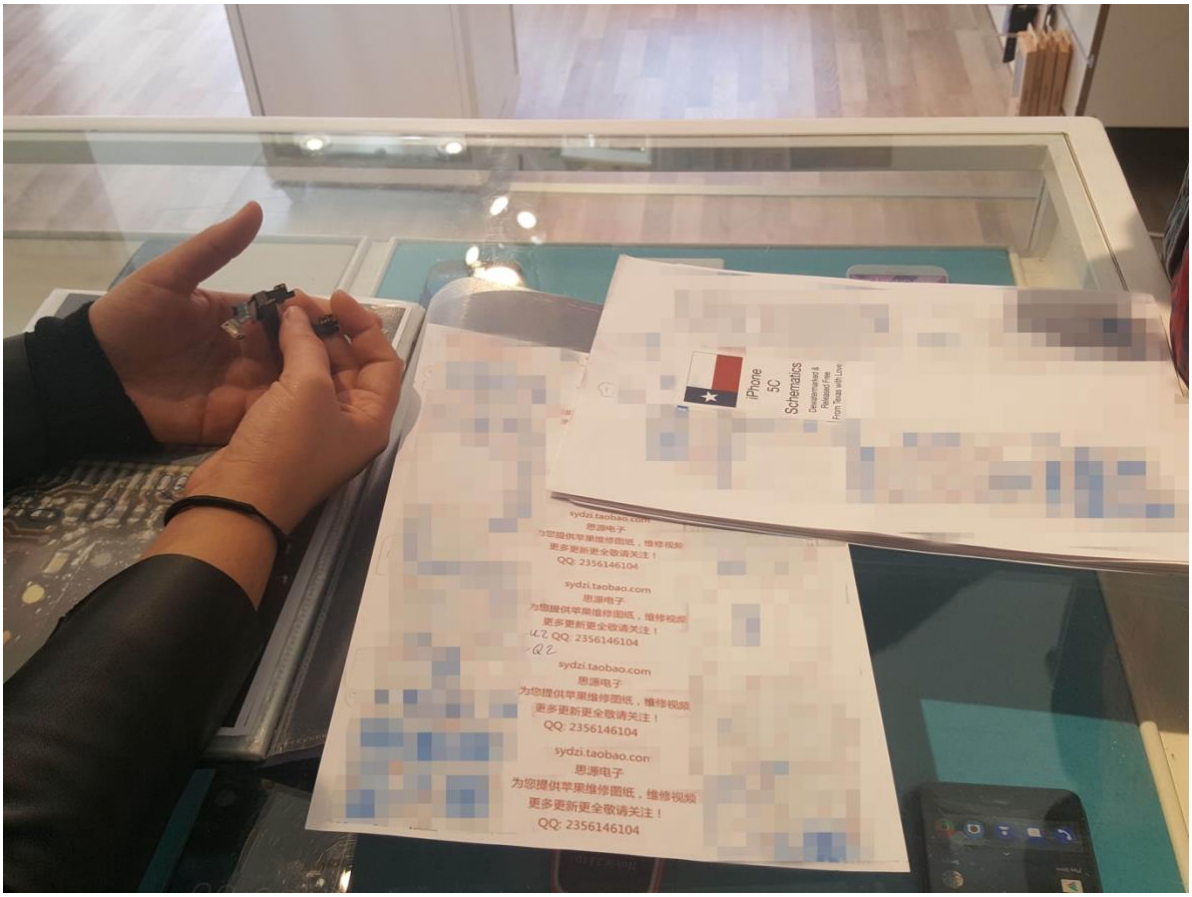

Figure 4. Photograph of printed motherboard schematics, found on an online forum by a repairer, extracted from a binder full of plastic sleeves (see figure 2) and shared with a client who holds the damaged circuit board of her smartphone. While this document is filled with information in Chinese characters about its provenance it can be easily accessed online typing "schematics" as well as the name of the phone model on a search engine. This version has been annotated by the technician. For instance, the arrows as well as the "U2" note refer to how the main motherboard represented here is connected to another smaller board that holds the U2 chip (which is in charge of the power and battery usage of the smartphone and how the device 'understands' when it's plugged in and how much battery is left). (Source Bloch).

Maintenance Process

Based on the knowledge gained while opening the phone components, or by reading documents produced by peers, repairers then try to rebuild how to check the status of corrupt or damaged phone parts, and how to adjust them (replacement, substitution with a similar component). Although repairers sometimes go on websites such as iFixit or GSM forum (2023), and print some of the pages they access, the documents produced by the repairers and described in this article go more into the specifics of the smartphone models they encounter; for example, by showing annotated plans and details of operations performed in the past or by trusted peers (shown in figure 5).

Figure 5. Photographed handwritten notes on a PCB diagram[1] about how to address charging issues of a specific model of smartphone. This page was found on an online forum by a repairer, and the warnings at the bottom regarding its confidential and proprietary content, illustrate the official nature of this document that was then leaked or shared by a third party. This diagram was annotated by the repairer, describing a sequence of operations to be conducted on several parts of the device like checking chips or replacing them. As presented above, these notes mostly act as a reminder for this technician, but their list format correspond to a process that can be followed, and potentially shared with colleagues. This finding of greater or lesser openness to competitors echoes the work of Bell et al. (2018) who found similar networked behaviors. (Source Bloch).

Sharing and Building

The majority of the documents collected and elaborated by the technicians we met in our field investigation remain stored in filing cabinets or in computer directories. However, some of them can be shared with

[1] A PCB diagram is a visual description of the functional diagram of electronic circuits. Symbols are used to represent components and show how they are connected electrically.

different people, within the small repair companies, with competitors (see figure 6 and 7), or even customers (see figure 8).

Figure 6. Illustration of a conversation in a WhatsApp group used by repairers from various shops. Repairers from local or regional groups in Switzerland (e.g. in the Geneva/Lausanne/Lyon area) share their problems and thoughts

on the message board, sometimes asking for comments about unknown issues or components, tips regarding how to solve problems, or actual help from their peers (as represented here). The WhatsApp group can also be helpful for accessing spare parts that are not always available, and the circulation of documents (internet addresses, pdf with diagrams). This kind of group also illustrate the way repairers operate, as a network made of competitors who can sometimes help each other, as shown by Bell et al. (2018). (Source Bloch).

Figure 7. Notes from a conversation about the "internal learning system" a Swiss store created to train their employees. While most of the documents we saw above were printed on paper and stored in binders, one of the

Swiss repair store chain we investigated adopted a more ambitious system : an intranet platform that compiles repair techniques, and help new recruits to learn how to master them through exercises. This "learning system" is not shared with external persons and is constantly updated with new knowledge coming from reverse engineering new phone models. (Source Bloch).

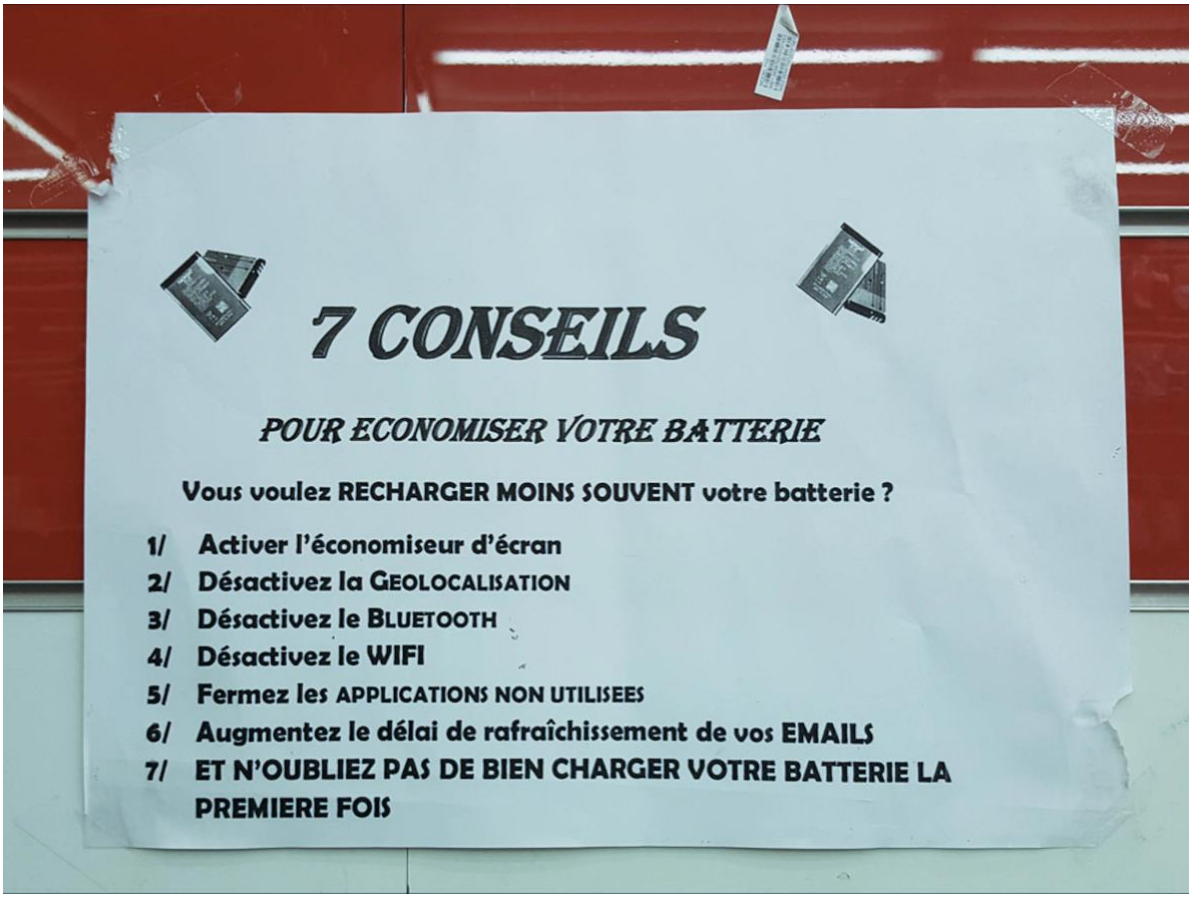

Figure 8. A poster displayed in a store in Geneva that gives advice to customers about charging issues. Such document is different than the previous one, as it is not focused on fixing and maintenance issues. However, the tips shared on this sheet of paper correspond to more general recommendations derived from the knowledge acquired by the technicians over time: switching off geolocation, Bluetooth and Wi-Fi, closing non-used apps, activating screen saver and changing the frequency of email fetching. They are also meant to prevent potential problems that the repairers could be confronted with by their customers. (Source Nova).

Discussion

The seven images presented in this visual essay testify to a trajectory of knowledge/know-how we identified in our research field on independent smartphone repair stores between 2016 and 2018. They are evidence of different ways of elaborating and sharing information, procedures, and recommendations—insights that go from the documentation of disassembly (found online or made by the technicians) to their use in a maintenance situation, and even to their distribution within a more or less restricted circle, as shown by Bell et al. (2018). The term "trajectory" we adopted here correspond to the transformation of knowledge gained

by their activities, turned into procedures of repair, and potentially into advice for peers or customers. As the annotations present on the documents attest, this set of photographs, diagrams and procedures also corresponds to different degrees of analysis by their authors. Most of them are case studies limited to one smartphone model, and the degrees of generalization are low (except for the case described in figure 8) due to the specificity of each device.

In working to maintain and fix opaque objects such as smartphones, we saw here that the "knowledge" produced by repairers is situated and unique in the sense that it has a different epistemic foundation from that of academic institutions or R&D labs from manufacturers.[2] Although repairers are organized as a community of practice that may be seen as close to the networked structure of researchers, they generate novel insights through alternative means. Practices of disassembly, reverse engineering, and trial-and-error exploration conducted in their shops enable them to approximate the ways smartphones are designed, but also provide the means of reworking or re-appropriating them without the approval of their manufacturers. We called this practice of gaining knowledge from dismantling technological objects "Critical Unmaking"; a term that mirrors the notion of "Critical Making" coined by Matt Ratto (2011, 253). We also used the "critical" qualifier in order to highlight that these shops' activities are shaped by a broadly critical stance towards large manufacturers and multinational companies. Facing the restriction they put in place to prevent repairers from helping customers, repair shops' work can indeed be seen as a form of "counter-making," i.e. as working against by manufacturers (Allard 2015, 164). Moreover, these shops also offer a counterpoint to the kinds of R&D producing the widely-hyped innovations that feed the digital economy.[3] Unlike these companies, the technicians working in these places support their customers' efforts to prolong their device's lifespan, and acting as a brake efforts to perpetuate a cycle of regular device upgrades—against the obsolescence pushed by manufacturers.

To conclude, this papier highlights three characteristics of the "knowledge trajectories" and the "politics of maintenance" of smartphone repair shops they enact. Firstly, these operations are constituted in the face of companies that make the functioning of these objects opaque, or that prevent the operations of maintenance/reconstitution/documentation. Secondly, this asymmetry is also caused by the fact that these maintenance operations take place in different contexts that do not always allow for their existence: moments of urgency, disparity in the skills of repairers, or in their ability to abstract themselves from breakdowns and repair operations but also to think about a more global understanding of the devices or the setting up of a shared information system. Finally, the situated knowledge[4] elaborated by these technicians combines practices of knowledge creation with an ethic of care: their goal is not simply to understand how smartphone work and behave, as this knowledge is a step towards helping customers whose phone are

[2] See for instance Knorr Cetina (1999) for an introduction to the plurality of scientific cultures of knowing.
[3] See for instance Pollock and Williams (2010) for a discussion about the role of managing expectations in technological innovation.
[4] This knowledge is situated in the sense that each phone model have its technical specificity, and each repair store a set of tools, knowledge, know-how and spare parts available to deal with the problem at hand.

broken or corrupted. For these three reasons, the knowledge and know-how produced by these repairers is unique and relevant, beyond its context of origin, forming a relevant case of amateur epistemology.

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