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Should I trust my gut feelings or keep them at a distance? A prospective analysis of point-of-care diagnostics practice

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Abstract Point-of-care devices can be expected to change current medical practices, create new ones and raise crucial questions concerning responsibilities in healthcare. In this paper we explore the issue of point-of-care devices and trust. More specifically, we draw attention on a dimension of ‘trust’ which is closely related to point of care devices, namely the potential tension in future users of emerging point-of-care devices between trusting their experience of a symptom and trusting the technology. We will take a case study approach in which we focus our attention on an emerging case of point-of-care diagnostics: the Nanopil. After introducing this case, we introduce the concept of mediation, as elaborated by Verbeek on the basis of Ihde and Latour’s work. This concept provides a good analytical tool to address the question of how a point of care diagnostics, like the Nanopil, creates new meanings and practices. Our analysis shows how the Nanopil is a hybrid of proximity and detachment from the user. We conclude with some final considerations explaining why this type of analysis of such a close-and-yet-distant relationship with the user is important in the innovation process.

Keywords point-of-care diagnostics, trust, mediation, body, philosophy of technology

Introduction

In the media, technology developers’ discourses and academic research, it is increasingly pointed out that ‘early diagnostics’ is a solution for the problems currently faced by Western healthcare systems of reducing treatment costs (Leifer 2003; Banerjee and Wittenberg 2009; Hogg et al. 2005). By detecting diseases at an early stage of development, therapeutic treatments are expected to be more effective and healthcare costs effectively reduced. Another type of innovation in healthcare that responds to a similar need is telemedicine. By creating a system in which the medical personnel enter peoples’ homes in a virtual way, through the use of online portals, web-based platform and smart sensors, costs of care personnel can be reduced and the efficiency of the system increased (Mosis et al. 2007; Noel et al. 2004; Voight 2012). Interestingly, so-called ‘Point-of-care’ diagnostic tests address the aim of reducing healthcare costs by clustering both expectations of early diagnostics and telemedicine. Commonly defined as ‘the analysis of clinical specimens as close as possible to the patient’¹, these devices allow patients to perform by themselves the test for early screening of health conditions from the comfort of their home.

These innovations can be expected to change the current distribution of roles within healthcare. First, as Gerard de Vries remarks, we are assisting to a change from clinical, complaints-induced medicine to a non-complaints-bund, health risk and prevention-oriented predictive medicine (de Vries 2005). Predictive medicine is based on new knowledge assumptions and intro-

¹ MacGraw-Hill Concise Dictionary of Modern Medicine 2002

duces new practices: sickness and health are redefined here in terms of health risks and the practice is oriented towards prevention rather than cure.

The shift towards predictive medicine includes a reorientation of goals (from cure to prevention), the emergence of a statistical style of medical reasoning and of concepts of health and disease that replace the old dichotomy between health and disease by a continuum, i.e. a new medical epistemology. The shift also includes changes in the relations between doctors and their patients and in the social organization of the healthcare system at large. Medical practice moves to new spaces and involves an array of new actors. Predictive medicine requires co-operation of clinicians with a large number of non-clinical professionals, inside and outside the traditional medical field: epidemiologists, geneticists, but also psychologists, health educators, and social workers [...] Medical action thus moves from consultation-room-based contacts induced by an individual's complaint, to interactions in a complex network of institutions. Individual who may not have asked for this are invited for diagnosis and risk assessment and are addressed by health education's targeted campaigns (de Vries 2005, 159)

Second, point-of-care devices, not only introduce a predictive medicine paradigm in the relationships that people have with their health conditions, they are also used as do-it-yourself, or self-tests. This specific aspect of point-of-care devices also influences healthcare practices. This has been pointed out, for example by Annemarie Mol, who analyzes the case of a monitoring device for blood sugar measurement (Mol 2000). When this device was introduced in the routine of diabetic patients, it did not simply fulfill a function of measuring the level of sugar in the blood, but it created a practice of self-monitoring. This new practice not only implied different actions, behaviors and routines, but also new standards of normality and different relations between a patient and their own body.

Therefore, point of care devices can be expected to change current medical practices, create new ones and raise crucial questions concerning responsibilities in healthcare. Some scholars have pointed out how this shift in responsibilities brought about by innovations in medicine raises questions concerning users trust in this services (Vedder and Vantsiouri 2013). Using the example of remote monitoring and treatment system, as vital sign monitoring for elderly or chronic patients, the authors examine the users' trust (as a pre-condition of acceptance) in these technologies. The dimensions of trust that are analyzed concern the trust in the fact that a system will be in place to protect sensitive data and liability for the misuse or damage caused by the system.

In this paper we will explore the issue of point-of-care devices and trust. More specifically, we will draw attention to a dimension of 'trust' which is closely related to point of care devices, namely the potential tension future users of emerging point-of-care devices may experience between trusting their experience of a symptom and trusting the technology. In order to do this, we will take a case study approach in which we will focus our attention on an emerging case of point-of-care diagnostics: the Nanopil². After introducing the case, we will introduce the concept of mediation, as elaborated by Verbeek on the basis of Ihde and Latour's work. This concept provides a good analytical tool to address the question of how a point of care diagnostics, like the Nanopil, creates new meanings and practices. Our analysis will show how the Nanopil is a hybrid of proximity and detachment from the user. We will conclude with some final considerations explaining why this type

² Since expectations on the 'Nanopil' have mainly circulated in a Dutch context, we will keep the Dutch form 'Nanopil' rather than the English 'Nanopill'. Some English reviews of the project circulate on the web, but they are mainly quotations of press releases from the University of Twente. In the text, we will also refer to the Nanopil with the acronym 'NP'.

of analysis of such a close-and-yet-distant relationship with the user is important in the innovation process.

A case-study of point-of-care diagnostics: the Nanopil

Between 2009 and 2011 in the Netherlands, television, several national newspapers, magazines, and a children's book presented images of the Nanopil (NP). The NP was presented as an ingestible capsule that contains a miniaturized chip that is able to perform an *in vivo* analysis of intestinal fluid, detect the presence of biomarkers for colorectal cancer, and communicate the result to the outside via radiosignalling. Although the development of such a complex pill may appear futuristic, Professor van den Berg remarked at the time that there was already a so-called "Camera pill" (PillCam), which could take pictures of the interior of the gastro-intestinal channel and send these to the outside of the body (2009). Professor Pinedo, the oncologist who conceived of the Nanopil idea, anticipated (in 2009) that in 5 to 10 years doctors would be able to use the pill in hospital settings (Melchior 2009).

Albert van den Berg (2009), professor of Miniaturized Systems for (Bio)Chemical Analysis at the University of Twente (the Netherlands) leads the research group that is currently investigating the feasibility of such a device. As he points out, on the occasion of the annual ceremony commemorating the founding of the University of Twente,

Colonic cancer is one of the most common cancers in people over the age of 50. The Dutch Health Board has already advised endoscopic or colonoscopic screening for people in this age group. But this is a painful and uncomfortable experience. Moreover, it presents a logistical nightmare and nothing is found in 95% of cases. What we need is a simple first-line test. The only alternative at present is a faeces test, but eventually, a nano-pill [sic] will provide a much more patient-friendly alternative.³

Prof van den Berg explains that the available methods for detecting colorectal cancer are painful and expensive, like in the case of endoscopic investigations. When simple screening tests are available, like the Fecal Occult Blood Test (FOBT), they are not user friendly. The FOBT is uncomfortable because it requires the screenee to collect a stool sample and to send it to the laboratory to check for blood traces: this is 'not the best hobby' as the oncologist remarks in an interview, or, as a scientist exclaims, it is 'a medieval practice!'. The NP proposes a 'technological' solution to this discomfort. The promise is therefore to provide the users (both the screenee and the general practitioner) with a means to effectively monitor bowel condition in an easy and comfortable manner. The NP offers a way for people to monitor their health and to detect abnormal statuses at a very early stage since it tests for the molecular causes of cancer and it is a clean, non-medieval, modern way of testing and receiving results.

Albert van den Berg clearly imagines the use of this pill: a population screening program in which, for example, every three years all people aged over 50 are invited to swallow a nanopil. In the event of a positive result, a colon examination will follow. *"I heard from the medical specialists that in this way the number of examinations, surgeries and deaths from colon cancer will decrease sharply. After all, the sooner something is found, the easier it is to treat the tumor."* (Melchior 2009)

The promises of the NP emphasize cost-effectiveness, the increased chance of saving human lives, the increased autonomy of the user, and a decrease in discomfort as valuable expected out-

³ A Pill with a Lab Inside <http://www.azonano.com/news.asp?newsID=15039> Posted December 8th, 2009.

comes of the introduction of the device in the colorectal cancer screening and diagnostic practice. The NP is expected to change the current screening practice by involving the patient in a self-monitoring practice and the medical practitioner in a monitoring system that is computer based and beyond the traditional laboratory or doctor's room. Within this context, how can we expect actors' roles and responsibilities to be altered? How can we expect trust relationships within these practices to be altered by this type of innovation in healthcare? Before addressing the question of how a point-of-care device like the Nanopil can be expected to alter users' roles and responsibilities, we will introduce some conceptual and methodological tools that inspire our approach to the question.

Conceptual tools and methodological remarks

In order to explain how artifacts influence and determine human epistemologies and practices, Peter-Paul Verbeek explores the concept of 'mediation' within the post-phenomenological tradition, drawing on Don Ihde's work (1990). Technologies 'mediate' our relationship with the world by providing a representation of the world that has to be interpreted. The thermometer is a good example of this type of so-called 'hermeneutic' mediation: such a device stands in between the world and our understanding of it. Indeed, when using a thermometer we do not perceive or experience the temperature directly, but we can 'read' it. A more complex example concerns imaging instruments introduced into the obstetrician's room (Verbeek 2011). By allowing parents to see the fetus with greater precision, these technologies alter the way the world presents itself to the future parents. The images of the fetus invite parents to perceive, experience and understand the world in a different way than a non-technologically-mediated perception would allow. These new ways of perceiving and experiencing involve 'opening' up the world in a different way and changing the universe of meaning; for example, by being able to see the fetus and its human resemblance, prospective patients may attach a new meaning to it. Re-articulation of meanings and interpretations of reality also affect the values attached to aspects of that reality. For example, being able to see the human figure in a fetus might influence the importance that parents attribute to it or the moral status that they ascribe to it.

Building on Bruno Latour's and Madeleine Akrich's 'script theory' (Akrich 1992; Latour 1992; Akrich and Latour 1992), Verbeek emphasizes a second type of technological 'mediation' that he refers to as 'pragmatic'. For example, the cumbersome shape and weight of some hotel key-chains encourages the users to return the room key to the reception before leaving the hotel (Akrich and Latour 1992). The key-chain contains a 'program of action' inscribed in it (Latour 1992): a non-written instruction of how it should be used and by whom: "*technical objects define a framework of action together with the actors and the space in which they are supposed to act*" (Akrich 1992: 208). In this space, roles and responsibilities are allocated to actors in a way that re-designs the previous practice. For example, the alarm system integrated in modern cars is activated when the seat belt is not buckled. In this way, the design of modern car invite drivers to wear a seat belts: the respect of the rule of safety on the road is not left to the driver's moral reasoning alone, but it is distributed between the human and the non-human actor. This artifact's design mediates human actions in the world in such a way that some actions will be allowed and others forbidden. In this sense, the artifact prescribes, obliges, permits, prohibits and disciplines users' behavior. This is what Akrich defines as the "moral" content of objects (*ibidem*: 219). The moral connotation of this relation emerges in the delegation of moral actions to the technology.

If the relationships between humans and technologies are so rich, we should reconsider the ‘instrumentalist’ expectations that a new and emerging technology like the Nanopil simply offers a tool for more effective and comfortable screening. These expectations hide a metaphor of linearity according to which technology is a direct means to a(n) (un)desirable end. However, one can expect that, in addition to comprising a tool with which to improve the current state of affairs, these new technologies create *new* meanings and practices in different areas of life (Geels and Smits 2002). In this paper, we take this perspective and we explore the mediating potential of the Nanopil.

In so doing, we will take methodological inspiration by Annemarie Mol’s philosophical narratives or ‘empirical philosophy’ stories (Mol 2000). As she remarks in relation to her work on blood sugar measurement devices, her stories are assembled based on empirical fieldwork (observations, interviews and reviews of professional literature), but they are not told for empirical purposes. Instead of offering a collection of empirical data or patients’ experience for generalization purposes, Mol aims at doing theoretical work of a ‘heuristic’ kind. This means that she uses stories, gathered in concrete times and places, to “*develop or strengthen in their readers the so urgently needed open eye and keen sensitivity for the kinds of effects diagnostic techniques may have when they are put to use*” (Mol 2000, 10).

Telling ‘empirical’ stories about technologies that are still emerging is arduous since the stories will be intrinsically fictional. The Nanopil is not there yet and every story about its role in changing practices cannot be grounded on empirical observations. In the case of emerging objects, we cannot de-scribe the program of action or prescription as we would do in the case of existing objects, like the previously mentioned car and key-chain, by observing the objects, their interactions with users and the intentions of designers⁴. However, as de Laat points out we can reconstruct the ‘fictive script’ of these emerging objects, that is the expected involved actors, their tasks and relationships (de Laat 1996 and 2000). Such reconstruction is based on funding proposals, public oral communications, patents and interviews with actors involved in the development of the emerging technology at stake (scientists/engineers, policy makers, funding institutions, venture capitalists, policy makers, etc).

Therefore, our stories, although based on fieldwork (see Lucivero 2012), are mostly explorations of expectations surrounding the Nanopil and thick illustrations of their ‘fictive scripts’. These explorations aim at ‘thickening’ the discourses about the use of the NP as a tool for more efficient and effective screening by fleshing out the details and concrete practices in which this device is expected to change. In the following, we first tell a story about current screening practices, then, we tell two stories of how the NP, as it is currently conceived, will mediate screening practices. That is, after we have explored current expectations of how responsibilities and tasks will be allocated to the NP user, we will explore the expectations of how the Nanopil-mediated screening practice will alter the users’ perceptions of the world and themselves. These stories lead us to reflect on how emerging point-of-care devices raise new compelling issues related to trust.

⁴ A methodological guidance and examples on how to conduct ‘script analysis’ is sketched in (Akrich 1992).

Nanopil's scripts

The practice of screening

The importance of monitoring oneself is not an emerging practice. In fact, it is quite rooted in our society; the idea that our body manifests some signs that inform us about our health condition is not new to us. Our grandmothers learned it from their mothers and they are still worried when our cheeks look rather pale or when there are white stains on our nails. Our grandmothers also know that if there is blood in their stool matter, there is something wrong going on in their body and they should contact the doctor. The practice of observing abnormal signs appearing on our body involves noticing something that should not be present. This practice can involve routine self-checking and relates to some feeling of repugnance on the realization of signs of decay on our body: we see pimples, blood, cuts, leakages or crusts, we sense bumps or nodes or we feel pain or tingling.

This routine self-checking differs however from systematic and scientifically informed self-monitoring. When women are instructed to palpate their breasts as routine self-monitoring for breast cancer, they are taught how to *look for* eventual nodes. Nodes do not appear on the body; rather women are asked to search for indications that something might be wrong with their health. The presence of blood in the stool, a change in bowel habits, diarrhea, constipation or a feeling that the bowel does not empty completely, abdominal discomfort, smaller stools than usual, and constant fatigue are symptoms of colorectal cancer⁵, symptoms that a GP might ask patients to investigate in a daily practice of self-monitoring.

Tests like the Fecal Occult Blood Test (FOBT) are similar to breast palpation in the sense that the users are asked to interact with their body (or a product of it). However, these tests differ: while the subject of breast palpation can experience the problem herself by sensing a node under her fingertips, the subject of the FOBT does not have direct experience of the problem. Her interaction with her body (or its product) ends with the act of collecting the sample. Subsequently, the responsibility of monitoring is transferred to the lab and eventually to the GP who communicates the result. In this practice of monitoring, the subject is detached from the experience of her health condition.

The Nanopil: Allocating tasks and re-distributing responsibilities

The discourses about the Nanopil are underpinned by a rhetoric of 'comfort', emphasizing the desirability of a test that is acceptable, easy and patient-friendly. By being able to test yourself in the comfort of your own home, whenever you want, and by freeing the user from being dependent on laboratories for results, the NP is expected to fulfill this promise. Furthermore, this device is presented as a clean modern test that saves the user from the unpleasant task of sampling her feces.

In fact, these ideas are inscribed in the NP's design. The miniaturization of the analyzing platform and its integration into a capsule allows the user to ingest it. The manual collection of samples becomes superfluous, since the pill gathers the sample and analyzes it from within. In this sense, the pill takes care of the whole monitoring process. The screenees are left with information on their mobile phones rather than having to involve themselves in an active and unpleasant prac-

⁵ See http://www.testsymptomsathome.com/mtl01_colon_facts.asp.

tice. The screenees do not have to move and touch their body as in breast or testicular cancer self-screening; they are relieved from the task of peering at their skin to map new and abnormal moles; and they do not have to bend over the toilet to collect feces samples. The technology is expected to liberate people from the discomfort of monitoring, the distaste of dealing with their body, and the embarrassment of describing repugnant signs and symptoms to their GP. The pill liberates users from this awkward link with their diseased body.

Indeed, the practice of self-monitoring requires the screenee to perform some tasks. In contrast to the FOBT, the Nanopil does not require the user to interact with her stool matter, to sample it and send it to the lab. However, the user is invited, or even directed to perform other tasks, like ingesting a laxative before taking the pill. This task is inscribed in an artifact, since one of the main conditions for the pill to work is the ingestion of a laxative to clear up the bowel and to allow the pill to traverse it. Moreover, depending on the interface chosen to communicate results to the user, the user is either required to put on a belt and receive a text on her mobile phone or to look at the color of the stool. Such a test requires strong self-discipline and clashes with some standards of well-being and user-friendliness that the user might have.

The Nanopil: Changing meanings and self-perception

The NP also ‘mediates’ in the same way a thermometer would do. Reading off the pill is like reading off a thermometer in the sense that the device tells something about ourselves without resulting in a direct sensation. The idea that the pill will be better than other available screening devices (excluding the colonoscopy) is grounded on the promise of molecular diagnostics. The developments of molecular biology in the last twenty years have shown that the presence of diseases can be best detected at a molecular level long before perceivable symptoms appear (Demidov 2003, Poste 2001).

Such scientific knowledge is mobilized by the Nanopil developers to justify why traditional self-monitoring, such as ‘peering into the toilet’, is not enough to detect early disease stages: there are some phenomena that cannot be observed by the naked-eye. A currently available screening device such as the FOBT detects the presence of blood in the feces that is hidden (‘occult’) to human beings, but visible when a sample of stool matter is analyzed in the lab. The NP brings this observation to a new level of molecular investigation. By detecting molecular markers in the intestinal liquor, the NP seeks a different type of ‘sign’ than the FOBT does. The latter detects the presence of blood in the feces. This could be interpreted as a sign of the presence of a tumor that causes the intestinal walls to bleed. The FOBT provides information about a disease in a stage that might be already advanced. Furthermore, the presence of occult blood in the stool could also be a sign of something else, for example the inflammation of anal veins (hemorrhoids). Finally, the absence of blood does not necessarily indicate the absence of a tumor: indeed, the tumor might be growing but not bleeding.

The NP provides information that differs from that of the FOBT; it provides information about a cancer that does not yet exist, but has the molecular triggering conditions that can lead to its development. In fact, the pill detects an abnormal status before any (visible or occult) symptom occurs. By analyzing the molecular mechanisms that underlie the disease, the pill enables detection of the disease at a much earlier stage, when it is still invisible. In this way, a therapeutic or surgical intervention can take place at an even earlier stage, increasing the chances of survival and reducing health care costs.

In the logic of these expectations and discourses, molecular knowledge is considered to be superior, because it is more accurate than the behavioral knowledge; it offers a means of returning to the subcellular, molecular level⁶, a level that is expected to be more informative. Our visible body is less informative than our invisible cells according to molecular medicine. It contains less information about ourselves, or it gives us information at a stage at which we cannot intervene with the same efficiency. It looks like the pill knows you best, better than you know yourself even.

The Nanopil can be expected to contribute to a change in the way we self-monitor our health, in addition to the way in which we relate to our body. It has an impact on our practices of being ill, being healthy, and being concerned about our health. In this sense, the practice of self-monitoring introduced by the Nanopil affects several dimensions of our beliefs and perceptions on our personal identity and relations to others.

Exploring the scripts: point-of-care devices mediating trust

As in the case of the blood sugar measurer used by diabetic people, also we can expect that the NP will not simply improve a current practice, but will create a new practice. As we showed, the users have to perform some tasks like clearing their bowel with a laxative, wearing a belt to detect the NP signal, having their mobile phone or other receiving device at hand. Within these expectations about the easiness and lack of burden of point-of-care devices, the tasks that have to be performed by the users are neglected. As Nelly Oudshoorn has remarked in the case of telemedicine, the users remain with some 'invisible work' to do (Star 1991; Oudshoorn 2011). With new tasks, new responsibilities also come. For example, adequate performance of the preparatory tasks prior to ingestion of the capsule becomes the user's responsibility rather than the responsibility of the medical personnel or the device itself. Within this new practice, responsibilities are re-distributed among actors and technologies. Indeed the adequacy of the sample collection is a shared responsibility of the pill manufacturer together with the pill user. While the screenee become more autonomous because free to perform the test at any location and time, more responsibilities for the good performance of such a test are allocated to them.

Furthermore, in mediating the screening practice of checking what is wrong with our body, the Nanopil creates some distance with one's body, or rather, it puts the un-hygienic body at distance, at bay. Following Martha Nussbaum's considerations (Nussbaum 2004 and Nussbaum 2010), we can say that there is a 'rhetoric of disgust' promoted by NP developers and inscribed in its design. The NP is expected to free screenees from the burden of interacting with their own diseased body and free them from the unpleasant ('medieval') task of relating with its secretions and abnormalities. As such, this device not only relies on and conveys a very specific idea of the body, but also enacts it. The body conceived in the Nanopil's script is hygienic, a whole entity that does not leak and whose boundaries stop at the skin. As Nussbaum remarks referring to the empirical work of psychologist Paul Rozin, the emotion of disgust '*concerns the borders of the body*' and it is related to the idea of 'contamination': '*the disgusted person feels defiled by the object, thinking that it has somehow entered the self*' (Nussbaum 2010, 14). The primary objects of disgusts are '*feces, blood, semen, urine, nasal discharges, menstrual discharges, corpses, decaying meat*' (ibidem, 15) are reminders of human animality, mortality and decay to which people express aversion. As

⁶ A similar remark is made by Nordmann (2007) on the assumptions behind the idea of efficiency of nanomedicine.

Nussbaum points out, the identification of some actors – and practices, as we would add⁷ – as disgusting implicitly contrasts them with those actors – and practices – that are ‘normal’ or ‘pure’. So, disgust is an emotion that underpins the stigmatization of some actors or practices and classifies them as less valuable and only worthy to be taken at distance. The rhetoric of disgust that characterizes the expectations surrounding the NP stigmatizes the practice of collecting samples of feces and checking for blood in the stool. The bleeding body and its secretions are identified as disgusting and therefore kept at a distance. When it enters into close proximity with the user – it is ingested – the NP simultaneously creates some distance, as the user gets detached from his or her body, or aspects thereof (e.g., feces).

The Nanopil is presented as a more efficient way of self-monitoring that transcends our physical body; in this way, while still burdened by some practical responsibility towards ourselves, we are relieved of what we can refer to as ‘epistemic responsibility’ (Code 1987). We are not responsible for the resulting information regarding our health condition because the device is responsible of the collection, processing, and understanding of information. The screenees’ responsibility lies in following the steps to make the pill work effectively, but they have no responsibility of materially collect and understand the signs in their body. The screenees’ capability of understanding their bodies is in fact undermined by the molecular knowledge provided by the pill. Thus, on one hand, the pill is presented as desirable within a ‘monitoring’ discourse in which health monitoring is presented as a moral responsibility towards ourselves and society at large. On the other hand, trust in the pill builds on a molecular trend that indirectly implies the incompetence of the user to effectively monitor her body.

Within the framework of technical mediation, the notion of trust takes on a renewed meaning. As Asle Kiran and Peter-Paul Verbeek (2010) have argued, trust in relation to technology has generally been conceived as oscillating between reliance and suspicion. One relies upon a technological artifact to achieve a certain task, e.g. the NP to detect the presence of the disease based on molecular information, and thereby trusts the technology, or else, one is wary of the risks the technological artifact generates and distrusts the technology, e.g. the fear of either a dysfunction in the NP that renders the screened information unreliable or the NP’s environmental impact once it is ingested and excreted from the body, into the toilet. Yet, such conceptions of trust are informed by an understanding of technology as being situated in an external relation to humans. In this external relation, technologies are viewed as neutral and transparent instruments used to reach pre-determined (by humans) goals. However, as previously showed, technologies mediate our perceptions and actions. Technologies are not external to human beings, but constitute what it means to be human. That is, as technological artifacts *mediate* our existence, they *constitute* us. Therefore,

[i]nstead of suspicion and reliance, here we encounter a third manifestation of trust, which could be indicated as *confidence*. From this manifestation of trust, human beings deliberately and actively trust themselves to technology. Rather than being risky or useful, technology is approached here as *trustworthy*. ...
[!]t comes down to taking responsibility for the ways in which one’s existence is impacted by technology.
(Kiran and Verbeek 2010: 424).

7

Nussbaum’s argument aims at showing the roots and fallacies of ethical arguments justifying popular stigmatization of some social groups (like homosexuals) and unequal policies towards them. We think that her reflection on the emotion of disgust can also be applied to the stigmatization of some social practices.

In fact, entering into a(n intimate) relation with a technology implies re-configuring oneself. If the NP is ingested and excreted, interacting with the device requires the users to engage in some invisible work. By performing such tasks, the body is put at a distance: users know if something is wrong because the device will show them, however they do not experience, perceive or feel any of that wrongness. As it enters into close proximity with the body, the NP is not a mere instrument screening for molecular makers, but rather mediates and constitutes one's existence. As it puts the body at a distance, or more precisely, puts the fleshy, carnal body at a distance, it enacts a very hygienic body. Proximity and distance fold into one another. Trust is pivotal here. Trust, however, is not a matter of not, or no longer, being suspicious of the technological device and finally relying on it. Rather, as the NP enters into close proximity with one's body, as the relation between oneself and the technology becomes intimate, trust in the NP becomes a matter of 'trusting ourselves to' the technology: *'technologies help to constitute us as subjects, and...we can actively involved in these processes of mediation and subject constitution'* (Kiran and Verbeek 2010, 425). There, as the body becomes intimate with technology and the technology 'enfleshed' (made flesh), trusting oneself to technology implies entering into a renewed relation with one's body, enacting, even, a different body. Trusting the NP is not a one-sided and exclusive relation, however. Trusting oneself to the NP does not mean handing over oneself to the technological device and dismissing or downplaying other 'sources' of trust. Rather, interacting with – and trusting – the technological device can be expected to give new meaning, as well as renewed actuality, to one's gut feelings for instance. Indeed, by getting aware of the mediating role of the NP with respect to our practices of self-monitoring and to the way we conceive of ourselves and of our body, we can become active and get involved in these mediating instances. As the NP promotes a 'rhetoric of disgust' and enacts a hygienic body, we might become ever more sensitive – if only revolted – to our bleeding, secreting, decaying body and come to develop a renewed trust in our gut feelings. In their intimate interaction, the NP and the body constitute each other, and trusting our gut feelings becomes intertwined with trusting ourselves to technology.

Conclusions

As we recomposed the fictive scripts embedded in the Nanopil, we were able to shed light on the mediating role of this point-of-care device. If point-of-care devices are expected to render health care cheaper and more effective through the increasing availability and generalization of early diagnostics, it can also be assumed that they will create new practices, involving new roles and responsibilities. The NP, and point-of-care devices in general, are not mere instruments but rather instances of technological mediation.

By mediating our practices of self-monitoring, these technological devices can be expected to reconfigure the conceptions we have of ourselves. While it is promoted as simplifying self-monitoring, the NP can also be expected to necessitate some invisible work. Furthermore, as it is informed by a rhetoric of disgust, when it enters in close proximity with one embodied self, the point-of-care device enacts a hygienic body while putting the leaking and decaying body at bay. Trust is also reconfigured. Trust is central when using a point-of-care device such as the NP. Trust is nevertheless not merely relying on the device and the information it provides, but rather trusting oneself to it. Point-of-care devices as they mediate our existence also constitute us as embodied subjects. Trusting ourselves to technologies does not mean passively abandoning ourselves to

them but becoming active agents in the ways in which point of care devices reshape ourselves. While trusting oneself to the NP might mean taking distance with one's leaky, fleshy and decaying body and enacting a hygienic body, it might also mean entering into a renewed relation – proximity – with one's 'disgusting' body and trusting one's gut feeling.

These aspects, which are generally neglected in the assessment of point-of-care devices, are pivotal if we are to understand what is at stake with these technologies. These aspects are important in the context of governance of the innovation process. Indeed, this type of reflection can guide technology developers in making design choices. In the case of the NP for example, technology developers are currently debating two alternative ways of conveying the results of the pill's sample analysis outside the human body (Lucivero 2012). Currently NP developers believe that the most effective and efficient design choice is to send the test result by radiosignalling to an external receiver that could also communicate with the screenee's doctor. The NP developers believe that the radiosignalling is a better technical solution than the one initially proposed by the NP inventors, that is the release of a colored dye within the intestine in the case of positive result. In this scenario, if the screenees witnessed colored stool after the ingestion of the pill, they would know that something was wrong and should contact the doctor. Our considerations about the change in the trust relationship between the screenees, their bodies the device and their disease suggest that it is important for the screenee to remain "in touch" with their bodies and to be responsible of understanding symptoms. This brings the dye-coloring solution back to the table for discussion.

When point-of-care devices are introduced, but also when their design changes, new practices and relations of trust come to existence. These are hidden in the current rhetoric and discourses surrounding point of care devices. Yet, identifying them and accounting for them is necessary not only for the successful introduction and use of a technology, but also for the kinds of selves we are to become.

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