When self-tracking enters physical rehabilitation: From ‘pushed’ self-tracking to ongoing affective encounters in arrangements of care

Nete Schwennesen

Abstract

In this paper, I explore what happens when self-tracking technologies and devices travel into the context of physical rehabilitation and come to constitute what Lupton has called ‘pushed’ self-tracking. By unpacking the processes through which a self-tracking technology is put to use in physical rehabilitation in Denmark, and the kind of relationships patients and healthcare providers establish with and through this technology, I illustrate how a new geography of responsibility is constituted, where responsibility for professional guidance is delegated to the technology and patients are expected to produce and engage in movement data. In contrast to the image of ‘pushing’ as a single activity where one part (technology) has the authority to push the other (patient) to act in certain ways, I argue that ‘the push’ is better described as an ongoing and contingent process that evolves through affective and affecting encounters between human (patients, healthcare providers) and nonhuman (technology, algorithms, software) actors. I illustrate that even though responsibility is delegated to the technology, it is unable to make bodies move by itself. Rather, what determines what ‘it’ becomes and how ‘it’ comes to act is enabled by the constitution of a wider arrangement of care and the arrangements’ ability to affect and respond to particular bodies.

Keywords

Self-tracking, physical rehabilitation, ethnography, socio-material, care arrangement

Introduction

In recent years, mobile self-tracking devices and sensors have moved into the context of the health care sector, in particular physical rehabilitation. When self-tracking travels into the context of physical rehabilitation the aim and functionality of self-tracking transforms. While studies on QS members describe self-tracking as a vehicle for cultivating self-reflexivity and mindfulness, self-tracking becomes a means for moving and restoring...
‘disordered’ bodies. Moreover, self-trackers in physical rehabilitation are not necessarily enthusiastic users of digital devices, but most often frail elderly people who may suffer from chronic diseases. They engage in self-tracking, not as a self-generated practice, but in response to professional encouragement and advice, constituting what Lupton has characterised as ‘pushed self-tracking’.4

When self-tracking is ‘pushed’ in rehabilitation practices it enters a relationship between patient and health professional with reciprocal duties, expectations and roles that each part are expected to undertake.5 Recent research on telecare illuminates how the introduction of communication technologies in existing arrangements of care constitute new ‘geographies of responsibilities’, and redistribute expectations, roles and tasks between health care professionals and patients as well as between humans and machines.6–8 Telecare and self-tracking technologies have been criticised for enforcing individual responsibility and for adding a further level of surveillance to contemporary society,9 that may lead to a medicalisation of society which must be resisted.10 However, social science scholars who adopt a socio-material approach to the study of user and technology, have highlighted how technologies co-evolve in the processes through which users try to make them work.5–11 These studies illustrate that the meanings and effects of telecare technologies cannot be determined a priori, but are decided by the specific arrangement of care of which it becomes a part.

In the following, I trace the processes through which ‘pushed self-tracking’ becomes part of the socio-material arrangement of physical rehabilitation in Denmark and constitutes a new ‘geography of responsibility’. I adopt a socio-material approach and unpack the processes through which self-tracking technologies are put to use in physical rehabilitation, and the kind of relationships patients and health care providers establish with and through these technologies. In doing so, I highlight the affectual relationship that patients and professionals develop in their use, which is less explored.12–13 I take outset in a Danish case, where a smartphone application for remote monitoring of home training has been designed for use in physical rehabilitation for patients who have undergone hip replacement surgery. The study follows the process of introducing the technology in physical rehabilitation in a Danish municipality and asks: how does the technology reconfigure relationships between patient and health care provider in the socio-material arrangement of physical rehabilitation? What kind of social and affective relations evolve in encounters between patient, health care providers and the technology? How is authority produced and negotiated in those encounters? In contrast to the image of ‘pushing’ as a single activity where one (technology) has the authority to push the other (patient) to act in certain ways, I argue that ‘the push’ is better described as an ongoing and contingent process that evolves through affective and affecting encounters between human (patients, health professionals) and nonhuman (sensors, algorithms, codes, interfaces) actors. I illustrate that even though responsibility is delegated to the technology, it cannot make bodies move by itself. Rather, what determines what ‘it’ becomes (authoritative/nonauthoritative, competent/noncompetent) and how it comes to act is enabled by the constitution of a wider arrangement of human and nonhuman actors, and the arrangements’ ability to affect and respond to particular bodies.

Visions

The technology consists of a smartphone application with a daily training programme and five sensors, which must be worn by patients during home training: two on each leg and one around the stomach. The sensors are virtually connected to the smartphone and produce data on bodily movement, which are then stored in a digital system. The digital system categorises movement data into three categories of colour indicating the quality of movement: green (good quality), red (bad quality) and yellow (between good and bad). For the patient, this data is transformed into immediate digital feedback (oral and visual) that is communicated to him or her, when he or she is exercising. For the healthcare provider, these data provide an opportunity to get to know the quality of training and the extent to which patients are following the training they agreed upon.

In the beginning of 2016, the technology was installed as an element in physical rehabilitation programmes offered to patients who underwent hip replacement surgery in Denmark. Remote monitoring of home training reflects a recent ambition among designers in the field of physical rehabilitation: the ambition of developing self-tracking sensors and software with the ability to provide ‘intelligent’ digital guidance to patients when they are doing their rehabilitation exercises at home. The vision is to design a virtual trainer that can act as a stand-in for the physiotherapist, to be used in different scenarios where a real trainer cannot be present because of financial or other reasons.14

In the current age of ‘demographic ageing’ and the expected rise of frail people in need of welfare services in the future, care technologies promising a more efficient organisation of care work are seen as attractive by many European countries that face a scarcity of resources.15 This is also the case for Denmark, where the development and investment in innovative and efficient welfare technologies is high on the political agenda.16 The vision of cost-efficiency was a strong foundation for the
development of the technology investigated, which was clearly emphasised by a health consultant engaged in the process of developing it:

The technology is developed in order to substitute physical attendance on rehabilitation centres with something digital, which is based on home training. Clearly, there is this economic rationality to it; that it also is a means to save money (health consultant).

This vision of cost-efficiency was linked to a vision of ‘empowerment’ of the patients who were offered to use it. It was seen as a means for patients to become more actively involved in physical rehabilitation and for providing independency in training. The installation of the technology in the collective practices of physical rehabilitation reconfigured the geography of responsibility and spaces that physical rehabilitation worked through. Whereas patients previously had to attend group-based training sessions at the rehabilitation centre 1 hour twice a week, patients who wanted to make use of it only had to meet up for training sessions once a week. The assumption was that the technology could act as a proxy or a stand-in for the physiotherapist, when the patient was doing his or her exercises at home. Hence, responsibility for guidance and professional supervision was partly delegated to the technology and patients were expected to be actively engaged in the process of generating and responding to data on bodily movement.

The vision of cost-effectiveness was reflected in the technology’s functionality of auto-progression and its design of templates with standardised training programmes. When a number of exercises are completed and performed correctly according to the sensors, the system will automatically progress with new and more demanding exercises. The automated progression and the standardised templates were seen as vehicles for pushing the training and the rehabilitation process forward and as a fundamental premise for saving time and hereby money.

If the main idea is to save time to be able to do other things, well, then it doesn’t make sense if the professional will have to use time for putting up exercise programmes for the patient. So we decided to incorporate auto-progression, in order to avoid that. We also made the templates, so if you have a hip patient, you can easily and quickly push the template button, then you don’t have to spend time on adding the exercises yourself (health consultant).

As Natasha Schüll illuminates in her paper *Data for life: Wearable technology and the design of self-care*, wearable technologies that track physical activity are designed with outset in specific presumptions about human behaviour and motivation. This is also the case of this technology: if the software evaluates the bodily movement as ‘bad’ or ‘not good enough’, a voice will correct the person who is doing the exercise by saying things like, ‘lift your knee to a higher position’ or ‘put your knees closer together’. In addition, the overall quality of the training is evaluated and visualised on the smartphone display in the form of stars after each training session. The patient will receive up to three stars if the training is evaluated as perfect. Hence, the technology is intended to engage the user in a relationship, which nudges the user to do his or her exercises and to perform them correctly.

This informatic mode of perception and knowledge production relies on a wide web of algorithms and codes. Unlike the clinical gaze that Foucault described, which focused on the sights, sounds and smells of ill bodies, bodies are assessed remotely from the space and time of the body—in the cloud/digital realm by the algorithmic system, not in the examination room. The algorithmic system translates data on bodily movement into digital feedback, which makes a judgement of the movements. The algorithmic system and the specific parameters that translate the data is the outcome of a complex process of selection of specific measures and parameters which—apart from professional judgements—was regulated by the sensors’ ability to measure and monitor bodily movement:

We started out describing 24 parameters that we saw as important for assessing whether or not an exercise was done well enough, and ended up with the selection of nine. In this process, we had to leave some of the parameters out as the sensors where not able to measure on those specific parameters (health consultant).

Hence, in the process of developing the algorithmic system parameters that were seen as important for evaluating whether an exercise was done correctly, were excluded in cases where the sensors were not technically able to evaluate on these specific parameters. This, however, was sought to be compensated by the design of written feedback to the user on parameters not included in the overall measurement.

From ‘pushed self-tracking’ to ongoing affective encounters

To unpack the processes through which self-tracking is ‘pushed’ in physical rehabilitation, I take inspiration from the literature on the mutually constitutive character of medical technology and user. Akrich, who was one of the first to explore the relationship between technology and user, argues that technical objects define
nonhuman and human actors, the spaces in which they move and the ways in which they interact in the use of the object. By using the notion of script, she illustrates how designers inscribe a certain framework of action in a technology and thus how competences are distributed in the scripts of technical objects. Mol, illuminates how bodies, rather than being pre-existing entities, are enacted in networks of human and nonhuman actors. Pols introduces the notion of patient positions to emphasise the patient as co-produced with specific situations and spaces rather than as a fixed individual independent of clinical contexts.

Recent research on telecare supports the idea that patient positions are inscribed in telecare technologies and actualised in specific settings; yet, it also draws attention to the different ways in which the scripted use of a technology is contested and negotiated by its users. Piras and Miele illustrate in their study on clinical self-tracking how the technology mediates the relationship between patient and healthcare provider in unexpected ways. While in some situations clinical self-tracking followed the path desired by the providers, at other times the users betrayed the providers’ expectations and was able to negotiate a desired relationship with providers through their use. Pols and Willems illuminate in their study on telecare how the meanings of telecare co-evolve in processes through which users and healthcare providers try to make them work; hence, ‘the same’ technology may perform differently in different arrangements of care.

In the following, I want to bring the literature on the mutual constitution of bodies and technologies together with the literature that focus on the social and affective relations those encounters may work through. Only a few studies focus on the affective relationship that people may develop with and through medical technologies. One exception is Pols and Moser who draw attention to the ‘sociability’ of medical technologies and illustrate that relations with healthcare technologies are not only functional but also social and affective. They argue, that while medical technologies embody visions and values that patients may or may not aspire to, technologies mediate affective relations through their use. Pantzar and Ruckenstein also draw attention to the ways in which self-tracking technologies not only generate information and data, but also emotional attachment to the data and the activities that are tracked.

The philosopher Vinciane Despret has looked at processes through which bodies become affected in encounters with other bodies and how such processes relate to authority. In doing so, she directs attention to authority as a relational and dynamic outcome of affective processes, rather than an outcome of suppression. Using the example of knowledge production in the context of animal experimentation, she demonstrates that authority works through processes of trust and bodies that make themselves available for transformation. From this perspective, we can understand ‘pushed self-tracking’—not as a process where one actor tells another actor what to do—but as an affective and dynamic process through which people become emotionally engaged in their bodies, their exercises and the data that self-tracking generates.

The study

The present work is based on an ethnographic study of the implementation of remote monitoring of home training at a rehabilitation centre in a municipality in Denmark. During two month in 2016, I followed 15 people undergoing physical rehabilitation who were offered to use the technology. I attended weekly 1-hour training sessions, physiotherapist—patient conversations about the technology, and engaged in informal conversations with physiotherapists and patients. Additionally, I interviewed eight patients in their homes and observed their home training and interviewed four physiotherapists, who were primarily responsible for the training session with users and the implementation of the technology at the rehabilitation centre. I also interviewed a health consultant who was engaged in the process of developing the technology and who is now employed at the company that owns it. Extensive field notes were taken in clinical encounters at the rehabilitation centre and during home training, and they were written up immediately after leaving the site. Subsequently, field notes were analysed across sources and sites. Interviews were transcribed and general themes were identified across the field notes and the transcripts.

Bodily movements in physical rehabilitation

Sophie is just about to turn 70. She lives alone in a flat on the fourth floor. She has four children, who she raised herself, and six grandchildren. For many years, she held two jobs to earn enough for a living, but she retired a few years ago. She describes herself as a ‘fighter’ who never gives up, even though life sometimes can be tough. I first met Sophie at the rehabilitation centre 3 weeks after she underwent hip replacement surgery, and I visited her in her home 1 week later. Sophie told me that she was happy that she was allowed to do remote-monitored home training, which meant that she would only have to attend training sessions once a week. While she was not able to drive to the rehabilitation centre by herself in her current condition, she had to wait for the municipal taxi service, which
often involved many hours of waiting. Hence, the technology promised her independence and flexibility by allowing her to do supervised training at home.

When I met Sophie, she walked with the help of a crutch, and she had difficulty moving around in the flat and doing everyday tasks, such as getting dressed or going to the toilet. She felt sure, though, that if she followed the guidance of the technology, her body would be transformed and restored, and it would become as mobile as it was before undergoing the surgery.

During her home training, Sophie engaged with the digital feedback she received by adjusting her movements when the digital voice corrected her (Figure 1). However, she experienced a gap between her movements and the ways in which the digital voice responded to them, which annoyed her:

Sophie: He says that I have to stretch the knee, but I cannot stretch the Goddamn knee more than I already do, see? I can get so angry with him.

NS: Yeah?

Sophie: At the hospital they told me that I was really good at this! He just tells me off. But I can’t stretch it anymore, isn’t that right?

Sophie also experienced a discrepancy between the feedback she got from the technology. This gap and the continual negative feedback, as it ‘told her off’, produced a sensory experience in Sophie, who became angry and frustrated. She kept trying to do what it wanted, but kept getting negative feedback. She was affected by the responses from the technology; she was happy when she received three stars and frustrated when it corrected her, and she strove to satisfy it.

Even though the technology frustrated her, she perceived it as a ‘friend’ that helped and supported her in doing her exercises at home.

Sophie: Sometimes he just doesn’t know what he is talking about, but I think he has also helped me.

NS: Yes?… So he does make a difference?

Sophie: Yes, he makes a difference, he keeps me on my feet. If I had to do training on my own at home, it would have been much easier to cheat, and I don’t think I would have trained so much.

NS: So he keeps you active?

Sophie: Yes, he definitely does.

The affective activity at stake in this situation points to affect as residing in the relationship between technologies and bodies constructing these technologies, and bodies in specific ways that give rise to emotional responses. That is, rather than being an innate response, affect was the result of flows between a body and a technology. During training, Sophie and the technology did what was expected from them. Their relationship was shaped by Sophie’s trust in the technology, which transformed it into an anthropomorphic technology that had authority. However, when I met Sophie 2 weeks later at the rehabilitation centre, she told me that she had been in terrible pain, especially in the hip that did not undergo surgery, which had started to hurt. A few weeks later again, I talked to the professionals at the centre, and they told me that Sophie was now scheduled for hip replacement surgery on the ‘healthy’ hip. Sophie explained to me that she believed that it was the training that caused the injury. While we cannot presume that Sophie’s explanation of causality is that straightforward, the developers of the technology recognise that there is a risk that the patients become ‘over compliant’ and start training too much:

The patients are extremely motivated for doing their exercises; they really do train a lot. We have had some who actually trained too much, so clearly there is this risk to it… The patients know that the physiotherapists can see what they are doing at home and they want to live up to that. And do it as best as they can (health consultant).
Sophie tried her best to follow the guidelines of the technology, even though she felt pain in her body. Sophie did not act on the bodily pain she experienced when she did her training. She continued her training in the belief that the technology, the digital feedback and the training programme would guide her towards an efficient physical rehabilitation process. In this process, she gave authority to the technology rather than her bodily senses, a phenomenon that is also found by Mol in her study on blood sugar measurement, and by Oxlund in his study on the use of digital technologies for lifestyle prevention. They both illuminate how using the device and relating to the data may move people’s attention away from their physical sensation in their everyday life towards the numbers measured.

**Misaligned temporalities and negotiated authority**

The story of Sophie indicates a misalignment between the temporality of bodily progress inscribed in the exercise programme and the transformation of Sophie’s body. The technology and its standardised functionality of auto-progression enacts a specific vision of bodily movement: It invokes a linear vision of transformation where a present body of ‘misfit’ is imagined to be transformed into a past fit body by undergoing various ‘restoring’ interventions that promise transformation. A body that undergoes rehabilitation after hip replacement surgery will over time often gradually become more mobile, but the timeframe and the extent to which this happens is uncertain. As such, the process of physical rehabilitation can be characterised as an uncertain and nonlinear process. In the case of Sophie, the standardised training programme, the linear temporality of auto-progression, and the more cyclical and unpredictable temporality of her body were not aligned—which resulted in pain.

Not all patients trusted the technology and did their home training with the same enthusiasm and determination as Sophie. The experienced discrepancy between their body’s movements and the digital feedback led many patients to doubt whether it was a competent stand-in for the physiotherapist, and they began to question the authority of it.

*Well, we all know that it is just an algorithm, it is just a machine, it is not a human being* (Woman, 65 years).

For many patients, their relationship with the technology developed into a more strategic and tactic engagement during the 8-week rehabilitation programme. They started to skip particularly painful exercises and to do their exercises only every second or third day, or to do training without the technology.

During the weekly 1-hour training session, many patients expressed insecurity about how to strike the right balance between bodily progression and pain. They also complained that the technology kept correcting them, even though they made every effort to satisfy it. The training at the rehabilitation centre was not explicitly linked to patients’ experiences during the home training, and exercises were mostly done without using it. The health professionals emphasised that they have not changed anything in their planning of the weekly training sessions, in comparison with the way they usually train people (without home monitoring), and that they deliberately decided to do exercises that the patients did not do at home to keep them motivated. When patients complained about pain, and asked how to strike the right balance between pain and progression, the health professionals most often responded that the technology was ‘thick-headed’; they also described the technology as ‘not very bright’ and ‘not able to deal with complex detail’. In doing so, the health professionals de-authorised the technology and gave authority to the patients to judge by themselves. However, for many patients, this was not experienced as a careful response to their experienced problems.

*When I tell them that it hurts, they just tell me that I am training too much, well yes I am training too much, but what do they want me to do? I just follow the exercise programme… What are the exercises that they don’t want me to do? The programme doesn’t take my specific body into account, and I can’t adjust the training programme myself. I am not educated in this, this is the first time I try this… I don’t think that the physiotherapists take responsibility for this* (Woman, 70 years).

As the quote above shows, some felt they were left alone with the impossible task of deciding for themselves when and when not to follow the guidance of the technology, how much pain they should accept before stopping training, how often to train, etc. Many patients also experienced that the health professionals did not check their movement data and that the health professionals did not explicitly relate to them during the weekly training sessions at the centre. Even though the technology allowed health professionals to observe patients’ training from a distance, it was rarely used as a tool for surveillance and control. Paradoxically, patients actually desired to be controlled and looked after by health professionals. When the patients realised that they did not, many of them expressed disappointment. Hence, neither the health professionals nor the technology acted as expected, which for some patients caused a loss of trust. Some patients started to exercise without using it, and some even hired a private physiotherapist to guide their
training progress. In these situations, the technology was not able to engage and affect either the patients or the health professionals in the practice of self-tracking and therefore became a worthless object without any meaning or functionality.

**Shared care and moving bodies**

Until now, we have seen how the (in)ability of the technology to engage patients in self-tracking practice is not decided by the device itself, but is part of a dynamic process that works through relations of affect and trust. In this last part of the paper, I will discuss the relation between power and care in processes of authorisations, which, according to Despret, is a pertinent issue of whether or not an actor is authorised to become and uphold its position as an authority. Despret distinguishes between bodies that are docile and bodies that make themselves available for transformation. In doing so, she distinguishes between a care-taker and a judge or a master. She argues that a care-taker is someone who is interested in the possible becoming of another actor, and allows him or herself to be transformed through a process of attunement. In the case of Sophie presented above, her body became a docile body, as she continued to do her exercises under the guidance of the technology, even though she experienced pain in her body. The technology did not make itself available for transformation and was not attuned to the temporality of Sophie’s specific body. The technology responded to her individual body only in situations where it progressed as planned, not in situations where her body might have benefitted from slowing down, doing something else, or taking a break from training to, perhaps, regain its physical condition.

The technology was, however, not the only actor that made itself unavailable for transformation. Sophie kept following the guidance from it, even though she experienced pain in her body. She did not attend to or act on her bodily sensations. The health professionals also did not give any attention to adjusting it to create a more suitable link between the device and specific patients (it was possible to create customised training programmes and to adjust the functionality of auto-progression) and they rarely checked the patient’s movement data. In short, they continued to do what they did before the technology became part of the care arrangement and did not see it as an object that could be tinkered with; rather, they came to detach it from the patients by emphasising its incompetence. Not much attention was given to support patients in their ability to listen to their bodies and eventually not to follow the guidance of the technology when their body was in pain. The problem seems to be that no one in the new care arrangement of human and nonhuman actors actually adjusted their interactions with each other, which constituted a detached and unengaged relationship between the technology, patients and healthcare providers.

In her study on wheelchair tests, Winance draws attention to the joint adjustment work which it takes to create a fit between a person and a wheelchair that enables him or her to move.26,27 She describes this adjustment work as ‘shared work’ between the wheelchair, the tester and the person in the wheelchair directed towards a joint exploration of the sensations that different links between human and nonhuman actors create. In the process of creating a fit, all the actors in the collective care arrangement were involved in experimenting and trying out different links and the sensations they created. Each person in the collective being was simultaneously an object and a subject of care. If we think with Winance and her notion of care as shared work and Despret’s notion of a care-taker as something or someone who makes itself available for transformation, I would argue that it might be possible to create an arrangement of care with the technology that would enable rehabilitation of bodies over time. Yet, it is unable to do so by itself. This would require that patients and healthcare providers were continuously attentive to and sensitivity towards the making of suitable links between the technology and specific bodies and a willingness to be affected by those encounters.

**Concluding remarks**

In this paper, I have explored what happens when self-tracking technologies move into the context of physical rehabilitation and come to constitute ‘pushed’ self-tracking. In contrast to the image of ‘pushing’ as a single activity where one (technology) has the authority to push the other (patient) to act in certain ways, I argue that ‘the push’ is better described as an ongoing and contingent process that evolves through affective and affecting encounters between humans (patients, healthcare providers) and nonhuman (technology, algorithms, software) actors. Hence, in contrast with studies on the QS movement that portray self-tracking as an individualising means of self-reflexivity and mindfulness, this study shows how self-tracking comes to mediate relationships between the patient and the healthcare provider. This process constitutes a new geography of responsibility where responsibility for guidance during home training is delegated to a digital device and patients are expected to engage in the production of movement data. While the vision of the technology is for it to act as a competent stand-in for the healthcare provider by motivating and guiding patients in rehabilitation process, I have illustrated that it is unable to make bodies move by themselves. Rather, the
working of the technology and its ability to act as a competent support of the transformation of bodies is enabled by the constitution of a wider arrangement of social and material actors, and their ability to affect and be affected by those encounters.

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