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VALUING HEALTH TECHNOLOGY –
NEW VALUE SPACES FOR PERSONAL
HEALTH SYSTEMS TO SUPPORT ACTIVE
AGEING

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Valuing Health Technology

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Abstract

In this paper, we strive to unravel in how far current practices of Health Technology Assessment (HTA) are suitable to guide health policy decisions about personal health systems (PHS). We focus on the implicit representations of users and their position in the innovation process that underly established HTA practices, and explore in how far these representations are conducive to health technology decisions that support older people in meaningful and active lives. Our analysis builds on Callon’s recent distinction between prosthetic and habilitation social policies [M. Callon, Economic Markets and the Rise of Interactive Agencements: From Prosthetic Agencies to Habilitated Agencies, in: T. Pinch, R. Swedberg (Eds.), Living in a Material World: Economic Sociology Meets Science and Technology Studies, The MIT Press, Cambridge, 2008, pp. 29-56]. We revisit the results of two case studies that we conducted in the fields of Point-of-Care Diagnostics, set in the domains of primary and secondary care, and care robot service platforms operating in domestic environments. By contrasting these cases we demonstrate how a different logic of addressing values in innovation feeds into either prosthetic or habilitation policy decisions about health technology. Based on this analysis, we argue that HTA practices in the context of PHS need to incorporate a logic of valuing health technology in order to fully deliver the potential of PHS to the lives of older persons.

Keywords:

Innovation; health technology; ageing; user representation; care robots; HTA
1. Introduction

Demographic ageing is one of the drivers behind the trend towards more personalized health systems. Indeed, it is common reasoning that demographic ageing leads to increasing costs of health and care systems, and that new technology can help mitigate such cost increases [1]. Against this background, Information and Communication Technology (ICT) is seen to have the potential to provide distributed services, devices and systems to support the treatment, prevention and self-management of diseases and chronic conditions. Patients are expected to become increasingly involved in self-managing their health status by pursuing healthier lifestyles, by actively monitoring a diverse range of health parameters using emerging personal health platforms [2], and by maintaining contact and sharing health data with doctors and care givers through a common and distributed ICT infrastructure [3]. This development towards personal health systems (PHS) implies that health technology increasingly cuts across the domains of hospitals, care organizations, private service providers, product developers in health and non-health related sectors, and domestic environments [4,5]. Health innovation is therefore on the move from the professional medical environments of primary and secondary care into more mundane segments of society. Most importantly, PHS will operate in the domestic lives of their end-users [6], where they meet and blend with other more mundane technologies and the everyday practices people [7]. We thus see an increasing relevance of health technology in larger soci-technical systems involving health, quasi-health and everyday functions. Older persons are likely to be at the vanguard of this development as users of domestic technological environments that blend health and care related functions with entertainment, fun, communication and other more traditional household technologies [8].

In this paper, we strive to unravel in how far current practices of Health Technology Assessment (HTA) are suitable to guide health policy decisions about PHS innovations. To do so, we focus on the representations of users and their position in the innovation process
that underlies established HTA practices. We explore in how far these representations are conducive to health technology decisions that support older people in meaningful and active lives. Our analysis builds on Callon’s recent distinction between prosthetic and habilitation social policies [9], where he analyzes how policy decisions create socio-technical assemblages that impute certain types of agency on individuals. Using insights from disability studies, Callon distinguishes between social policies that produce disciplined agency where individuals are empowered to follow pre-configured scripts for individual action (prosthetic policies), and habilitation policies that produce interactive individual agency where individuals are empowered to explore and develop their needs and preferences.

We take Callon’s distinction into the domain of health technology assessment, and explore the kind of agency these practices implicitly ascribe to the various kind users of health technology. We demonstrate, both theoretically and empirically, that the established practices of HTA, and the related assumption that technology interventions should be evidence base [10], implicitly proceed on a prosthetic logic; as such HTA is likely to favor health technology that creates passive and inept technology users. In the context of PHS, this is problematic in so far as standard procedures of HTA are likely to carry this imagery into the homes of older persons, where they might contribute to create older technology users that fit existing ageist stereotypes. Against this background, we claim that an alternative approach is needed—a habilitation form of HTA—in order to let pro-active older technology users thrive, and give them a voice in defining the future of independently living with technology at home.

In a nutshell, this paper develops the hypothesis that established HTA practice is likely to favor prosthetic interventions over habilitation interventions. This is potentially problematic in the lives of older persons, as prosthetic interventions are likely to feed into socio-technical assemblages that impute only limited agency on technology users. We base our argument on existing literature on HTA, where values to be addressed by health technology are a central concern [11] (Section 2). Using our own empirical examples on the design of health
technology, we extend the analysis of values to the analysis of the position of values in the innovation process (Section 3). Tentatively, we explore the notion of value spaces—joint niches in which values become articulated and evolve. We contrast the value spaces in two empirical cases of health innovation—Point-of-Care Diagnostics (POC) set in the more traditional environments of primary and secondary care, and PHS service robot platforms meant to operate in domestic environments. In the concluding Section 4 we argue that, in order to arrive at habilitation health policy, the idea of a value space independent of the emerging health technology needs to be complemented by procedures that acknowledge both technical objects and their users as agents in creating the emerging value space.

2. HTA and the Value of Health Technology

Since mid 1980s, healthcare systems in the Western world are adjusting to different kinds of new health technologies [11,12]. Like pharmaceutical innovation, health innovation takes place in highly regulated markets and sectors, and for health policy it is thus important to being able to assess the value of health technologies. The increasing importance of health innovation, therefore, has been accompanied by various ideas how to assess more rationally its value. By and large, these ideas have resulted into what has become known as Health Technology Assessment (HTA)—the conviction that health policy decisions should be based on “the ‘best available evidence’ on the costs, efficacy, and safety of health technology” [13: 1083]. This is not the place to discuss and review the prolific amount of approaches and studies dealing with HTA (but see for example [11,14,15]), and health innovation more generally (see for example [12]). We are interested in two particular aspects that seem to be characteristic of ongoing HTA discussions:

(1) HTA revolves around the idea that health policy decisions should be based on “facts” [16] to evaluate the value of a particular health innovation. According to Lehoux, HTA is as a scientific and policy movement operating in the manner of ‘regulatory science’ [17]
and seeking to foster the institutionalization of knowledge-based changes in healthcare systems, and the relevance of adopting and using technologies proven to be effective, safe and economical [11: 1]. Although HTA approaches should be broad in principle, most actual approaches are grounded in epidemiology and health economics, thus focusing on the treatment value for patients and the often substantial costs of adopting new health technologies [11]. Standard HTA procedures can be seen as a cost-benefit analysis that tries to assess the value of a new technology in terms of costs per health benefit. However, the wider ethical and social values, although considerably sidelined, have been part of the HTA literature since its inception as well [15,18]. But only recently, discussions have more decidedly focused on the value of technology beyond the logic of cost-benefit analyses. Such discussions have tried to unravel how social and ethical values can be addresse in HTA procedures [19-21], and how they are addressed by different stakeholders [22-25]. The scope of values to be included and addressed in HTA exercises is principally infinite, and a prolific body of literature has proposed a variety of procedures to deal with this issue worldwide [see 26] and widening the knowledge base of HTA [27]. Less attention, however, has been given to the position of these values in relation to emerging technologies, i.e. the way in which they influence policy decisions regarding health technology.

(2) In this latter regard, the emergence of HTA has been closely connected with the evidence-based medicine (EBM) movement [28]. Although EBM is much narrower in focus—it deals with assessing the clinical effectiveness of medical interventions—its basic tenet that interventions should be based on sound evidence has been central in defining the HTA field [29]. More specifically, EBM carried as very specific idea about what constitutes sound evidence into HTA procedures. Indeed, randomized controlled trials as well as systematic reviews of existing evidence are seen as the gold standard for proving the value of an intervention in EBM, whereas anecdotal evidence from case
studies and practice are regarded as much less reliable [30,31]. In this sense, EBM is strongly associated with an empiricist and positivist epistemological position [32,33], and the art of compiling systematic reviews and meta-analyses have become the stronghold of procedural and methodological debates [10]. This position is subject to ongoing disputes within both the medical profession itself¹ and critical analyses from science studies (e.g.[35,28]). Nevertheless, the basic ideas of EBM have quickly gained currency among health policy makers due to their putative ability to provide an unambiguous basis for decisions about health interventions [32,36]. Indeed, HTA has been quick in borrowing from EBM the basic logic that decisions about health technology should be based on a sound understanding of the costs per quality-adjusted life years (QALYs) [35]. This has two effects that permeate established HTA practice: it describes a rigid scheme of what counts as evidence (i.e. ideally insights about a clear-cut medical effect and its costs based on the results of randomized controlled trials compiled in a systematic review), and it describes how this evidence should be included in policy decisions (i.e. as “facts” established before the technology is adopted or rejected). It is this logic of assessing the value of health technology that interests us most in this paper, because it implicitly ascribes certain positions to users, policy makers, and technologist in defining and assessing value.

Hence, what transpires from this discussion is not so much that the value of health innovation is too narrowly defined in the practices of HTA². Rather, it becomes apparent that HTA both describes a range of knowledge, in terms of values, to inform decision makers, and a relation of this knowledge to decisions about emerging health technologies. The latter narrowly frames knowledge about the value of a specific health technology as an input that can be assessed before this technology is put to use. The HTA field inherited this stance from

¹ The satirical pamphlet of the Clinicians for the Restoration of Clinical Practice Writing Group, published in the British Medical Journal [34], gives an enjoyable overview of this controversy.

² Of course, in many HTA exercises the value of technology is defined too narrowly. But this is not our main concern here because other social science analyses of HTA have extensively stressed this before (e.g. [27]).
its origins in medical practices [37], where health innovations meet their users as patients. The question is whether this basic position can fruitfully inform the assessment PHS that meet their users as citizens and consumers in domestic environments. From an STS perspective, this question translates into the problem of what kind of agency current HTA practices impute on different stakeholders in the health innovation, and on future end-users in particular [38]. When older persons are likely to be at the vanguard of adopting and domesticating PHS, then the standard HTA logic as elaborated above raises critical questions as to their position vis-à-vis health innovations: Is current HTA likely to favor policy decisions in favor of technologies that allow older persons to thrive as citizens and consumers that are able to self-manage their lifestyles and health status? Or will they foster technology that propels a negative imagery that associates older persons technological incompetence and fear?

Callon has recently proposed a distinction between prosthetic and habilitation social policy [9]. Using Barry’s [39] work on technology policy, which highlights how technology policy feeds into socio-technical assemblages that configure certain distributions and types of individual agency, Callon argues that modern network societies presuppose interactive individual agency. Essentially, interactive individual agency describes an individual’s capacity to self-manage his or her needs and lifestyles, and to develop them through the planning and execution of projects. Using the metaphor of disabled persons, Callon takes these ideas into the field of social policy. A key task for policy making, he argues, is to compensate “for maladjustments encountered by individuals in their professional and private lives” to “the mold of the Western neo-liberal subject” [9: 46]. He defines prosthetic social policies as measures that produce disciplined agencies where individuals are empowered to follow pre-configured scripts for individual action. Habilitation social policies, by contrast, are those measures that include individuals in the creation and exploration of scripts for individual action, and thus empower them to contribute to the evolving mold of the neo-liberal subject itself.
In the remainder of this paper, we use our own empirical work to demonstrate that HTA practices, both broadly and narrowly defined, are likely to produce prosthetic technological interventions as defined by Callon. Using an analysis of policy debates about the value of Point-of-Care Diagnostics (POD), we illustrate how the established logic of HTA indeed tends to impute passive, pre-scribed agency to the divers users of health technology. We then use a case study on two design research projects dealing with PHS robots in the domestic sphere, as well as common insights from innovation studies, to show how designers of PHS address end-users. We argue that values we identified in these design processes more closely resemble Callon’s idea of habilitation, but also bear considerable tension with the logic of HTA. We then conclude that this logic is flawed as a logic of innovation because it hampers experimentation and learning; it is particularly flawed as a logic of consumer innovation, as it misconceives the position of technology users and their needs in innovation processes. Finally, we use these insights to outline advice for HTA practices that might better fit the conditions of PHS, give rise to habilitation interventions, and contribute to configure older technology users as pro-active consumers able to fully participate in modern network economies. We also use these insights to ponder a more balanced and positive interpretation of older persons as consumers that frees them from the burden of being framed as patients rather than consumers or citizens in policy decisions about health innovations.

3. Comparing prosthesis and habilitation: the value spaces of POC diagnostics and PHS robots

In this section, we revisit two case studies that we have conducted on Point-of-Care (POC) Diagnostics and service robot platforms in PHS, respectively. We use our empirical material to elaborate how practitioners of innovation look at the values that they deem important with respect to “their” technologies. The POC case is set in the professional medical environments of primary and secondary care, whereas the service robots are designed to operate in domestic
environments. By comparing these two cases, we strive to understand how these settings vary in terms of how the value of technology is discussed in relation to the adoption and use of these technologies. That is, we elaborate how the logic of valuing the respective technologies differs between professional medial and domestic environments for health technology.

3.1. Values in Point-of-Care Diagnostics

Point-of-Care (POC) diagnostics are those analytical testing activities that take place near or at the site of patient care, outside clinical laboratories. These new diagnostic devices are often based on biosensors and deliver fast results, are small and handheld, and enable data management and communication with a larger ICT infrastructure; they are also sometimes referred to as ‘labs-on-a-chip’ because they make the laboratory step in the diagnostic process unnecessary [41]. In what follows, we briefly present the results of a case study that we conducted about POC devices, and focus on the added value practitioners in primary and secondary care discuss in relation with POC. We also explore how these values are seen in relation to the users of POC devices. We first provide a brief overview of POC technology and then explore how values of POC technologies are discussed in these settings.

Point-of-Care diagnostics technology could lead to new healthcare services as preventive care, personalized medicines, and active health risk monitoring, and is thus seen to have a considerable potential to decrease the costs of health care [43]. Various applications for POC diagnostics exist or are in development, for example for Acute Coronary Syndrome (ACS), or for Prostate Cancer Screening, especially for ageing men. These technologies answer a need to both reduce the costs of health care and to provide more patient centered care, where the diagnosis takes place at the patient’s bedside in hospitals or in the General Practitioner’s

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3 A biosensor is a diagnostic device that couples a recognition element with a transducer and converts the recognition into an electric signal [40].

4 For this study, the technical, medical and clinical literature review articles on Point-of-Care diagnostics and biosensor technology were reviewed to explore its role in primary and secondary patient care. Moreover, 11 interviews with representatives of the main organizations in the Dutch health care system were interviewed, including medical specialists, scientists, business developers, health policy actor, coordinator secondary patient care, health insurance, and General Practitioners. What we present here is an excerpt of our study tailored to the objectives of this paper. The original study is available as [42].
(GP’s) office rather than in central laboratories. Indeed, central testing requires the collection of samples, logistics, communication of research results, and so forth. Against this background, POC devices have a potential to facilitate quicker, more complex and more precise testing thus enabling more effective treatment at lower costs [44,45].

At present, the main diagnostic application areas for POC diagnostic devices are professional medical care settings such as primary care and secondary care (although in the future home care setting are likely to be important, too). The technology is expected to develop differently in these two settings. Primary care is delivered by general practitioners, dentists, pharmacists etc. and is the first contact point for patients. POC diagnostics are expected to play an important role in GPs’ offices and health management centers, where they help support different disciplines such as physiotherapy, general medicine, dentistry, and lifestyle advice thus aiming at more patient centered care. Although GPs would have to acquire additional and sometimes expensive diagnostic devices, the general expectation is that these additional will pay off because POC diagnostics can provide immediate results thus making a second visit to the GP unnecessary.

Another dimension of POC innovation is its clinical impact and the effects of POC tests on the (post)diagnostic care pathway (medical and non-medical) [46,47]. Some researchers expect that diagnostic testing will be largely decentralized due to POC, supported by IT developments, electronic patient records (EPR system), flexibility in diagnostic sales channels etc. Others expect the health system to slowly restructure around alternative care pathways or health value chains [48]. In both scenarios the role of the GP or health managers will become more important, although POC diagnostics at GPs’ offices is still in its infancy. The most important developments regarding quality, connectivity and regulatory standardization are expected to take place in secondary care settings such as hospitals [46].

Secondary care is acute care, e.g. emergency or specialist care, such as planned specialist medical care or surgery. In secondary care most diagnostic tests still take place in central
hospital laboratory, which is often optimized to deliver very quick results, with smart logistic systems. The value of POC tests is increasingly recognized in secondary care, where it is used for the detection of heart problems, or anticoagulation factors for example [49]. POC diagnostics in hospital settings enable a faster diagnoses and stabilization in emergency situations, and enable immediate risk assessment. Regarding its potential value in secondary care, POC diagnostics can increase the capacity of emergency rooms. Moreover, because it can be performed by staff without specialist medical training, it can save the expensive time of specialists [49]. Also in secondary care the most immediate value of POC diagnostics is seen to reduce costs while at the same time improve the quality of patient care. The latter, in turn, is evaluated against the background of existing standard protocol that closely define rules and guidelines for what adequate medical and diagnostic treatment is. The value of POC diagnostics is preponderantly discussed in terms of its cost saving potential, and its capacity to improve diagnosis and treatment along pre-defined standards of good medicine. The secondary care environment is perceived to be the setting in which important steps in the implementation of POC take place before it will trickle out to primary care settings.

This brief analysis demonstrates how the value of health innovation is framed in the professional medical settings such as primary and secondary care. POC diagnostics is widely perceived to provide added value in these setting, but also that this value is in a particular way in policy debates and by practitioners. What we found are values like analytical accuracy (validity and reliability proven by means of medical scientific results), diagnostic accuracy (value of diagnostic test is the difference in health outcome resulting from the test), clinical utility (health related outcome of test-plus-treatment-strategy), cost effectiveness (total costs of test-plus-treatment-strategy and (unwanted) side-effects), and indirect utility (such as non-health related (efficiency) impact on procedures, routines, social behavioral impacts and lifestyle). However, the most important implementation path perceived in the field would initiate in secondary care, where important evidence could be collected in relatively confined
organizational setting. Indeed, the primary care setting, with its comparably high distribution of actors and activities, was perceived to be too messy to collect the necessary evidence in a clinically meaningful way.

While it is not our intention to make a judgment whether this perception is an accurate depiction of the future, it does highlight how medical professionals and policy makers frame the value of POC diagnostics and its position vis-à-vis the implementation and innovation of POC devices. Indeed, the focus on secondary care indicates the importance of collecting best available evidence from valid and practically relevant scientific research before a decision is made by clinical guideline developers to take up a new diagnostic tool and thus make it accessible to larger patient groups. This logic fits well the models of established HTA procedures, as it highlights costs and effects (in different shadings) as the most relevant values of POC diagnostics. What emerges from this focus on the secondary care setting is a logic of addressing value that revolves around compiling high quality evidence according to the established hierarchy of EBM. The values to be addressed, therefore, are regarded to be more or less pre-given, while the collection of evidence is delegated to experts and specialists. Although some of these specialists, most importantly doctors, are also users of the technology, their role is largely confined to probing into the value of the device along pre-figured dimensions. Other, less specialized users like nurses or patients are not perceived to be central actors in this process. The value space that emerges from these analyses, therefore, resembles what Callon has suggested to be a prosthetic logic: the POC devices should be optimized in such a way as to deliver the best value within the pre-defined mold of existing clinical standards. The exploration of new values, as subsumed above under the label of indirect utility, is considered to be ancillary to cost effectiveness and clinical impact. This demonstrates how in professional medical settings the performance of a new technology has to prove its effects on established values, before its wider impact can be explored and
manifest. As a side effect this logic imputes only limited agency on both the emerging devices and most of its users.

3.2. Values in the design of PHS service robot platforms

At present, personal health systems (PHS) are an emerging topic that is discussed mostly in terms of its possibilities for the future [5]. One of the more tangible PHS technologies that receives dedicated attention by design and technology researchers is robotics for health and care [4]. Indeed, care robots are both a hotly debated topic in relation to serving older persons [50,51], and an example of a health innovation that enters the domestic environment of users: An underlying expectation is that service robots can provide medical and care services, while at the same time they provide a sense of companionship and support that transcends immediate medical or treatment functions [52]. They exemplify a hybrid identity of technology that combine more traditional medical and care functions with fun and entertainment. In what follows, we revisit results from our case studies in the field of robotics, where we have investigated two design (research) projects, and explored how designers address the challenges of technology at the intersection of health innovation and consumer products. We provide a brief introduction to the technology, the intricacies of the innovation process at the intersection of health innovation and consumer products, and elaborate upon how designers perceive of the value of the robot in relation to its future users.

Both projects addressed robots as service platforms; the robots themselves would provide a carrier for a potentially wide and adaptable set of services into the homes of their older users. Moreover, the cases were embedded in the context of Ambient Assisted Living (AAL) environments. That is, they were meant to operate within broader ICT-based systemic solutions to support ageing well at home. When talking to the designers about their

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5 An example for a companionship robot is the famous Paro—essentially a robotic seal that should provide the kind of companionship normally associated with living animals [53]. See http://www.parorobots.com.
6 We present here a targeted revisiting of our material. The study itself has been conducted with a different research questions in mind—to understand how designers approach and imagine older users—and its results as well as its methodological underpinnings can be found in more detail in [54]. Additional information about the two projects is available online at http://www.florence-project.eu and http://www.mobiserv.eu.
technological work and their representations of older technology users and later life more
generally, they identified two decisive challenges for the development of the service robot
platforms: robots have hybrid position at the intersection of medical treatment and everyday
life, and they operate as part of integrated and broader technological environments. These two
challenges, and the way the designers looked at them, prepare the ground for looking closer at
the perceived values of the robot platforms, and the position of these values with regard to
their move into domestic environments:

(1) The designers of the service robots we looked at struggle with positioning the
technology as either an assistive device or a life companion made to provide meaning,
entertainment and simply fun. Robots were seen as a platform that could bring a wide range
of services into the homes of older persons. These services include fall detection and
handling, health status monitoring, communication with family, doctors and caregivers,
collaborative gaming, personal tracking techniques, a range of reminders, lifestyle
management, and a home interface to operate other technological functions at home. For the
designers, the robot was a device that could seamlessly blend care and health functions with
entertainment, fun, social networks and interoperability with a wider technological
environment. The prototype was imagined as a central device in the lives of older persons, a
device that could adapt to changing lifestyles and health needs. As such, the value of the
technology comprised both aspects of a more traditional consumer good, and of a medical or
assistive device. Indeed, the designers saw this particular blend as the key challenge of the
emerging technology. The specific blend of services and functions to be offered would
depend on the specific circumstances and the input of its user and his or her wider context of
caregivers, medical professionals, friends and relatives.

Evaluating the effectiveness of the robot was thus a tricky task: an “evidence-based” logic
that would rely on “sound evidence” was deemed necessary to some extent, but at the same
time such a logic was also considered to hamper the implementation of the robot. For one, it
would constrain its acceptability (“older people don’t want to be addressed as old”); but probably more importantly, the necessary evidence was regarded too difficult to provide given the hybrid nature of the robot. Indeed, the designers were very clear that the robot would have to be attractive to older persons as “consumers”, while at the same time its effectiveness as a medical or assistive devices would have to be clear to insurance companies. Consequently, discussions of potential marketing paths meandered between the need to address consumer markets, and the need to develop a device that would be viable in the evaluation schemes of public health policy makers, insurers and service providers. In a nutshell, the robot crystallized a range of discussions in the boundary zone of consumer goods and health technology—a boundary zone in which issues of user experience, acceptability, patient value and cost effectiveness were inherently entangled.

(2) The robots were seen as integral part of a wider technological environment. Indeed, they were designed to become a central interface to the different technological functions of a home environment such as heating and electricity, window shutters, doors and different media in- and outputs. At the same time, the particular set of services they can provide is flexible and depends on the particular situation of its use. The designers were very clear that putting the robot into use would involve a significant amount of tinkering by both its end-users and the intermediate users such as caregivers, doctors, housing co-operations, and so forth in order to specify its functioning. This underpins another aspect crucial to PHS, namely that they operate in the context of already existing and evolving socio-technical systems that usually permeate private homes. In other words, the service robots we investigated are configurational technologies [7,55]. By this we mean that they have to make sense in the context of already existing systems, and they have to operate within the situated and evolving everyday practices and needs of their users. The socio-technical assemblages in which these robots will eventually become entangled are by no means under the control of their designers,
but crucially depend on the continuous efforts of its users to configure it with evolving practices and technological environments [8].

The designers only gradually learned to perceive of the robot in this way; or, to be more precise, the hybrid nature of the technology together with the challenge of user involvement gradually revealed to them that a key feature of the robot would be its configurationability in the light of changing circumstances. One of the robots, for instance, has initially been designed to substitute for the need of human caregivers, but through various rounds of user involvement the designers learned that they would have to address older persons on more meaningful, playful and active grounds. In the end, the robot prototype was designed as an entertaining and playful device; this was seen as a preliminary to ensure its acceptance among older persons, so that the end-user could familiarize with the robot and explore its usefulness. Assistive and health services, then, were dependent on a robot that has already become a familiar object in the lives of its users to which care and health service could be added when needed. Assessing the robot’s effectiveness became much more complex than originally assumed, and had to include fit to existing practices, identity as a companion and entertaining device, interoperability with other devices, and the quality and experience of assistance and care. Crucially, these values were seen as important in order for learning processes to take place through which different stakeholders involved with the implementation of the robots could learn about its functions, and feed this knowledge back into future rounds of innovation. The identity of the robot, rather than being a clear-cut intervention, emerged as a “fluid” (cf. [56]) configuration of potential services, everyday practices and devices.

If we follow the perceptions the designer have about “their” technology, what transpires is an innovation process that challenges the logic of HTA. Indeed, the service robot platform, after all, was not perceived to be viable as a straightforward technological intervention; rather, the designers, sometimes painfully, learned that robots would operate in a configurational setting, where different kinds of users would have to be enrolled in order to define and
explore the potential value of a technology. Valuing technology, after all, is a process that involves people and devices (and many other things) [57], as well as social learning that reaches well beyond the sphere of technology design and adoption decisions [58]. In the robot cases, designers gradually realized that it was not a primary concern to identify the added value of the robot beforehand, and to collect evidence of its performance against this background. Rather, the robot should be seen as an element whose “effectiveness” would have to be explored in the wider socio-technical assemblage of health and consumer technologies, caregivers, older persons, regulations, markets, and so forth. Both the robots and its future users where perceived as agents, not as objects, in valuing the emerging configurations around the new service platforms.

In an earlier paper, we have coined the notion of “domesticability” to capture a design’s ability to trigger and facilitate creative and playful encounters [59]. The designers of the robots acknowledge this as an important value of service robots in health and care. This became clear when they discussed viable implementation strategies. They highlighted that it is a key issue to have the robots enter private homes, so that users could get acquainted with them, tinker with them, learn about them, and, in other words, domesticate them. Hence, the decisive design parameters revolved around issues of valuing rather than values, and that socio-technical interactions are a key part of this valuing process. Of course, to this adds that the robots were developed in the context of ICT enabled technological environments that would ultimately span the contexts of private homes, hospitals and care centers; ultimately, the robots would combine and relate to health, quasi-health and wellbeing, and more traditional consumer electronics functions in a seamless way. Little earlier experience could be used as guidance into this context, so that designers were forced to resign to consider implementation strategies where interactive learning and experimentation were crucial. Again, humans and devices were inseparably connected in the talk of designers that were discussing how the eventual operation of the robot would be explored and defined.
When designers discussed the implementation of the service robots, they suggested an imagery of future users that resembles the kind of individual agency Callon indicates with the notion of habilitation [9]. Indeed, when designers talked about the position of future users (and they were talking primarily about end-users) they evoked the idea of a socio-technical assemblages that would grant users the ability to define for themselves how to position the new device in their lives, what to do with it, and ultimately which specific balance they would give to fulfilling health, fun and entertainment functions. In a nutshell, designers learned not to focus on how to fit the technology into the mold of earlier defined values, and thus require later users to fit this mold as well, but struggled to provide technology that would allow and stimulate users to explore needs, new practices and, finally, new configurations. The designers, however implicit and unwitting, refused to trap into what Stewart and Williams [60] have called the “design fallacy”—the conviction that technology design should incorporate a meticulous understanding of future uses. And it is precisely this refusal to think about and define the value of the emerging technology beforehand that is at the heart of what designers have outlined as promising implementation strategies. In the perception of the designers, a value space emerged that imputes considerable agency on both future users and the technology in exploring value. For health policy makers, it should thus be a central task to ponder how such strategies, which designers deem crucial for the success of PHS, can be facilitated through HTA.

In a nutshell, the designers of service robot platforms considered “domesticability” and “configurability” as central values of their PHS innovations. In contrast to the values identified in the POC case, domesticability and configurability are meta-values that indicate a certain logic of addressing value in the assessment of a technology. This marks a process perspective, where valuing technology becomes an important success factor for health innovation. Interactive learning, experimentation and smart ways of monitoring and adjusting innovation to it are important elements of this process. Users (of different kinds), rather than
seen as an object whose values should be addressed, participate in this process as agents. As we shall elaborate in the concluding section, the value space that follows from this logic is markedly different from the value space that underlies current HTA practices. This has a number of health policy implications for innovation of PHS in ageing societies, as we shall also demonstrate.

4. Conclusions

In this paper, we have addressed the practices and pitfalls of mainstream HTA practices and the underlying logic of evidence-based medicine. We are certainly not the first to highlight the problematic aspects of established HTA procedures (Faulkner [12,61] and Lehoux [11] are excellent entries into the prolific body of literature in this regard), nor are we the first to demonstrate empirically that HTA practices are often more messy and fractious than their textbook versions suggest (see for instance [22,62]). Instead, our interest in HTA has been triggered by our own involvement with PHS innovation, where in particular the notion of evidence in the strict sense suggested by EBM seems to permeate policy debates. We deem this to be a fundamental problem in the light of health innovation that targets at domestic environments, and we have strived to bring to bear insights from innovation studies and into innovation dynamics to the evolving knowledge base of HTA (see [27]).

In this sense, our case studies have zoomed in on the position of users and use in health innovation, and how practitioners frame their position in the innovation process. The POC case, set in a primary and secondary care environment, reveals the work necessary to frame a health innovation as an intervention with measurable effects. Our analysis brought out how this idea about the effects of technology as predictable implicitly frames most users as objects that should behave in ways pre-scribed to them within a pre-defined value space. This logic nicely fits the mold of traditional HTA, and our analysis thus unravels how HTA practice is at
risk to produce prosthetic policies. In Callon’s terms, health technology decisions based on
the traditional HTA logic is likely to produce technology that focuses on changing socio-
technical assemblages along preset dimension. But individual agency in the sphere of users
and use is framed to be disciplined and passive, as erratic usership would disturb the precious
relationship between costs and health effects so carefully established before. In a nutshell, our
case demonstrates that health policy decisions based on established HTA practices will work
to discipline individual agency; they are not equipped to deal with the constant
experimentation and learning in the absence of evidence that is so typical for innovation
processes.

The robot case illustrates this experimental dynamics for a PHS targeting at a domestic
environment. The designers we talked to gradually learned to perceive the users of the robots
as agents that are essential for the process of valuing the technology. This way of recognizing
value as something open and fluid suggests implementation strategies that revolve around
socio-technical assemblages that impute the ability to experiment and explore new practices
on users. In Callon’s terms, therefore, the designers considered habilitation strategies as a
crucial element to ensure that the robot would be used beyond the design stage at all. Such
implementation strategies understand that users are active agents in innovation processes, and
give them space to experiment to learn about the value of a technology. In comparison with
the POC case, the designers of the robots thus had a markedly different idea about the
position of values in relation to their emerging devices. They highlighted the open and fluid
nature of valuing rather than the collection of evidence for already defined value. What
emerges is an opposite logic, where a successful process of valuing is seen not as an ancillary
aspect but as a premise for the collection of evidence. The robot case demonstrates that for
PHS it would be crucial to broaden HTA practices in such a way that they are able to deal
with this experimental co-evolution of values and evidence. Otherwise, HTA runs the risk to
prematurely cutting short health innovation with promising prospects but limited available evidence.

But there is another probably subtler risk to the prosthetic policy decisions about health technology that is particularly unfortunate in the context of ageing societies. Older persons are likely to be at the vanguard of using and domesticating PHS. If it is true that established HTA practices, through the technologies they favor, are likely to create passive users and disciplined use of PHS, then this will affect older persons in particular. Even worth, the implicitly prosthetic logic of HTA resembles existing stereotypes of passive and inept older technology users [8,59]. Health policy decisions about technology that focus on evidence and HTA are thus prone to create older technology users in private homes that fit the mold of patients in primary and secondary care. In a mild scenario, this may simply lead to PHS technologies that are not successful, because older technology users simply do not see themselves to fit this mold (see [52]); HTA is then at risk to hamper the potential of innovation to improve HTA’s most central value of improving cost effectiveness [43]. But where health policy decisions limit the space of available technologies it might also foster the diffusion of PHS technologies that contribute to further frame older persons as passive and technologically inept through the disciplined individual agency imputed by prosthetic technologies. We deem this latter aspect to be the main reason why current HTA practices need to be revised.

To conclude, we argue that the values of “domesticability” and “configurability” deserve a central position in HTA. This suggests that the range of values itself, however broadly defined, should not be the main concern of adapting HTA exercises to the realities of PHS innovation in ageing societies. Rather, the value space in which the values to be addressed evolve should be broadened to include experimentation and the use and diffusion of PHS devices. For the robots, the health value they will ultimately be able to deliver depends on learning processes that stretch well into the diffusion phase of the technology, and need to
incorporate an understanding of the robot as a companion in everyday life. Prosthetic value spaces, in which values are explored independently of technology, are not able to deliver this. What we need instead are value spaces that incorporate a habilitation logic, i.e. niches for experimentation and joint probing into the value of PHS. Current discussions in HTA fall short in delivering such broader notions of a value space, although some recent claims for constructive forms of HTA point into the right direction [63]. We deem exploring such approaches further in order to free older persons from existing stereotypes associated with illness, handicaps and technology-averseness.
References


