

"Remaining time: 21 minutes" Ambivalent emancipation by 3D printing

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Abstract. In this article, we offer to examine different current behaviours surrounding 3D printing whilst concentrating on certain practices observed directly in a variety of third places used for fabrication (FabLabs, hackerspaces, etc.). We shall refer to three real cases to examine firstly the types of attention applied to 3D printing and the "default" or "trivial" productions used for their demonstrations or their performances. We suggest referring to these objects printed by default to maintain the spectacle of the machine as *phatic objects*. As formulae prepared in advance they represent a readymade version of the possibilities of personal creation. Then we shall discuss how the question of repairs offers a possible meaning for certain 3D printing practices, before dwelling on the idea of "disengaging" (*débrayage*) which brings us to privilege the notion of "acting" (*conduite*).

Keywords: 3D printing; FabLab; hacker; emancipation; personal digital fabrication; behaviour

1 Introduction

"With this device it is now possible to make a prosthetic limb or a gun at home, based on a three dimensional computer file..." said a voice over on the "Envoyé spécial" report on television channel France 2 on 6 March 2014. Firstly, we are introduced to Chapman, a former IT technician who manufactured his own gun, a 9 mm automatic pistol entirely made out of plastic. Although additive technology has existed for over thirty years, the last few years have been marked by the development and the distribution of 3D printers at prices that are ever more affordable to the general public. Most models can now be built at home for a few hundred euros. As was the case in their time for artificial intelligence or the conquest of space, 3D printing as an incarnation of the latest technical-scientific progress is a force both of assembly and division. With both sides supported by isolated cases and exceptions. As the media oscillates between the two extremes, the domestic production of guns provokes outcry, whilst the printing of low cost made-to-measures prosthetic limbs quickly feeds the most outrageous fantasies, that combine with those of the "emancipation" of consumers by a form of self-manufacturing. As a backdrop to these stories there is often a confusion between the high quality means available to the medical or aeronautic industry in terms of 3D printing and the rather more infantile reality of fused deposition 3D printers that equip FabLabs [5], hackerspaces, makerspaces, and collective workshops— which we might think suffer from the constant repetition of the same type of fantasies, predictions and desires.

3D printing is just one of many options in the range available for personal digital fabrication. Making up part of the same arsenal as laser cutters or numerical milling machines, 3D printing shares with these machines the possibility of creating objects from designs or models produced by a computer. These machines execute the instructions of operators whose practices—or behaviours—have yet to be qualified. These emerging technical situations pose a series of questions: who are those who use these 3D printers? What are they printing? What are the techniques, the gestures or the rituals imposed or offered by these machines?

We offer to establish here a critical description of the *printing methods* or "ways of doing" [3] arising from 3D printing by concentrating on the technical situations that present different levels of emancipation [9], commitment and behaviour. As part of the work for a thesis on personal digital fabrication as practised in FabLabs, hackerspaces and makerspaces, since 2012 we have carried out a large scale field survey at the heart of these workshops. We have paid particular attention to the relationships established between the inhabitants of these places and their machines, observing the logic of developing projects and the reactions or techniques employed to counter unforeseen obstacles—that we shall demonstrate to be an essential occurrence for these moments of production. From Paris to Amsterdam, Barcelona, Rome, Lyngen (Norway), San Francisco, New York, Boston, Tokyo, Kamakura (Japan) to Dakar, we have created a means of observing at the heart of more

than thirty makerspaces (FabLabs, hackerspaces), with the aim of looking beyond the speeches relayed by the media and to constitute an observatory of these places. The analyses developed in this article are based on three real cases from our corpus. Firstly our analysis led us to consider the types of attention applied to 3D printing and the "default" or "trivial" productions [2] used for their demonstrations or their performances. Then we shall discuss how the question of repairs offers a possible meaning for certain 3D printing practices, before dwelling on the idea of "disengaging" (*débrayage*) [7] which brings us to privilege the notion of "acting" (*conduite*).



Fig. 1. A. Image on the left: A group watches a FoldaRap 3D printer, FacLab in Gennevilliers, February 2013

Fig. 1. B. Images on the right: Sculpteo exhibition stand, Maker Faire in Rome, October 2013.

2 Fascination and *phatic objects*

The same scene is repeated every time. The printer is placed on a table, connected to a computer by an enrolled umbilical cord which mixes in with other electronic cables to make up its structure, which is generally left bare. From far away we can already hear a mechanical scanning, a stuttering electronic sound which is interrupted by the same sequence of little organic noises. In the midst of the gurgling and coughing of the machine is the hot plate, a thin metallic sheet on which everyone's attention is fixed. A slender podium to which the image that was displayed on the computer screen a few seconds before will soon be transferred. A plastic component darts across the plate in every direction trailing a slender melted filament which is immediately assimilated by the preceding layers. Scarcely has one layer been laid than another level of the object appears, as something gradually emerges, shapes that cannot be immediately recognised are formed. Of course, everything was programmed in advance! A small box appears: "Remaining time: 21 minutes." There is little movement. Everybody's gaze is transfixed on the minuscule layers formed by the material that is building on the small stage, at the heart of the machine. (Fig. 1. A.) 3D printers employ production by the addition of layers, with no human intervention, but for which the printing process remains long. Time stands still. The demonstration requires your full attention. Observing the printing process itself generally offers a sufficient sense of satisfaction and obtaining an end product almost feels like a bonus.

However you must print *something*. The produce of a machine the purpose of which is really just want to show the fascinated audience that "it works", that it goes, that "it functions". 3D printers in the context of demonstrations and performances produce *empty* objects that multiply: Yoda's heads, vases in psychedelic shapes that are more or less waterproof, unfortunate busts of women, elastic bracelets and other trinkets that serve only as a "pretext" for operating the machines. (Fig. 1. B.) Most of the time these samples are downloaded from the internet. They are sometimes called "crapjects" (a contraction of 'crappy' and 'objects') and are printed to make up for a lack of inspiration when confronted with the concept "we can print anything" that petrifies far more than it liberates. We suggest that these objects created by default be referred to as *phatic objects*. As a ready to use formulae they represent a readymade—or lyophilised?—version of the possibilities of personal production. From the ancient Greek word *phanein*, "to show" the phatic function of language was defined by Roman Jakobson [8] as a declaration of information. In the technical situation imposed by 3D printing then this means, in the context of a demonstration, avoiding silence and maintaining an active contact between the operator and the printer. The *phatic objects* are objects that are printed without any real purpose, a kind of cheat sheet to hide a lack of ideas. (Fig. 2)

The following dialogue that we have had with different people about the same 3D printer during our few months of immersion in the FacLab in Gennevilliers reveals the almost powerless attitude that people feel on their first contact with the machine:

- Is this the first time that you've used a 3D printer?
- Yes, I've never seen this before. It's crazy.
- So, what are you printing? - That: it's a little bendy snake... - Did you make it?
- No, I downloaded it just now. I didn't know what to print, I had to find something!

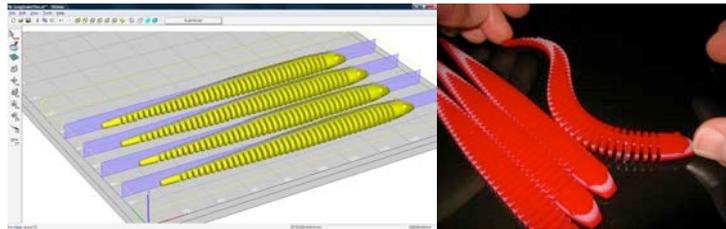


Fig. 2. Little snake downloaded from Thingiverse.

3 Repeating, replicating, repairing

The *phatic objects*, extruded one after another by the 3D printers during the demonstration sessions are the physical proof of the machines' production capacities. During the study of personal digital fabrication carried out in schools by Paulo Blikstein he denounced certain excesses: "Since the machines can produce beautiful objects with very little effort, the teachers should avoid quick demonstration projects and push students in more complex directions." [2] What he calls the "Keychain syndrome" embodies an often occurring mechanism in practices that have developed around digital production machines and 3D printers in particular. Making keychains is often the first discovery session with a laser cutter that he offers in one of his classes. "By the fourth session I realised that something wasn't right. The workshop had become a factory for producing keychains, and students refused to work on other projects," explained Paulo Blikstein. By valuing the product rather than the process, the students simplify all the technical aspects to concentrate on the "trivial" object that they can make independently as it is repeated and supervised.

The distribution of readymade models, that are ready to print, calls into question the emancipation of the amateur by digital technology as valued by Patrice Flichy, as a modest acquisition of skills driven by passion. According to the definition established by Jacques Rancière, emancipation is to be found in a "blurring of the boundary between those who act and those who watch, between individuals and the members of a collective corpus." [9]. As means for denying the real acquisition and transmission of expertise, the distribution and the repeated production and replication of *phatic objects* extends this situation of a spectacle and at the same time encodes this frozen expertise, thus hiding the emptiness that should give rise to new ideas or new aims.

If we accept the distinction made by Pierre-Damien Huyghe between a tool, un *outil* (which is used), an application, un *dispositif* (a closed system) and a machine, un *appareil* (with which we must "deal", that requires some distance) [7], the initial project with a 3D printer must be viewed from another angle. Indeed, when Adrian Bowyer began the RepRap (Rapid Replicator) project in 2005—with an open source 3D printer that was entirely documented online in order to encourage its development by the viral claiming of its plans—he could not have imagined that ten years later this model would have developed a genealogy of different machines based on very specific developments of one particular feature or another. One of the essential principles of RepRap is that each printer can self reproduce, that is to say that the printer can itself print many of the parts that can be used to build another printer, and so on and so forth. The RepRap (and the other generations of 3D printers designed based on its plans) is simultaneously replicable, modifiable, adjustable and repairable. It is in this sense, a machine, to be taken care of and care giving, repairable and repairing. The idea of repairs, that is to say improvement or "care given to", *soin porté à*, is central to the text by Pierre-Damien Huyghe *Plaidoyer pour une technique hospitalisable* [7] [Advocating hospitalisable technology], that works from the principle that "if we accept presupposing that, that which we create may breakdown (and is therefore allowed to do so) and must therefore be designed to be repairable", these behaviours with the technology would reveal our existence by allowing us to

demonstrate it, to test it. These machines that are able to determine active behaviours must be repairable. "It appears to me to be important that we might envisage repairing the world," writes Pierre-Damien Huyghe. There is doubtlessly an element of play here and a form of "DIY" as analysed by Levi-Strauss in *La pensée sauvage*, that is to say a readjustment of the "residues of previous construction and destruction". In this sense the practices that we are studying reveal the "ruses" described by Michel de Certeau [3] that produce without necessarily profiting. In his introduction to *The Practice of Everyday Life*, he describes the "poaching" practised when reading inventions and the re-attributions that introduce a "different world (the reader's) slips into the author's place" and "makes the text habitable, like a rented apartment". From repairs to re-attribution, different manipulations make it possible to work around the passivity often induced by the production of *phatic objects*.

4 Adjustment, disengaging

If our first reflections were principally drawn from *dramaturgical* situations [6]—recurring situations due to their novelty—in situations of more committed uses, we witness several phases of behaviour in 3D printing. After the initial fascination of the first minutes, which generally lasts once the printing has been "launched" follows another sequence, which often goes beyond the patience of novices, but which more experienced users impose on themselves in a more systematic manner. Contrary to traditional 2D printers, into which you feed paper and into which the sheets are taken one by one into the obscurity of a darkroom, someone who is undertaking 3D printing rarely leaves their printer alone. At South End Technology Center in Boston, a small panel indicates this in a direct manner: "*If you are using the 3D printer, you must be at the 3D printer.*". In the FabLabs that we studied, we often noted the same phenomenon: "launching" an impression does not mean sending it very far. On the contrary, the user stays by the machine for several minutes, often even until the object has fully emerged and the shape is completed.

This enthrallment is caused by different factors. Beyond the spectacle of the extruded thread that is laid with precision on the previous layer, the individual who is already familiar with the machine knows that a large part of their role for the remainder of the operations lies in managing random events that may occur, an intrinsic factor to the babbling of the machine. In this specific case, the random event constitutes as much an issue as a source of satisfaction. Foreseeing it being a source of much speculation before each printing. It may arise from an error in the settings from the software, dust on a hot plate or any other kind of unforeseen event. The unforeseen counters the inaction of the operator before the machine and may be of any kind. It requires the intervention and expertise of the operator tasked with balancing and managing the disruptions. In reality therefore, not everything is prepared in advance. In spite of a frequently simplistic view of these technologies that are described as "Plug and Play"—where "you just press on the button and wait"—these machines require a form of translation on the part of those using them. When placed in front of an "open machine", the operator becomes this "permanent organiser, a living interpreter of machines, from one group to the other" as described by Gilbert Simondon [10]. The signs vary: it may for example be an irregularity in the diameter of the thread or a short circuit that causes the printer head to slow down. These margins of error are on the one hand part of the technical situation offered by 3D printers as they are popularised for manufacture in third places. The results are deformations of the model, unforeseen colours, imperfections, differences or accidents that may sometimes go as far as stopping the machine. The distinction that Pierre-Damien Huyghe establishes between "behaving" (*se comporter*) and "acting", (*se conduire*) is illuminating on this subject: "animals behave, men act. [...] We can only really act within the limits of margins for manoeuvre that make it [...] so that everything is not decided in advance." According to him, "if we cannot live without techniques, we can only truly act within these techniques by specific means of disengaging." [7]. Disengaging (*débrayer*), to take the verb in its most mechanical sense comes down to breaking apart, uncoupling, creating a difference in the engine, configured otherwise than by adjustment. This is precisely what the person monitoring the printer must do in seeking out or tracking the breakdown. Unwind the thread to make it looser, assess the diameter of the nozzle, gradually adjust the parameters for the movement of the printer head. In the example of the keychain production described by Paulo Blikstein as referred to above, one might think that by totally avoiding undertaking new projects the students obsessed by mass production are reduced to "behaving", that is to say following the logic of production and profit without any deviation being made. On the contrary, "acting" supposes that the operation of the machine may be open, modifiable, interpretable, repairable, that it may be *disengaged*. This means not systematically following the rules.



Fig. 3. Assembling a 3D FoldaRap printer, FacLab, June 2013

"We had the manual but we threw it away" a young hacker from /tmp/lab in Vitry explained to us during a series of interviews that we did in December 2012. Hacking practices form part of the degrees of disengaging offered by our technologies. In some of the different hackerspaces that we studied (particularly in Noisebridge, San Francisco), the machines are often exposed without housing, grills or protection. Here we saw a refusal of any kind of surveillance of behaviours that is described as an obstacle to accident and free movement. The machines in most hackerspaces (and also in some FabLabs where they are not subject to overly strict safety standards) are often left with their inner workings exposed. Thus giving the operator direct access to the body of the machine, at the slightest unusual noise, thus making them personally involved in the technical activity. The 3D printers such as the RepRap and its descendants are stripped down, left exposed to guarantee and provoke disengaging, development and play. By accentuating the plasticity of the machine that may itself become a subject for experimentation and testing. (Fig. 3) Going against the flow of users who limit themselves to the controls planned for the "actors" by the designers [1] and fighting against the closed subject and the black box, the hackers as they were studied by Sherry Turkle [11], deliberately place themselves in situations "on the edge of catastrophe". Beyond adjustments and playing at disengaging that determine active behaviour, some operators seek to deliberately explore, by putting their printers in difficulty, situations of as yet unexplored technical failures, leading them to push back the limits of their ingenuity.

5 Conclusion

In the introduction to this text we presented a closed situation where the 3D printer, the subject and object of our study, was displayed at a distance to a small crowd of fascinated individuals. Our latter reflections present a machine as an appliance (*un appareil*), that not only inspires an impression created on the audience but also an exploration of the control of areas of uncertainty, driven by the acts of an operational translator of its faults and random occurrences. Over our three periods of reflection, we have taken the level of emancipation from the lowest degree to the point of a technology that is repairable and that can be disengaged. From the production of *phatic objects* stripped of all purpose we have gone to a ground-breaking practice of assembly and disassembly, from replication to adjustment. All these practices or situations mark the first steps towards technical and technological ambivalence of 3D printing as it is being deployed little by little into the hands of the "general public". This may take the form either of a group of disciplined "anonymous" users [3] who are fascinated and entranced, or of individuals transformed into operators, participants in technical situations of their own making.

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