

RESEARCH ARTICLE

Beyond checklists: toward an ethical-constructive technology assessment

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While many technology assessments (TAs) formally conducted by TA organizations in Europe and the USA have examined the implications of new technologies for ‘quantifiable risks’ regarding safety, health or the environment, they have largely ignored the ethical implications of those technologies. Recently, ethicists and philosophers have tried to fill this gap by introducing tools for ethical technology assessment (eTA). The predominant approaches in eTA typically rely on a checklist approach, narrowing down the moral assessment of new technologies to evaluating a list of pre-defined ethical issues. In doing so, they often remain external to processes of technology development. In order to connect the ethics of technology more closely with processes of technology development, this paper introduces a set of principles for an ethical-constructive technology assessment approach (eCTA), reflecting on insights developed in the philosophy of technology and Science and Technology Studies, and drawing on examples of telecare technologies. This approach bases itself on an analysis of the implications of technology processes at the micro-level, particularly for human–technology relations. The eCTA approach augments the current approach of the ethics of new and emerging science and technology at the meso- and macro-levels of institutional practices.

Keywords: responsible innovation; technology assessment; ethics of technology; socio-technical integration

1. Introduction

The history of technology assessment (TA) shows a peculiar pattern. Whereas many TA studies, particularly but not exclusively European parliamentary TA, have assessed the implications of new technologies for safety, health or the environment – the so-called ‘quantifiable risks’ – ethical implications have been largely ignored (Palm and Hansson 2006; Boenink, Swierstra, and Stemerding 2010). More recently, ethicists and philosophers have tried to fill this gap by introducing tools for ethical technology assessment (eTA). According to Palm and Hansson (2006, 543), eTA should ‘serve as a tool for identifying adverse effects of new technologies at an early stage of technological development’. This explanation of eTA suggests an approach similar to that of Constructive Technology Assessment (CTA), which emphasizes the importance of assessing and addressing the social implications of new and emerging technologies while the technology is still in the making (Schot and Rip 1996; Schot 1998; Rip and Kulve 2008). CTA, however, also rarely addresses ethical concerns.¹

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Although Palm and Hansson's plea for including ethical implications in TA studies is important and timely, there are three major problems in their approach. First, the method they developed focuses only on assessing adverse effects of new technologies. This restricts TA to evaluating how new technologies put constraints on, or violate, existing norms and values. As a consequence, the ways in which new technologies may open up new forms of morality and co-produce positive norms or identities of future users remain invisible. For example, the introduction of telecare technologies, information and communication technology systems that support virtual contacts between healthcare professionals and patients, opens up new ways of interaction in which healthcare professionals cannot rely on stereotypical assumptions about patient identities, based on gender, age or ethnicity, because they cannot see the patient. The absence of visual cues prevents telecare nurses from making hasty judgments based on visual characteristics, which prevents a discriminatory attitude toward patients (Oudshoorn 2009, 2011, 137). An eTA of telecare technologies that only addresses adverse effects would have neglected these positive implications.

A second problem of the eTA method developed by Palm and Hansson is that it relies on a checklist approach. As other methods currently used, for example, in medical ethics and the formalization of ethics in research practices (Strassnig 2009; Shelley-Egan 2011), the moral assessment of new technologies is narrowed down to evaluating a list of pre-defined ethical issues. These approaches thus reflect a principle-based ethics in which 'established ethical principles are applied to new moral problems as they emerge' (Shelley-Egan 2011, 5). This checklist reinforces a TA method in which the potential ethical implications of new technologies are evaluated according to given, fixed ethical principles and rules. Although this approach may be tempting, because of its transparent way of 'doing ethics' and its efficient reduction of the complexity of assessing the ethical implications of new technologies, it fails to take into account how ethical principles may be affected by new technologies.

Scholars in the field of Science and Technology Studies (STS) have convincingly shown how society co-evolves with technology (Geels 2005). In this view, norms and values are not given, but will be (re)constituted in relation to new technologies, and vice versa. In a similar vein, philosophers have argued that the assessment of ethical implications of new technologies should be based on a co-evolutionary approach to ethics, technology and society (cf. Boenink, Swierstra, and Stermerding 2010; Ferrari 2010; Shelley-Egan 2011). We suggest that this alternative approach to assessing the ethical implications of new technologies is crucial because it enables us to understand how technology, morality and their interaction may evolve over time and how this interaction eventually may change the very foundations of normative judgments (Boenink, Swierstra, and Stermerding 2010; Kiran 2012a).

A third problematic consequence of the checklist approach is that it adopts a rather universal approach, neglecting differences among technologies as well as among users. Consequently, this approach cannot adequately address unforeseen and unanticipated ethical consequences in different local, cultural settings and the diversity with which users appropriate new technologies (Oudshoorn and Pinch 2003; Oudshoorn, Brouns, and van Oost 2005).

In order to emphasize that technologies often enable and constrain ethical reflections, we have chosen to give a strong voice to technology. This choice is not without some concern, as it might raise the impression that we defend some version of technological determinism – which we do not, as we address more explicitly toward the end of the paper. Rather, we argue that for an ethical Constructive Technology Assessment (eCTA), it is important not to smooth over the fact that technologies play a vital part in the constitution of ethical issues, moral subjects and social groups.

This paper aims to contribute to the further development of ethical assessment approaches that go beyond a checklist approach. Reflecting on insights developed in the philosophy of technology and STS and drawing on examples of telecare technologies, we introduce the outline of an

approach that can best be portrayed as eCTA. Its key feature is that ethical implications of technology are analyzed and evaluated in a potentially dynamic way, rather than against a set of unchanging, given ethical principles.

In order to develop this approach, we will first discuss its relation to the ‘soft impacts’ approach, which focuses on the interaction between normative frameworks and technological developments. After this, we will elaborate how a detailed analysis of human–technology relations, and of the processes of subject constitution connected to these relations, can inform an ethics that focuses on *accompanying* technological developments rather than *assessing* them in terms of given normative frameworks.

2. Soft impacts

The moral implications of innovation – that is to say, how the introduction of new technologies affects relations, identities, norms and values – are sometimes referred to as ‘soft impacts’ (van der Burg 2009; Swierstra, Boenink, and Stermerding 2009; Swierstra and te Molder 2012). Although denoting phenomena that often are far from soft in the sense of being easily moldable – norms change slowly and rarely from a deliberate effort to change them – the concept of soft impacts has proven valuable in identifying and emphasizing issues other than those more closely associated with the functional aspects of the technologies. The latter types of issues, which include risks of pollution, of unemployment, of safety and health, are for reasons of contrast called ‘hard impacts’ and differ from soft impacts in having a quantifiable risk of being realized as a result of innovation (van der Burg 2009, 302). Note that also hard impacts concern moral aspects of new technologies and that the ability to quantify hard impacts does not imply that they will always be anticipated or properly taken into account.

The concept of soft impacts is also helpful when considering that taking the user perspective into account does not merely mean ease of learning and user-friendliness (cf. Oudshoorn and Pinch 2003). For example, after having been exposed to an abundance of consumer electronics, many of us expect new technologies to be very user-friendly. While soft impact is about the users, however, it is not about how technologies challenge users’ unwillingness to read manuals. Rather, through soft impact we consider the way in which technologies enable and constrain ways for the users to *be* and to *become*, both directly – through shaping identities and relations – and indirectly – through shaping values and norms.

Usually, soft impacts do not receive much attention when developers map the possible impact a technology will have on a given practice. Typically, they are either viewed as irrelevant or as a private issue (Swierstra and te Molder 2012). Part of the reason for this myopia is that they are more difficult to predict than ‘hard’ impacts. However, since the concept denotes actual changes as mapped by historical, anthropological studies it is more pertinent, not less, to attempt to anticipate this kind of change from innovation. In order to do that, however, we need a different framework and a different methodology than when approaching hard impacts.²

The concept of ‘soft impact’ comprises two different temporal perspectives: short-term and long-term impacts (cf. Boenink, Swierstra, and Stermerding 2010). The short-term impact relates to how new technologies (or new uses of technology) contribute to a re-structuring of norms and relations within a practice or a given context. Most often this happens because a practice needs restructuring in order to accommodate and make use of the functional aspects of the technology. For instance, telecare technology requires the use of telecare centers and a new profession of ‘telenurses’ in order to monitor the condition of patients in a sufficiently careful manner (Oudshoorn 2011, 102–103).

While the soft aspects are usually not the explicit purpose behind implementing new technologies, they nonetheless might develop into the main reasons for resistance to a technology, as

when physicians refuse to use such equipment because it transforms their professional identity (Oudshoorn 2011, 72–75). A telecare center, for instance, requires that the physician delegate part of the responsibility to the centers, thus implying a decrease of professional autonomy. Physicians in these cases resist the newly re-defined professional identity and responsibility that they are expected to accept as result of the implemented technology without resisting the functional aspects of the technology (and their potentially beneficial consequences).

We can also expect a longer-term soft impact, namely, how technologies contribute to changing the *moral landscape*. People's lives are immersed in sets of moral principles and moral routines, many of which are tacit: we communicate, we interact, we carry out our daily lives making many choices that are constrained by these moral routines. Rarely, however, do we think explicitly about our choices and actions in this way. Most of us do not have to deliberately prevent ourselves from hitting a colleague during an argument, or deliberately decide not to shoplift if we are short on money. Under normal circumstances, we do what we do without considering such actions as options at all. Our routines instantiate moral norms in manners that make them seem self-evident.

'Tacit', though, does not mean 'static'. The moral landscape changes all the time: when someone violates tacit moral principles; when the principles are challenged; or when dilemmas occur. One way of challenging these moral principles happens when technologies disturb the existing structure of a practice: 'Emerging technologies, and the accompanying promises and concerns, can rob moral routines of their self-evident invisibility and turn them into topics for discussion, deliberation, modification, reassertion' (Swierstra and Rip 2007, 6). For instance, the availability of telecare technology might induce reflection over what kind of healthcare a society wants. Are we willing to forego personal contact and face-to-face consultations in favor of a more effective but 'colder' type of care? And is the implied (tacit) opposition between 'warm care' and 'cold technology' a valid distinction, or can telecare technology help facilitate other, equally 'warm' forms of care (cf. Pols 2012)? Innovation, however, might also contribute to changing the moral landscape in a still slower and more incremental manner. For instance, it is reasonable to understand the development of the social roles of men and women as being related to the invention of technologies like the washing machine, the contraceptive pill and condoms (Swierstra and Waelbers 2012, 160). However, the ways in which technologies change social roles, and the norms and values connected to them, may have unexpected and unintended consequences. The contraceptive pill, for example, implied a break of sexual behavior from procreation which contributed to a growing acceptance of same-sex relationships (Mol 1997). Moral standards rarely change as a result of ethical deliberation and philosophical discussion; rather they change via incremental behavioral change that is partly due to technological development.

The main idea framing the concept of soft impacts, then, is that technology and morality co-evolve: '[t]echnological developments will not only be promoted or contested in terms of generally accepted moral principles, but may also provoke debates challenging established moral routines' (Stemerding, Swierstra, and Boenink 2010, 1135). The outcome of such challenges will often be changes to the moral landscape and changes to how people perceive moral standards and understand moral norms, both tacitly and explicitly. Co-evolution of technology and morals means that we should not hold on to established ethical frameworks no matter what: In order for the ethical response to new technologies to address real socio-technical development, we must acknowledge that moral frameworks themselves undergo change. Furthermore, this admission should be an integral part of how TA and policies are formed.

To anticipate and assess the possible soft impacts of a technology, then, is difficult for ethicists, scientists, designers and laypeople alike. What is more, there is no established methodology for how to anticipate specific soft impacts in relation to a given technology under development. In

order to factor in soft impacts properly, we believe that an ethics of technology should, first, apply technological mediation (Section 3) as a key concept for describing the human–technology relations and, second, incorporate the existential-ethical perspective of *subject constitution* (sSection 4), which concerns how human beings are shaped by the technologies that inhabit our lives, and have a *moral responsibility* to actively shape their lives in accompaniment with these technologies. People rarely choose the technologies that populate their surroundings, but they can choose (within certain socio-technical, political, legal and other limits) *if* and *how* technologies shall accompany their daily lives. When technologies enter healthcare practices, few (if any) patients have taken part in debates about either its hard or its soft impacts. Nonetheless, patients and healthcare professionals alike have to relate to it even if they oppose or reject the new technology (see Section 4 and 4.3).

3. From technology assessment to technology accompaniment

3.1. Technological mediation

The central idea in the approach of technological mediation is that technologies need to be analyzed as mediators of the relations human beings have with their environment. Rather than locating human beings and technological artifacts in two separate domains – the domains of subjects and objects – this approach considers technology to be a medium for human experiences and practices. Technologies help to shape how human beings perceive and understand the world, and how they act in it; they are mediators of human actions and perceptions (Verbeek 2005). Everyday objects like coin locks in supermarket carts mediate our politeness to return carts to their collection point. Ultrasound imaging helps to shape what an unborn child is for us, just like road design affects people’s driving style. By establishing specific relations between humans and the world, technologies help to shape how the world can be there for human beings, and how human beings can be in the world.

This approach developed out of the ‘postphenomenological’ work of Don Ihde, who has extensively investigated the relations between humans and technologies (Ihde 1983, 1990). Ihde has argued that there are at least four ways in which technologies play a role in the relations between human beings and the world around them. First, there is an ‘embodiment relation’, which gives human beings a sensory relation with the world ‘through’ artifacts. We can not only look at a pair of glasses, but we can also look through it at the world. Second, there is a ‘hermeneutic relation’, in which human beings have to ‘read’ a technology in order to have a relation with the world. A thermometer does not give a sensation of temperature, but rather a representation of it in the form of a number that requires interpretation in order to be meaningful. Third, there is the ‘alterity relation’, in which human beings interact with technologies as if the technology is another subject, for example, when drawing money from an ATM or when communicating with a social robot. Fourth, there is the ‘background relation’, in which technologies play a primarily contextual role. By creating a background for our interactions with the world, technologies can help to shape human perceptions and practices, for example, when the sound of a car urges people to speak loudly (Ihde 1990).

With some contemporary technologies, though, including those in the field of telecare, we can see reason to expand Ihde’s framework. Imagining Ihde’s four human–technology relations as a continuum from embodiment to background, we can add new relations at either of the extremes. First, more ‘intimate’ than embodiment relations are relations in which our bodies actually *merge* with technologies. Pacemakers, brain implants or automatic insulin pumps are examples of this relation, which we can characterize as ‘fusion’. Technologies like these are not ‘used’ in the normal, self-conscious sense; they are linked to our bodies in such a way that the boundaries

between them are blurred (Oudshoorn, forthcoming). At the other extreme, beyond ‘background relations’, there are relations with technologies that can be characterized as ‘immersion’. Here, technologies become *interactive* backgrounds that ‘perceive’ human beings and interact with them in intelligent ways. Examples are smart toilets that automatically analyze people’s feces and urine, smart beds in hospitals that can detect if a patient falls or steps out of his or her bed, smart doors in geriatric hospitals that can decide who is mentally competent to go outside and who – such as an Alzheimer patient – is not.

3.2. *The moral significance of technologies*

This phenomenon of technological mediation has important consequences for the ethics of technology because it helps reveal their full moral significance. First, the concept of mediation makes visible that technologies can have an impact on moral actions and decisions. When medical doctors decide to start or to stop medical treatment of a patient because a magnetic resonance imaging scanner helps them to understand the patient’s physical condition, or when people save energy in their homes because a smart energy meter gives them feedback on their electricity consumption, these decisions are intrinsically technologically mediated: technologies mediate morality (Verbeek 2011).

Second, the phenomenon of technological mediation implies that technologies-in-use have impacts that can themselves be assessed in a moral way. When a telecare device for patients with seriously reduced lung function, known as chronic obstructive pulmonary disease (COPD), advises patients about how much exercise they should take, this device is not only a functional tool to give instructions. The specific way in which it gives these instructions, for instance, has an impact on how patients experience the disease as a part of their lives, and on the degree to which they themselves now become responsible for aspects of medical treatment. Such a telecare technology, therefore, constitutes patient-hood in a specific way and alters patterns of responsibility (Maathuis and Oudshoorn, forthcoming).

This moral significance of technology has important implications for doing ethics of technology. First, it implies that technologies themselves need to be subject to ethical reflection: Not only do the human ways of designing, using and implementing them have a moral character, but the technologies themselves also require ethical work. Second, the fact that technologies are morally significant implies that this ethical work cannot limit itself to *assessing* the moral quality of technologies from an external position. Rather, it should *accompany* the development and implementation of technologies ‘from within’. When technologies help to shape moral frameworks, the moral criteria we deploy for assessment are influenced by these technologies themselves. This implies that TA always needs to be aware of the fact that the criteria it is using are related to the technology it is addressing. At the same time, when it has become clear that technologies themselves are morally significant, moral reflection cannot limit itself to developing a position about the desirability of the technology, but it should also engage with the very design and use of technologies. The character of care changes, but so do the standards by which we assess care. Not only is there no external position, but the criteria themselves are not independent of what they are supposed to assess. The nature of good care develops in interaction with technologies of care.

We therefore articulate our version of ethics of technology as more of a ‘technology accompaniment’ than ‘TA’. Our approach aims to reflect on the moral dimensions of technologies while they are being designed, implemented and used, while taking into account the mediated character of its own frameworks. Rather than aiming toward a ‘yes’ or ‘no’ regarding a technology, the ethical accompaniment aims to develop answers to the question of ‘how’ a technology could get a desirable role in society.

3.3. *Anticipating, evaluating and designing technological mediations*

Verbeek 2011 has distinguished three levels at which technological mediation can play a role. First, the approach of technological mediation can be used as a heuristic tool to *anticipate* the potential mediating effects of the introduction of a new technology. Second, these anticipated mediations can be systematically *evaluated* – where such an evaluation is necessarily an evaluation-from-within, since the frameworks used for it can never be independent from the technologies they evaluate. Third, designers could explicitly *design* mediations ‘into’ the technology-in-development.

In order to anticipate mediations, users, designers and policy-makers can use their imagination, guided by the theory of technological mediation, to develop a realistic idea of the potential influences of a technology that is under design, about to be used or about to be implemented. How might the technology, once used, have an effect on the practices in which its users are involved? And how will it affect people’s experiences and interpretations of the world? Here, techniques of anticipation like scenario development can play an important role (see Dorrestijn, van der Voort, and Verbeek, 2014).

After having identified the potential mediating roles of the technology, these roles can be systematically evaluated in terms of their desirability. In an ethics of accompaniment, such an evaluation of mediations is primarily a practical affair. The central idea is to make insights in the mediating role of a technology available for systematic reflection by users, designers and policy-makers. This reflection can, obviously, be informed by existing ethical theories and frameworks. But the ambition of this reflection is not to give an external assessment of the question if the technology should be allowed or not. Rather, it aims to work toward creative and critical forms of using, redesigning and implementing technologies. By making the anticipated mediations an explicit topic of decision-making, they will not take shape implicitly behind our backs.

This is not to say that mediation theory makes it possible to predict the future or to control the future impact of technology. But it does make it possible to guide one’s imagination in a more robust and systematic way along possible scenarios in order to think through their ethical implications, and to take these into account when designing, implementing and using a technology. Users can evaluate the desirability of the ways in which their lives will take shape when using the technology, and they can begin to develop alternative appropriations of the technology in different use practices. Designers can redesign specific characteristics of the technology in order to avoid or stimulate specific mediations. And policy-makers, for example, in hospitals, can choose to develop specific procedures regarding the application of the technology that take into account any undesirable forms of mediation.

The most radical way to integrate the approach of mediation in the ethics of technology is to aim at the explicit *design* of mediations. Rather than just anticipating and evaluating them, designers can more deliberately shape the impact that technologies can have on the practices and experiences of people using the technology. This step might be controversial for some, because it implies a form of implicit steering of people; it seems to be a form of ‘social engineering’ that leaves little room for democracy and individual freedom because of the asymmetry in power between designers and users (cf. Dorrestijn and Verbeek 2013). In fact, the approach of mediation shows that *any* technology has an impact on people’s actions and perceptions. As soon as we see this fundamentally mediating character of technology, we become responsible for giving these inevitable mediations a desirable shape. What is irresponsible is not the explicit *design* of mediations, but the conscious *neglect* of them. Rather than seeking to realize values of democracy and freedom by avoiding technological mediations, designers should seek to foster them in their design activities.

The central question, then, is how to give mediations a desirable shape in technology design? This question takes us back to anticipating and evaluating mediations. What is needed is a

systematic thinking through and assessment of the various possible forms of mediation in order to make an informed decision. For organizing such a decision-making process we connect to the well-established approach of CTA (Schot and Rip 1996; Schot 1998; Rip and Kulve 2008). By expanding this approach with the internally oriented ethical approach developed above, we arrive at an eCTA approach, which integrates mediation-based ethical reflection in decision-making processes about the social impact of technologies while they are still in development.

4. Subjecting oneself

Technology accompaniment implies subjecting oneself to the behaviors and norms scripted by technology, although temporarily and discerningly so. However, ‘subjecting’ has a double meaning that becomes interesting when we identify the ethically pertinent issues for the eCTA. Living in a technologically permeated life-world means that technologies play a part in shaping us as subjects, as persons. But we are shaped not only upon using technology; technologies also shape us as subjects when they are not being used. Non-use may be temporary but may also include a definite decision not to use a certain technology at all. In both cases we associate ourselves with the mediations shaped by the technologies, either as a person who *can* do specific actions or as a person who *cannot*.

In focusing on the rather theoretical topic of subject constitution, we want to emphasize that some ethical deliberations on concrete technologies (a) concern practices that already have implemented the technologies, and (b) must be performed from within the practices, by the users who might not have had a say in whether or not this concrete technology should be an integral part of the practice. For instance, in healthcare, insurance companies in Europe will often push for ‘the latest’ technologies for safety and treatment regimes to be taken up and used in order to reduce expenses relating to illness and care. The sanction for non-use will be to reduce or cut off the reimbursement, which is often not an option for patients, as alternative treatment can be expensive (if at all available). Technologies thus influence the daily lives of patients whether they want it or not, which is why subject constitution is an ethical process, distributing specific responsibilities to designers, legislators, policy-makers and others. But, as we shall see, it also distributes responsibilities to the users themselves, in planning and carrying out innovation in specific practices. Understanding subject constitution is therefore important in order to understand the human–technology relations that our eCTA approach takes as its point of departure. In other words, in our opinion, assessing technologies needs to be done against a background of how technologies play into the process of subject constitution.

4.1. *The possibility to shape oneself through technology*

As seen above, the concept of technological mediation suggests that humans’ relation to the world is shaped by the technologies. The human–technology relations drawn up by Ihde also imply that humans themselves are co-shaped – in a strong, but not determinist manner – by the technologies they use (1983, 1990). Ihde mainly focuses on how a current technology relation temporarily changes the appearance of humans and the world – by magnifying some aspects of the world while reducing others, and triggering and activating (and passivizing) some bodily resources. However, as one of us has argued, it is also the case that humans are in a shaping relation to a technology when not using it: human understanding and action are shaped by the technological arsenal a person finds in his or her environment, which in turn influences that person’s self-understanding (Kiran 2012b, Forthcoming). A mobile phone in the pocket, airplanes flying to New York City, a mobile heart-rate measuring device and COPD equipment in the home all contribute to how a person is able to plan and execute daily chores and, more importantly, contribute

to define for the person just what kind of person he or she is. Human beings recognize *their possibilities* in the technical possibilities of their surroundings. By relating to, and assessing, the technologies that exist in these surroundings, we recognize what we can achieve, either in a short-term or in the long, in making life-plans.

It therefore can be argued that what a person *is* is not so much what that person has done as what she or he can become (Kiran 2012b). However, no one becomes anything or anyone in a vacuum. In our surroundings, which can be social (other persons) or material (things), we find both that which enables us to become and that which constrains us. We do not always choose whether to be influenced by our surroundings or not. We use the language(s) that we learn growing up; we usually follow norms and customs that we were socialized into. Becoming a person is only possible in relation to those subjects and things that make up our world. This analysis is an existential one that resembles the empirical situation patients find themselves in when living through a disease, especially if they are to do so at home. Becoming a patient often means having to relate to various kinds of diagnostic, treatment and care technologies (not to mention other persons, policies, etc.).

There are different ways of becoming, of being shaped. It might happen passively when we undiscerningly follow norms and customs. Or we can take charge of our lives, and actively shape our own becoming, using the possibilities that we find in the social and material world surrounding us, such as the technological possibilities through which we can *set* and *realize* plans.

These different ways of being shaped by technology turn the existential characteristics of becoming into an ethical one. For instance, new telecare equipment are not just means of communicating with the health care professionals; they shape a patient's identity, his or her experience of being ill, his or her responsibilities and degrees of autonomy (Oudshoorn 2011). This analysis raises a number of relevant ethical questions. What kind of patient does the person want to become? Can the patient actively co-shape this new patient-role, or does she or he have to adapt to the technical scripts? Accepting technological mediation, therefore, does not imply that we should be content with merely letting ourselves become a kind of patient that we do not want to become. In fact, it has been argued that we have a moral obligation to partake actively in this subject constitution. The moral implication of technology accompaniment (next section) includes the option to *not* use the technology (Section 4.3).

In our opinion, the ethical importance here is a twofold responsibility: users have a moral obligation to take an active part in this shaping, and – in a more practical and applicable manner – designers and technology developers have a moral obligation to take into account the shaping impact technologies have on persons. Deliberation on subject constitution is thus important for eCTA.

4.2. *A moral responsibility to shape oneself*

In his work on 'technologies of the self', Foucault (1984, 1988) developed a comparable approach to the human subject. Technologies of the self can be seen as Foucault's answer to his earlier work on power (Foucault 1977). In numerous analyses, Foucault has shown that society is full of invisible powers that have an impact on how we come to live our lives. Ever since the Enlightenment the autonomy of the human subject has been a central theme, but in the meantime we fail to see how we have organized numerous systems of power that actually have a large impact on our autonomy. Many societal arrangements have come to 'normalize' human existence. Courts and jails draw boundaries of criminality, hospitals help to define health and illness, schools set norms of being educated and equipped well enough to have a working life.

While many have read Foucault's work on power as a call for resistance and subversive action (cf. Sawicki 2003), his concept of 'technologies of the self' takes a radically different approach.

Rather than working *against* power, technologies of the self are techniques to constitute one's subjectivity *in interaction with* power. Rather than seeing freedom as the *absence of* 'external' influences, they enact freedom as developing critical and productive *relations to* power. Technologies of the self are the ways in which human beings shape their 'selves' in a creative interaction with the forces that are exerted upon them. In his *History of Sexuality* (1984), Foucault elaborated how any ethical system in fact implies a specific form of moral subjectivity – one in which the moral subject did not remain implicit, but was explicitly at stake in ethical reflection and activity.

Technologies of the self should be seen as techniques of subject constitution: becoming a subject in the active interaction with power. Rather than being a blind 'subjection' to power, subject constitution involves critique and creativity. But this critique has a special character. After all, when power relations cannot be escaped or avoided, there cannot be a place 'outside' these relations from which to criticize them. Subject constitution, therefore, can never start from a given list of norms or requirements, as our normative ideas are related to the powers and mediations that are at work.

This understanding resonates closely with our assertion that the ethics of technology should focus on technology accompaniment rather than TA. If the frameworks by which we judge technologies are themselves technologically mediated, only an approach that acknowledges this fact can be a basis for eCTA. In the context of technological mediation, this attitude implies that users of technologies can develop an awareness of the technological mediations that can come with the technologies they are using, and that they critically and creatively integrate these technologies in their lives, as a deliberate subject constitution.

Such practices of subject constitution – the technologies of the self in a technological culture – are the central element of an ethics of technology accompaniment. This focus on subject constitution in practices of *using* technologies adds a significant dimension to a focus on *policy-making* (van der Burg 2009; Boenink, Swierstra, and Stermerding 2010; Swierstra and te Molder 2012) and to the current focus on *design* in mediation theory (Albrechtslund 2007; Verbeek 2013).

All three activities – designing, embedding and using technologies – help to shape the technologically mediated character of human existence, but in very different ways. In order to address this adequately, we need to include a micro-perspective in ethical reflection. Technology accompaniment encompasses more than policy-making processes; it is about designing people's everyday lives. Therefore, it should also address the critical design and appropriation of technological mediations. Accompanying technology in a critical way implies an engagement not only with the impacts of technology on a societal and political level, but also at the micro-level of human–technology relations and the interaction between the impacts of technologies on human practices and experiences, and the ways in which human beings appropriate these impacts.

4.3. *Subject constitution and non-use*

Shaping oneself in relation to technology is not restricted to the actual users of technologies. What is needed for developing an eCTA approach is to include non-users as well. A focus on non-use is important to avoid a 'pro-innovation bias', a view of technology that suggests that new technologies should be adopted by everybody (Rogers 2003; Wyatt 2003). Openness to non-users creates an awareness of the co-shaping of use, non-use and morality. Technologies that inhabit the daily lives of users shape the lifeworlds even of people who do not use them. The use of mobile phones or social media, for example, contributes to changing the moral landscape of communication by introducing the norm of being available all the time. People who resist this norm often experience pressure by friends, family, colleagues or employers who want to turn them into active users. Addressing these dynamic processes between non-users and users reveals the gradual changes in morality related to new technologies and how existing and emerging norms are enacted and

negotiated in daily life. Taking non-users seriously provides an opportunity to open the black box of tacit moral routines challenged or contested by the introduction of new technologies. A proper framing of eCTA thus requires openness for the co-evolution of technologies, users and non-users, which involves a reshaping of identities, relations and moral norms embedded in daily routines.

We can learn from STS studies on non-use that we should be careful to avoid a conceptualization of non-users solely in terms of negative identities such as ‘have-not’, ‘laggards’ or ‘drop-outs’, a terminology frequently used in policy discourses (Wyatt 2003). Instead of portraying non-use as a deficiency or an irrational, anti-technology act, it is more appropriate and productive to conceptualize non-use as a reflective, significant act (Oudshoorn 2011). For example, in the current healthcare system, non-use of medical technologies reflects an explicit and dedicated choice because people have to resist advice and treatment offered by healthcare providers they otherwise depend on when dealing with issues of health and illness.

The conceptualization of non-use as a reflective act can be linked to the manners in which persons subject themselves to technology. Both users and non-users are shaped by the technologies that inhabit our world, where non-use should be considered as a critical, self-reflective form of subjecting oneself to technology. The eCTA approach developed in this paper argues for an awareness of these two different forms of subject constitution. Most importantly, technologies of the self will be very different when it concerns users or non-users. The act of integrating new technologies in daily life implies a different way of engaging with technologies than the act of avoiding or resisting them. Non-users will have to engage in keeping alive the technologies whose existence may be threatened by the new technologies. This engagement does not only involve maintenance and repair, in case the technology is no longer nourished by its producers (Lindsay 2003), but also the articulation and active defense of moral routines related to the existing technologies.

Equally important, the moral responsibility to shape one’s life in accompaniment with new technologies may be more consequential or problematic when there is no choice for opting out. When healthcare insurance companies decide to reimburse telecare instead of face-to-face healthcare encounters, some patients have to subject themselves to using the technology even when they are not willing to do so. Patients will have to participate in a technology-mediated health-care practice even if they reject the kind of life or morality inscribed in the technology that may result in involuntary use, including selective use. Heart patients who were expected to use a mobile heart-rate device for the diagnosis of their heart-rhythm disturbances did not use it during everyday activities such as work or traveling in public transportation because they were afraid that the beeps would make their heart problems audible to others. These patients did not subject themselves to the norms and behavior inscribed in this technology but invented creative workarounds in order to domesticate the new technology (Oudshoorn 2011). As with non-users, technologies of self are thus very different when it concerns involuntary or selective use.

In this respect, the most radical form of subject constitution may be found among (selective) users who tinker with technologies to make them their own. According to Akrich and Latour (1992), people rarely follow the actions and responsibilities inscribed in technology but rather modify, negotiate and bypass these scripts (cf. Akrich 1992; Oudshoorn and Pinch 2003). Subject constitution may even involve creativity that leads to new technologies made by users themselves (van Oost, Verhaegh, and Oudshoorn 2009). At the other end of the spectrum, however, we find people who are not able to take responsibility for engaging with technologies because they are excluded by design because of physical incapability. Beeping sounds of telecare devices, designed as feedback signals to its users, exclude elderly people with hearing deficiencies because they cannot hear the beeps (Oudshoorn 2011).

5. Concluding remarks: toward an ethical CTA

Summarizing, the eCTA approach developed in this paper includes four principles:

First, technologies not only have implications for moral frameworks and social processes at the macro-level, but also for the everyday lives of their users. This micro-perspective on technologies-in-use is needed to assess how technologies mediate human–world relations, including moral routines and practices. eCTA studies should include a systematic thinking through and assessment of the various possible forms of mediation in order to make an informed decision about desirable futures of new technologies.

Second, eCTA should be framed in terms of technology accompaniment rather than assessment. This change in conceptualization is important because we can never step out of the mediations that shape our moral frameworks. Consequently, eCTA should start ‘from within’, that is, addressing ethics of technology while they are being developed, implemented and used.

Third, eCTA should focus on the accompaniment of both the design and the appropriation of technological mediations. This accompaniment should be done in such a way that design practices incorporate openness to situatedness, alternative lifeworlds and changing moral routines.

Fourth, eCTA should address practices of subject constitution, not only in terms of how human beings are shaped by technologies but also in terms of the moral responsibility persons have to actively shape their lives in accompaniment with these new technologies. More specifically, eCTA should aim to make visible how this moral responsibility is enacted in daily life, taking into account the different forms of subject constitution, including use, non-use and selective use. These insights can be used as input in eCTA workshops in order to create bridging events between designers, users and non-users.

Although the eCTA approach is primarily an attempt at discerning moral issues that can be put to use in CTA, it can also prove its value as a framework for other, non-participatory methodologies that aim to come to grips with ethical issues in innovation. The key concepts ‘technological mediation’, ‘subject constitution’, ‘accompaniment’ and ‘non-use’ all contribute to disclose the dynamics in the co-evolution of technology, society and ethics. For that reason, our eCTA approach will also be useful as a framework to ensure a cohesive and balanced perspective for such recent methodologies in the ethics of technology as midstream modulation (Fisher, Mahajan, and Mitcham 2006), ethical parallel research (Zwart et al. 2006), embedded ethical research (van der Burg 2006) as well as for multidisciplinary projects in the responsible innovation or ethical, legal and social aspects of new technologies.

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Notes

1. Although conceptual frameworks developed in CTA may allow for addressing ethical issues CTA practitioners rarely mention ethics. See Shelley-Egan (2011) for a notable exception.
2. An important perspective that focuses on anticipation is the anticipatory governance approach (Barben et al. 2007; Guston 2014). This approach has been developed to study how different lay and expert stakeholders anticipate, critique and shape possible societal impacts of emerging technologies. Although soft impacts are taken into account, the anticipatory governance approach primarily addresses the dynamics of knowledge production of emerging technologies with a specific focus on possibilities for learning and interaction between experts, policy-makers and other publics. In this paper we

develop a different perspective that is primarily concerned with how new and emerging technologies shape people's lives rather than the governance of knowledge production.

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