Beyond breakdown: two horizons of maintenance work

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Our interest in repair and maintenance practices increased through various fieldworks we conducted together or separately. During an ethnography of bailiff's work and the production of deeds, one of us encountered what legal procedure calls "material mistakes", and eventually discovered that documents recover their operative and juridical performativity through a minute, textual and material, repair work (Pontille, 2009). While studying IT security policies and practices, the other one experienced another side of maintenance, where technological fragility and vulnerability are not hidden but raised as a collective matter of concern (Denis, 2012). Finally, studying the design and standardization the Paris wayfinding system, while we were initially focused on the extremely precise guidelines that define the shape and the emplacement of subway signs, we were struck by the richness of maintenance operations. We discovered that, though normalized and standardized, subway signs need a continuous attention. Along with sharp design, daily monitoring, fixes and renewal are crucial to perform the graphical ordering of the transportation spaces.

Thus, from one study to another, we gradually developed a particular interest for what we call "maintenance work" (Denis & Pontille, 2014), that is the routine work done for things to remain

fully functional day after day. Investigating maintenance work is notably a way to go beyond the major focus of STS on innovation and, most and foremost, it allows to go beyond the inherited Heideggerian opposition between breakdown and standard functioning. Maintenance work is made of repair operations, replacement ones, but also supervision activities, that occur before major breakdowns, being precisely aimed at preventing them.

Following Mol (2008) and Puig de la Bellacasa (2011), we proposed to consider such maintenance work as a care of things (Denis & Pontille, 2015). Indeed, as a care, maintenance takes vulnerability as a ''natural'' state and not as a temporary deviation from a healthy normality. Maintenance workers truly take on material fragility, facing its uncertainties (notably through specific perceptive skills and bodily commitment), instead of denying or relegating it to a secondary, insignificant dimension of the life of objects. Investigating such work is thus a way to tackle the theoretical issue of the vitality of matter (Barad, 2003 ; Ingold, 2007 ; Bennett, 2010) through the practices that daily deal with it.

We would like to seize the opportunity of this workshop to follow up on this idea. Drawing on our own research and on some of the repair and maintenance studies literature, we propose to explore the diversity of maintenance work. To do so, we will examine three main dimensions: the distribution of care, the kind of objects that are enacted through maintenance, and the ecology of visible and invisible at play in the various ways maintenance work is accomplished and organized. We will show that the relationships between these dimensions delineate two main configurations of maintenance work that point toward (at least) two conflicting horizons.

Who cares ?

The very idea of distribution is central in Mol's "logic of care" (Mol, 2008). The fact that patients but also their relatives or the nurses can be part of the process is one of the things that contrasts the logic of care from a "logic of choice" (in which individual patients alone are asked to take the co-responsibility of healthcare) and from the traditional healthcare organizations where physicians are the only ones in charge. When it comes to maintenance work, the degree of distribution of care can be very different from one configuration to another.

The way we experience maintenance daily can be identified as a first horizon. We use things that work, we live on buildings that do not collapse, and we lean on reliable infrastructures. This mundane aspect of our lives is characterized by an important amount of maintenance work which we are mostly not aware of. Numerous people are devoted to the care of the things we rely on: it's their job and we're not supposed to take part in it. In this configuration, maintenance work is the exclusive domain of dedicated occupations that are in charge of the supervision and the repair of specific objects, technologies or infrastructures. This is the case of buildings (Brand, 1994 ; Strebel, 2011) or wayfinding systems (Denis & Pontille, 2015) that come with their army of workers that take care of them. This configuration draws a boundary between workers and users. Through their daily operations, the former perform flawless objects and services that the latter can enjoy without even thinking about maintenance and repair.

If maintenance can be seen as a process of order restoration or preservation, and a constant struggle against disorder, this configuration sets the concerns for vulnerability and disorder apart from the "normal" use. Material fragility and the messy side of things are meant to remain in

maintenance workers perimeter, whilst maintenance work itself is aimed at performing order in users' life.

At the opposite of such a configuration, there are situations where maintenance work is largely distributed. This is for instance the case of IT security that we mentioned above. IT security policies notoriously emphasize the idea that the vulnerability of devices should be everyone's concern, and that every employee should take care of their machines, not only the technicians (Denis, 2012). In a completely different situation, such a configuration is also recognizable in the life of the Zimbabwe Bush Pump studied by de Laet and Mol (2000). Indeed, challenging the focus of STS on closure and stabilization processes, de Laet and Mol, showed that an innovation can be successful thanks to its capacity to be maintained and transformed by its users. A distributed care of things is also what characterizes a lot of practices in urban settings communities. This is what Sánchez Criado, Rodríguez-Giralt and Mencaroni (*forthcoming*) more recently showed about urban infrastructures for disabled persons, or Verhaegh and Van Oost (2012) about the maintenance of a WiFi community installation.

In such situations, material fragility and vulnerability are a shared concern. Everybody is supposed to deal, and partly accept, disorder and decay as features of "normal" life (Mol, 2008). Here, order is performed as an "active verb" (Haraway, 2003), something that takes collective work.

Enacted objects

Objects themselves and their properties take of course a crucial part in these configurations. One of the crucial issues they raise concerns their openness and their capacity to be taken care of (Denis & Pontille, 2015). Some objects can easily be opened and disassembled to be maintained, while others resist such operations. Maintenance work and the care of things are then also a matter of design. This is of course what planned obsolescence is all about: the design of things that instead of being maintained have to be completely changed. But beyond this radical case, a lot of objects are designed, or protected against certain kinds of maintenance work, not only with material restrictions, but also with legal and commercial ones (from intellectual property to guarantees and terms of uses). In this configuration, innovation works mainly against maintenance (Graham & Thrift, 2007). On the contrary, some objects can be designed as open, accepting, even favoring, maintenance operations, may they be accomplished by specialized workers or mundane users.

But maintenance work itself participates in enacting objects in very different manners. In the first configuration we identified, maintenance workers perform stabilized, clearly identifiable objects for the eyes and the hand of the users. This is what we understood following the maintenance workers of the Paris subway wayfinding system, who strive to provide a standardized set of signs always available to riders. The side of subway signs we discovered during our ethnography (some were stolen, broken, worn out…) should not be considered as a counter-example we could have pushed against the standardized ideal version of a normalized coherent wayfinding system made of immutable immobiles. On the contrary, the workers' very ability to spot fragility and flaws allow them to provide to its users sturdy and flawless signboards. It is such an horizon that Domìnguez Rubio described in the Louvre Museum, when he studied how Mona Lisa is preserved as an unchanged object (Domínguez Rubio, 2015). He discovered that the conservation of the painting

goes through the surveillance operations of manifold transformations, both of which are kept invisible for the visitors.

In the opposite configuration, where there are no clear boundaries between maintainers and users, and where everybody takes care of things, stabilization is not considered as the mere condition of objects "normal" mode of existence. Mutations and transformations are commonplace, even when visible to all. Here, in other terms, the criteria that define the "continuity" of an object, its ability to remain "the same", are looser and broader. This is precisely what de Laet and Mol emphasize with the notion of "fluid object" (de Laet & Mol, 2000), and this is what Sánchez Criado, Rodríguez-Giralt and Mencaroni (*forthcoming*) experienced as well, observing the operations of collaborative critical design that transform part of the cities (and in the case of they studied, wheelchairs).

In/visibilities and the boundaries of work

Finally, maintenance work takes part in – and performs – specific ecologies of visible and invisible (Star & Strauss, 1999). Indeed, what we saw about the first configuration clearly implies invisibilisation. Since maintenance is oriented toward the ongoing production of stabilized and functioning objects, it results in the erasure of both work and workers from the picture. Here, all maintenance traces are meant to remain invisible for the sake of objects' visible integrity, or service's continuity. In the second configuration, workers are not only visible to everyone, but they are fully part of the crowd of people potentially participating in maintenance work. Besides, visible traces of maintenance operations are not considered as an issue.

More generally, the visibility and invisibility of maintenance raise the question of the "costs" of a world entirely focused on consumption and innovation, that is on bright and shiny objects (Jackson, 2014). Such a world draws on the erasure of central features in the mundane life of objects, from their day-to-day existence (and the place maintenance work takes in it) to their "death" and their transformation into waste (Gregson & Crang, 2010 ; Gregson, 2011 ; Cállen, *forthcoming*). The second configuration performs a much more open world that takes material vulnerability for granted, refuses to participate in the re-production of the "myth of order" (Graham & Thrift, 2007), and brings maintenance work and maintenance workers to the surface. Moreover, in such a world, the boundaries of work itself are broaden, since everyone is required to play a part in the care of things. Such a world "reframe[s] how we approach material vulnerability, not as something to be avoided, dismissed or 'repaired', but as something to think responsibility" (Cállen & Sánchez Criado, *forthcoming*). This somehow can free us from sociomaterial ordering processes, but it goes not without a cost either. In this world, we are not supposed to blindly rely on sturdy, always available, functioning technologies. Everybody is invited to adopt a both modest and empowered position, where s/he has to participate to the care of people and things.

Conclusion

In any case the configurations we describe here are to be considered as evidences for an exhaustive, sufficient and stable account of what maintenance work is or can be. This paper is simply an occasion to foreground major differences between ways of engaging into maintenance. Surely, a lot of concrete situations oscillate between the two horizons isolated here.

What we think is important about maintenance work, though, is that breakdown is a relational phenomenon and that such relativity reveals itself in very distinct fashions. In the first configuration, where dedicated people take care of objects they cast towards users as stable and disciplined things, maintenance work consists in restricting the number of people who are able to perceive or recognize breakdowns. Here, maintenance is a success as long as objects remain at their place and in a decent condition (that is, mainly unnoticed) in the eyes of their users, even though they are considered as flawed and soon-to-be repaired by specialized workers. As soon as breakdown is a shared and indisputable reality – when phones do not work anymore (Houston), when computers won't start (Jackson, Pompe & Krieshok, 2011), when copier stop to print (Orr, 1996), or urban infrastructures collapse (Graham, 2010) –, it's a whole different affair. Maintenance work then turns into repair work. In the second configuration, for material fragility is a collective concern and maintenance is a distributed practice, there is no such thing as a binary opposition between broken and functioning objects. In the hand of "maintainers/users" objects are always changing, living entities that meet a lot of intermediary states before being considered as inoperative.

A lot of questions remain open after this exploration. We could ask for instance if such a distinction between "maintenance work" (that would occur before collectively acknowledged breakdowns) and "repair work" (that would deal with fully stated breakdowns) stands. We also could investigate whether or not maintenance and repair share the same horizons. Moreover, our attempt to characterize the diversity of maintenance work is an invitation to go further. There are surely other horizons besides the ones we identified, and a lot of other dimensions do obviously play a part in the configurations of maintenance. For example, manifold norms and standards are decisive in defining what is normal and what (or when) is a breakdown. Other norms organize the rhythms of maintenance and designate the actors that are allowed to take care of specific things(Jackson, Pompe & Krieshok, 2012). Of course, these norms may vary dramatically depending the institutions they emanate from, or the domain they concern (Jones & Yarrow, 2013). This is why we think we have a lot to gain in taking the multiplicity of maintenance and repair activities into consideration, notably beyond an univocal and essentialist definition of breakdown.

References

Barad, K. 2003. « Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter », *Signs: Journal of Women in Culture and Society*, vol. 28 (3), p. 801-831.

Bennett, J. 2010. *Vibrant Matter. A Political Ecology of Things.* Durham, Duke University Press.

Brand, S. 1994. *How buildings learn: What happens after they're built.* New York, Viking Penguin.

Cállen, B. *Forthcoming*. « Repairing (electronic) vulnerabilities. Towards an ethics of e-waste. »

Cállen, B. & Sánchez Criado, T. *Forthcoming*. « Vulnerability tests. Matter of 'care for matte' in e-waste practices », *Tecnoscienza*, vol. 6 (2).

Denis, J. 2012. « L'informatique et sa sécurité. Le souci de la fragilité technique », *Réseaux*, vol. 30 (171), p. 161-187.

Denis, J. & Pontille, D. 2014. « Maintenance work and the performativity of urban inscriptions: the case of Paris subway signs », *Environment and Planning D: Society and Space*, vol. 32 (3), p. 404-416.

Denis, J. & Pontille, D. 2015. « Material Ordering and the Care of Things », *Science, Technology, & Human Values*, vol. 40 (3), p. 338-367.

Domínguez Rubio, F. 2015. « On the discrepancy between objects and things », *Journal of Material Culture*.

Graham, S. 2010. « When infrastructures fail », *in Disrupted Cities.* New York, Routledge, p. 1-26.

Graham, S. & Thrift, N. 2007. « Out of Order: Understanding Repair and Maintenance », *Theory, Culture & Society*, vol. 24 (3), p. 1-25.

Gregson, N. 2011. « Performativity, Corporeality and the Politics of Ship Disposal », *Journal of Cultural Economy*, vol. 4 (2), p. 137-156.

Gregson, N. & Crang, M. 2010. « Materiality and waste: inorganic vitality in a networked world », *Environment and Planning A*, vol. 42 (5), p. 1026-1032.

Haraway, D.J. 2003. *The companion species manifesto: Dogs, people, and significant otherness.* Chicago, Prickly Paradigm Press.

Ingold, T. 2007. « Materials against materiality », *Archaeological Dialogues*, vol. 14 (01), p. 1-16.

Jackson, S.J. 2014. « Rethinking Repair », *in* Gillespie T., Boczkowski P.J., & Foot K.A. (eds) *Media Technologies - Essays on Communication, Materiality, and Society.* Cambridge, MIT Press, p. 221-240.

Jackson, S.J., Pompe, A. & Krieshok, G. 2011. « Things Fall Apart: Maintenance, Repair, and Technology for Education Initiatives in Rural Namibia », *Proceedings of the 2011 iConference*, p. 83-90.

Jackson, S.J., Pompe, A. & Krieshok, G. 2012. « Repair Worlds: Maintenance, Repair, and ICT for Development in Rural Namibia », *CSCW'12*.

Jones, S. & Yarrow, T. 2013. « Crafting authenticity: An ethnography of conservation practice », *Journal of Material Culture*, vol. 18 (1), p. 3-26.

de Laet, M. & Mol, A. 2000. « The Zimbabwe Bush Pump: Mechanics of a Fluid Technology », *Social Studies of Science*, vol. 30 (2), p. 225-263.

Mol, A. 2008. *The Logic of Care: Health and the Problem of Patient Choice.* New York, Routledge.

Orr, J.E. 1996. « Talking About Machines: An Ethnography of a Modern Job », *in Collection on Technology and Work.* New York, Cornell University Press.

Pontille, D. 2009. « Écriture et action juridique. Portrait de l'huissier de justice en réparateur », *Semen* (28), p. 15-31.

Puig de la Bellacasa, M. 2011. « Matters of care in technoscience: Assembling neglected things », *Social Studies of Science*, vol. 41 (1), p. 85-106.

Sánchez Criado, T., Rodríguez-Giralt, I. & Mencaroni, A. « Care in the (critical) making. Open prototyping, or the radicalisation of independent-living politics », *ALTER - European Journal od Disability Research*, vol. on line fisrt, p. 1-16.

Star, S.L. & Strauss, A. 1999. « Layers of Silence, Arenas of Voice: The Ecology of Visible and Invisible Work », *Computer Supported Cooperative Work (CSCW)*, vol. 8 (1), p. 9-30.

Strebel, I. 2011. « The living building: towards a geography of maintenance work », *Social & Cultural Geography*, vol. 12 (3), p. 243-262.

Verhaegh, S. & Van Oost, E. 2012. « Who Cares? The Maintenance of a Wi-Fi Community Infrastructure », *in* Egyedi T.K. & Mehos D.C. (eds) *Inverse Infrastructures Disrupting Networks from Below.* Cheltenham, Edward Elgar, p. 141-160.