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Being in a mediated world: self-tracking and the mind–body–environment

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Abstract
Self-tracking is an increasingly ubiquitous everyday activity and therefore is becoming implicated in the ways that everyday environments are experienced and configured. In this article, we examine theoretically and ethnographically how the digital materiality of these technologies mediates and participates in the constitution of people's tacit ways of being in the world. We argue that accounting for the presence of such technologies as part of everyday environments in this way offers new insights for non-representational accounts of everyday life as developed in geography and anthropology and advances existing understandings of these technologies as it has emerged in sociology and media studies.

Keywords
digital materiality, everyday life, lived experience, perception of the environment, self-tracking

Introduction

The human-technological activity of self-tracking everyday bodily movement using digital mobile media and related wearable and computing devices is an increasingly significant part of the everyday lives of many people in affluent societies. Here we examine the implications of these increasingly ubiquitous technologies for their users' experiences of everyday environments, by investigating how they are implicated in ways of moving through and perceiving the world. Such technologies, and their increasing embeddedness in mundane worlds, we propose, is of relevance to geographies of everyday worlds since self-tracking technologies mediate everyday mundane embodied and spatial experience through the representational techniques of global positioning

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system (GPS) and quantitative measurement technologies. Yet also, they participate in the experience and constitution of the everyday in ways that are usually unspoken, unseen, and have consequences for how we experience being in the world and for how we interpret this theoretically.

Building on approaches to the mind–body–environment relationship in anthropology and geography, we extend media studies and sociological explanations towards an understanding of self-tracking as being *in* the environment rather than *of* the body. The increasing ubiquity of self-tracking technologies within mundane or private everyday activities requires us to attend to how the digital materiality of these technologies mediates people's tacit ways of being in the world. This in turn emphasises the need for non-representational accounts of such apparently quantified elements of everyday life. We suggest that as these technologies become increasingly ubiquitous, such an approach is needed because while self-tracking technologies might appear on the surface to belong to a quantified world of measurement, as our research demonstrates they participate considerably in how people 'feel' or sense in their everyday environments.

As Justin Spinney has pointed out in a *cultural geographies* article, in geography Don Ihde's post-phenomenology has invited the emergence of a 'more rigorous analysis of embodied perception' and an interest in 'probe[ing] the role of technologies/non-humans in assembling the social and cultural' along with what Spinney refers to as 'the study of those aspects of lived experience such as affect that may escape conscious thought and language and thus can be described in some ways as being "beyond" experience: experience as pre-personal' inspired by non-representational theories.[1] Spinney has suggested taking these methodological concerns forward through video go-alongs, with a speculative proposal for combining these with bio-sensing technologies.

We explore self-tracking as a way of working with research participants in a similar space. There is recent interest in 'digital methods' in the geography-focused digital humanities,[2] and in the social sciences more broadly where 'digital devices and the data they generate are both the material of social lives and form part of many of the apparatuses for knowing those lives',[3] thus indicating a methodological role for self-tracking technologies.[4] As Ruppert et al. suggest, to realise this we need to identify 'the relations between the elements that make up different apparatuses and how are digital devices reconfiguring those relations' and to undertake this 'demands a conceptual understanding of the specificities of digital devices and the data they generate'.[5] Before such use of self-tracking technologies can be properly understood, we moreover need to understand how they participate as *part of* and as assembled or configured *with* everyday lives and worlds, rather than as a research technology or device that is *as separate from* the people and environments it is deployed in.

Self-tracking involves people using and engaging creatively and analytically with wearable, digital, mobile and locative sensor and computing technologies to record data and quantify and analyse various aspects of human activity. This includes walking, running, cycling and other forms of movement, heart rate, sleep, calorie intake and expenditure, stress levels and much more. Self-tracking is usually associated with Quantified Self (QS) described on its web site as follows:

> Quantified Self Labs is a California-based company founded by Gary Wolf and Kevin Kelly that serves the Quantified Self user community worldwide by producing international meetings, conferences and expositions, community forums, web content and services, and a guide to self-tracking tools.[6]

QS enables its practitioners to meet, discuss and collaborate over a range of activities. In 2015, the QS movement had 202 groups, 46,387 members in 129 cities across 39 countries.[7] However, these figures do not represent all uses of self-tracking technologies because they do not capture users who do not self-identify as members of the movement. Self-tracking is moreover used in medical and health contexts, with increasing attention to the use of apps by medical professionals.[8] Because

they are often used socially on shared platforms or via social media and have GPS or location-based functions, self-tracking technologies also serve as forms of social and locative media. While there has been little attention to the non-representational aspects of the roles these technologies play, they have recently been analysed by sociologists of digital media, human–computer interaction (HCI) researchers and in Internet and social media contexts.

Whereas existing accounts have tended to focus on how self-tracking is *represented* online or in interviews, we focus on aspects of self-tracking that are embedded with how people experience their everyday environments but that are not normally spoken about or represented in public contexts. We thus shift the analysis away from the QS movement, and instead concentrate on the experiences of participants who we refer to as *everyday self-trackers*, with whom we have undertaken ethnographic research in Australia and Sweden between 2014 and 2016. This group includes people who use self-tracking technologies routinely in their everyday lives to track their movement (often steps), sleep and sometimes heart rate, but who do not necessarily talk about their data in public forums, and if they share it, only do so with one or two others. We were interested in this group of participants precisely because since they do not regularly communicate with broader communities of users, their own uses of the technologies are embedded in personal everyday routines.

In what follows, we outline the context of existing self-tracking research as it has emerged primarily in sociology, and discuss how a non-representational approach enables us to differently situate self-tracking technologies in relation to human activity, perception and environments. Thrift's proposal that an emergent qualculative environment has implications for our sensory experience of being in the world[9] and Kitchin and Dodge's argument that 'code/spaces should be understood and conceptualised as relational and emergent spaces in which software frames the unfolding but does not determine it'[10] inform our discussion. In response to this, we explore how a reconceptualisation of the composition (or assemblages that constitute) and affordances of our everyday *experiential* environments might be probed methodologically, and the implications of sensory ethnography practice as it emerges in dialogue with theories of digital material environments. We demonstrate this through examples from our ethnography with self-trackers.

Self-tracking in the world: current perspectives

There is a fast-growing literature on and interest in self-tracking developing in fields of HCI,[11] 'e-health and m-health predominantly in health promotion and health communication circles',[12] medical and health apps,[13] discussions of data and big data online[14] and other materials around self-tracking,[15] and the politics of (free) commercially valued 'digital labour'.[16] Some existing empirical social science studies have been industry focused or derived, with a view to understanding self-tracking consumers or users.[17] Lupton has argued for highlighting the 'social, cultural and political dimensions' of 'self-tracking cultures',[18] as well as emphasising embodiment[19] and self-tracking as practice.[20] This has brought to the fore people's perceptions of their bodies or selves[21] or the relationship of data to embodied experience which frames data representations as 'decorporealized and decontextualized bodies – hybrid composites of information – in ways that are intended to encourage people to act in certain ways',[22] or that 'health-tracking data act as a kind of active and algorithmic layer of skin that does not only sheathe but animates and orders the body'.[23]

While this existing work demonstrates that we should consider human embodiment as integral to the experience of self-tracking technologies, it has often emphasised the ways that algorithms structure experience *quantitatively*. However, following Thrift's notion of a qualculative world, we argue that this needs to be better connected to understandings of how self-tracking becomes part of people's sensory experience in everyday environments, and that theorise human perception and self-tracking as similarly part of and constitutive of everyday processes and environments.

Self-tracking in the environment: a non-representational approach

Among geographers, there has been a long interest in what Heidegger called our 'being-in-the-world', and Bollnow's notion of *experienced space* (*erlebter Raum*).[24] Here we are particularly concerned with habitual and often unspoken about experience of space in relation to both the presence and habitual uses of technologies. As Dewsbury and Bissell argue, the study of habit lends itself well to a non-representational approach in that it invites us to attend to a past–present–future temporality whereby the representational qualities of what has happened cannot ever be fully transferred towards what is happening in the present or what will happen next, since we can never repeat the same thing.[25] A focus on self-tracking calls our attention to how technology and, in Thrift's term, qualculation are part of and might shape the sensory and affective dimensions of the experienced space where habits play out and also co-constitute. Thrift's interest in how 'qualculative developments . . . make themselves known in the sensorium'[26] invites us to consider the sensory and affective experiences afforded by/with self-tracking technologies. However, we modify this approach, since Thrift draws on the anthropology of the senses of Guerts and Howes[27] to consider how sensory categories (for instance haptic experience) might shift in a qualculative environment. Here we advance this anthropological attention to the senses differently. Through attention to the perception of the environment,[28] Ingold has advanced a powerful critical response to the representational and culturalist theories that inform Howes' 'anthropology of the senses', which uses sensory cultural categories as its units of study and analysis.[29] This culturalist anthropology is necessarily past-oriented and thus hard to reconcile with non-representational approaches in geography which stress the difficulties of accounting for the present and future in representational categories. Following the argument that we experience environments from within, as part of them, perception involves 'the network of sensory pathways that are set up by virtue of the perceiver's immersion in his or her environment',[30] is not necessarily experienced in sensory categories or communicated verbally, and involves the non-determinacy of what is now and what is next as well as what can retrospectively be defined.

In geography, attention to the sensory perception of digital technologies in everyday life has focused on the question of how calculative processes might be experienced or conceptualised from the perspective of both designers and users of technologies. For instance, Ash's work on how game designers anticipate users' future affective experiences of technologies[31] and a 'politics of captivation in which the sensual and perceptual relations in the body are organized and commodified by these games in order to create attentive subjects'[32] suggests that digital technologies play a determining role in the constitution of affective atmospheres. In the context of media studies scholars working in the fields of media phenomenology and non-media-centric media studies, such as David Morley,[33] Nick Couldry[34] and Shaun Moores,[35] media has been treated as situated and experiential rather than simply being representational. Some work in this field has been influenced by Ingold's phenomenological anthropology to understand digital media and technologies[36] as *part* of everyday environments, experiences, things and processes, rather than as objects or representations that are separate from them. Interpreting digital technologies as part of what Ingold calls the 'meshwork'[37] of overlapping and entangled lines that trace the trajectories of things and processes through the world, offers a way to understand the digital not only as part of everyday activity, but as part of everyday environments. Although Ingold pays little attention to new technologies himself, his work remains relevant here because it takes us beyond the focus on how moves towards quantification, code or algorithmic cultures are shaping human perception, and reminds us to decentre technology in this discussion: the meshwork as Ingold conceives it includes the full range of what we can perceive, including the air, the sky, the wind, the ground under our feet, hills, gravel, sound, people, buildings, digital infrastructures and much more. This, we argue, is the complexity

of the world in which we need to situate self-tracking and its capacity to mediate contemporary lives and worlds. In doing so, we also argue, based on the ethnographic example of self-tracking technologies, for an approach that departs from recent conceptualisations in human geography of the 'material conditions of the digital'[38] through an emphasis on human–technology relations as 'technicity',[32,39] towards one that sees the digital-material as constituted within and as part of the wider configurations of things and processes, including bodies. As such, we respond to Kinsley's urge towards 'greater attention to the material conditions of contemporary digitally inflected spatial formations'[40] through an alternative understanding of the relationship between the body, technology and environment. We expand on this in the conclusion to the article.

Self-tracking technologies are particularly pertinent for such an exploration precisely because they are inseparable from sensory, embodied and affective experience and they implicate human relations with the environment beyond the human–technology interaction explicitly and in a way that can be explored empirically. Existing studies have acknowledged the complexity of self-tracking. For instance, Lupton argues that self-tracking data are part of 'data assemblages', which are 'configured via systems of thought, forms of knowledge, business or government models, human users, practices, devices and software, and also sometimes by networks of other users and agents other than the self-tracker'.[41] Lupton also recognises how 'turning fleshy human sensation, behaviour and perception into digitally produced numbers becomes a way of mastering the uncertainties, inaccuracies and vagaries of human embodiment'.[42] However, attention to Ingold's ideas invites us to interpret this complexity and the embodied, experiential elements of self-tracking differently, by asking how we might understand self-tracking as producing data *in the environment* (with the body), rather than as producing data *about the body*. Here we understand environment, following Ingold, in that 'the environment is, in the first place, a world we live in, and not a world we look at. We *inhabit* our environment: we are part of it; and through this practice of habitation it becomes part of us too'.[43] Data assemblages[44] constitute part of this environment, but so too do the weather, the topography, landscape, forms of sociality and representations. Just as we are part of our environments, so are digital technologies, their content and their presences. Thus, such self-tracking technologies can be thought of dually (or simultaneously) from two perspectives. On the one hand, they are part of the digital materiality[45] of the environments we inhabit and perceive. This means not 'starting with an a priori definition about what is digital and what is material' but understanding 'digital materiality as a process, and as emergent, not as an end product or finished object', whereby 'Digital materiality refers to the making and to what emerges of these entanglements, not to a state or a quality of matter'. Yet, on the other hand, self-tracking technologies are, through their relationship with active human subjects, also part of how we perceive our environments from the inside. Self-tracking as such does not just track the self or the body, or centre primarily on just human–technology relations, but rather moreover becomes a mode of experience through which people's embodied experiences, and environments and technologies cannot necessarily be separated out into different representational categories.

Researching self-tracking

Sociological self-tracking research has used the mind–body relationship as a methodological paradigm. Ruckenstein[46] describing a study undertaken with self-trackers in Finland suggests that self-tracking technologies provide the possibility 'of transcending juxtapositions of the biological and the social: the mind and the body, and the normal and the pathological interweave when everyday actions and physiological reactions are described within the same research design'[47] and can 'represent data on bodily reactions in a thought-provoking manner'.[48] Other studies have been based on analyses of representations such as QS members' self-produced narratives online and at

meetings,[49] participant observation in QS movement events, interviewing and web analysis,[50] and survey and ongoing face-to-face and email interviews with participants as they self-tracked over a determined period of time.[51] These methods have produced understandings of what we might see as the representational world of self-tracking – and this is undeniably an element of the experience of self-tracking. We re-direct attention to the dimension of self-tracking that is characterised by the flow, ongoingness and usually unspoken elements of our encounters with its technologies and data, to make them both visible or verbalised, and accessible to us as researchers.

Our 14 participants were all broadly middle class people living in Melbourne, Australia and Halmstad, Sweden, working in education, public sector, the arts and information technology (IT). They manifest a range of approaches to and uses for self-tracking technologies – from non-professional athletes who used the technologies for training, to sporadic users who might use them to train for particular events, and people interested in the insights they provided into how much they already exercised. Researching their everyday technology uses and experiences was challenging because they were interwoven with other ongoing mundane activities, rather than being discrete units of action. Indeed, for them self-tracking happens in the background of the everyday, and is encountered sporadically by users. Ethnographic hanging around to observe such moments in people's everyday lives is difficult, since they engage in those mundane and solitary everyday routines that would not involve others anyway; such moments happen 'sometimes' and are contingent on what is happening around them. For instance, in Melbourne, Ella, a research participant in her 30s, wore a Fitbit wearable wristband that recorded her sleep, steps and heart rate, which she viewed on her computer or smartphone. As she told Sarah, she did not see herself as someone who checked her data very often, but sometimes, she said, 'I'm on the train and I just want to see how I slept that night, I'll be going to work in the morning and I'll click on it'. It would not be easy to predict when one needed to be there to research such activities, and hanging around filming such a participant all day just to catch her checking her Fitbit for a few seconds on the train would not necessarily be viable.

Research into the use of other mobile technologies has produced similar challenges. For instance, listening to an iPod while walking through the city,[52] taking and posting camera phone photographs while travelling,[53] or having the TV on while going to sleep.[54] Our research has built on the opportunities afforded specifically by working with self-tracking technologies to seek an appropriate route into the recollection and discussion of such experiences. This engages the unique qualities of locative and social media, which since they self-track activity online or on devices, they offer a route into 'recovering' the flow of the everyday while not necessarily following its detail in real time/place contexts. A sensory ethnography approach is participatory, and involves the co-generation of knowing with participants through such encounters.[55] We combined two methods: the sensory ethnography interview and video re-enactment methods. The sensory ethnography interview[56] is understood as a conversation between researcher and participant,[57] in a face-to-face location, informed by the argument that sensory perception and empathy can produce ethnographic ways of knowing. As part of our focus on empathetic knowing, we also carried out auto-ethnographic self-tracking over a period of several months. Sarah used the Moves app and Vaike the RunKeeper and Sleep Cycle apps, which tracked and mapped physical activity and sleep on an iPhone, on the recommendation of research participants. We both used the Jawbone UP wristband wearables and apps collectively with our full group of four co-researchers. This enabled us to engage empathetic ways of knowing (about) the experiences participants discussed and, and a sense of attunement to their experiences as they recounted their uses of the technologies, and showed us the tactile and visual ways they engaged with apps and data. Our second method was to ask participants to re-enact typical scenarios on video, to show how they had used their technologies, and to probe the feelings that this invoked. This included showing us how they were used in meditation, weighing, how wearables were checked and how data were viewed on other devices.

The experience of spatiality

In locative and mobile media studies, the concept of geomedia refers 'to the transforming epistemic effects of the geolocated practices made possible by the new technological conditions'.[58] It accounts for the spatiality of mobile camera phone photography and digital mapping. Here, 'the digital map and its augmented reality do not exist purely for our visual contemplation, rather, they make and are part of environments, imply movement and are experienced corporeally'.[59] Theories of place enable us to situate mobile media use as part of a dynamic 'place-event',[60] to understand them as 'emplaced'[61] or through a concept of 'implacement, . . . which, like Heidegger's 'being-in-the-world', Farman suggests, 'locates our situated nature and our sense of proprioception with others and with objects in a space'.[62] Self-tracking can, like camera phone photography, be seen as part of how 'human subjects, images and socialities become emplaced',[63] and as these literatures suggest is itself emplaced, as part of everyday environments.

Like other locative and mobile media, self-tracking apps use digital maps to represent movement. Participants showed us their maps during our meetings as a way of involving us in their digital material worlds. For example, Christoph, a man in his 30s (the only participant who was connected to Melbourne's QS movement) described to Sarah how he liked to track his GPS location and how this helped him to jog his memory. Because the Moves app he used automatically tracked his GPS location all day, counted his steps, and the number of kilometres he covered, he noted he never had to check in when you got somewhere. The data were also important for him, and part of his perception of the spatiality of his being in the city, since he said, 'I can get an aggregate for how far I have walked' and it shows the parts of the city he spends most time in. This was a way of remembering and making experiences autobiographically with the technology, as he put it, 'somehow through these apps I'll have a set up that like a perfect journal' so 'I could replay a day in my mind . . . things move by so quickly that I like to track them'. Another participant, Adam, in Melbourne, likewise, demonstrated how his apps showed his movement data on a digital map, showing Sarah the routes he had taken the day they met and where they had encountered each other. Thus, the spatiality of self-tracking creates new relationships with and ways of feeling situated in relation to and part of a digital, material and sensory mapped and felt world, that corresponds to those discussed for locative media and camera phone photography.[64] However, a focus on self-tracking shows how accounting for the environment, including but beyond 'others' and 'objects' and beyond digital infrastructures, offers an expanded empirical and theoretical view of how mobile media can mediate our relationships in/with the world/environment. An examination of the specific nature of the sensory and embodied relationships with the environment made possible through locative self-tracking technologies demonstrates the possibilities.

Participants in both countries often discussed with us how their spatial routines, and movements through the city were constituted in relation to the self-tracking technology. For example, Jens (in Sweden) showed Vaike how his use of the Apple watch had changed his way of coordinating his movements through the environment. He was interested in how he could experience the technology at its full potential and he used his body movements to explore what the technology could do for him. He was particularly interested in the step counting features and the visual representations produced by his body movements on the Apple watch display. He showed how his daily movements produced a visual circle diagram and how when the circle was complete he knew that he had fulfilled his daily quota of movement (Figure 1). During their discussion, he realised what these circle diagrams had come to mean for him and how they felt when he managed and compared them from day to day. As he described it, these diagrams had become embedded in how he planned for his movement in different environments:

Figure 1. Jens shows how he uses and understands the visualisation of his movements, and uses these visuals to explain what it feels like when he has managed to move in a way that fulfils the array of circles over time.

> I control the display a couple of times every day and use it to plan my movements. It can mean that I decide to run to the copy machine at work or take an extra walk around the building when I go out for lunch . . . At one time when I was going to bed I realised that I didn't yet have one whole circle that day and I put my clothes and a head lamp on and went out for a walk in the dark and cold winter night . . . later when the full circle appeared on the display I got my reward

In common with Jens, other participants in Australia and Sweden explained how they would walk an extra stretch before going home, go out to exercise, or bring forward an errand in order to reach the 10,000 steps goals that these apps commonly set them. Thus, becoming newly attuned to the spatiality of their environments, investing new meanings in everyday landmarks and feeling affective and sensory states of accomplishment and wellbeing in relation to the self-tracking apps and data. Jens' example demonstrates this particularly well because even though he realised that his main purpose in using the technology had been to manage the goals he had set up as they were visualised as circles on the display, he also started to reflect upon what such a full circle felt like when it was fulfilled, what it had come to mean for him in his way of moving through the environment and in experiencing the environment from new perspectives. He was particularly interested in the part of the diagram that showed him how long he had been standing up during the day, and how this had changed over time from sitting most of the time to instead standing up, since this was key to the major changes in how he perceived his surroundings after starting using the Apple watch. This change had been good for improving his health, but that achievement appeared to now be secondary to how he felt good about producing full circles in a row by changing his movement patterns, which subsequently meant inhabiting his everyday environment in new ways.

The experience of movement from the ground

Our discussions with participants about activities like walking, running and cycling demonstrate how the experience of self-tracking technologies goes beyond the mind–body relationship towards the environment. Cadence as well as looser references to how hard it felt to run or cycle on particular terrains, was an element of experience that participants could articulate, and some described in particular how they felt when covering different topographies when self-tracking.

To contextualise this theoretically, we draw on Ingold's proposition that we do not think of life as being lived on 'the inanimate surface of a readymade world' and that 'Inhabitants, . . . make their

way through a world-in-formation rather than across its preformed surface' which may involve experiencing

> wind and rain, sunshine and mist, frost and snow, and a host of other conditions, all of which fundamentally affect their moods and motivations, their movements, and their possibilities of subsistence, even as they sculpt and erode the plethora of surfaces upon which inhabitants tread.[65]

Even hard surfacing, such as that of floors or roads cannot be closed to this process, since it 'cannot withstand the elemental forces of the sky and earth that erode it from above and subvert it from below'.[66] When this idea is connected to the question of how people know in and as they move through their environments, it offers us a way to conceptualise the relationality between self-tracking and the ground. Ingold has expanded his earlier argument that we 'know as we go' to encompass the idea that when walking, 'the complex surface of the ground is inextricably caught up in the very process of thinking and knowing'.[67] He continues that, 'the ground is an instrument, not only in the blunt sense that we need it to stand on, but also in the sense that without it we would lose much of our capacity to know'.[68] We can also consider the body and self-tracking technologies to be bound up in this relationship.

Our interest in the relationship of self-tracking, topography and the way movement feels emerged when one participant, Joe based in Australia, who was a sporadic user of self-tracking technologies began to describe how new questions had come to him when cycling. He used his apps only for specific training purposes, because he considered the GPS worked inadequately on his new smartphone, making the data collected insufficiently accurate to be useful. However, he had been impressed by the possibilities of self-tracking apps, having used the app Strava when training for marathons, and had intended to use it out of 'curiosity' when cycling to an area of the city where he used to work in order to gain a better sense of both the distance and the elevation. He recalled that this route was very steep, 'or it feels very steep', and in some places, 'you feel you're almost there, so you feel like you're on the flat but there's a hill, and there are other places where it looks totally flat but there's a slight incline'. He was interested to know, 'does the degree of difficulty in the journey correspond to its actual topography, or is it just psychological'.

For another Australian participant, Jason, the relationship between the data, his physical experience and the environment was central to how he used self-tracking technologies. Jason was a serious but not professional athlete and used specialised technologies only for training, rather than everyday self-tracking. This example demonstrates in a more extreme and self-conscious way the possibilities of self-tracking technologies to tell us not about the body in isolation, but about the body–mind in the environment. Jason explained how usually when running he may not need to use a self-tracking technology, since, 'you usually monitor how hard you are running just purely on breath, just how hard your lungs are working'; however, for training he used a range of technologies to monitor both his heart rate and his splits (the time it takes to cover a specific distance). He explained how this worked for him in the context of running up hills:

> With normal running maximum breathing is going to be your constraint, you don't need a monitor to tell you that. With hill work, breathing actually isn't the problem, it's actually being able to flush your muscles out fast enough . . . and again, you can feel, muscles just stop working, you can feel that, but . . . often your muscles will shut down before they really need to and that's where you need the heart rate monitor information to tell you actually how hard you are pushing yourself. So . . . I know where my maximum heart rate is . . . if it drops down below that I can check that, but when you're in that zone breathing is already a problem, you're well into that, can't breathe fast enough . . . but you can push through that. The

> lactate in your muscles is building up . . . but you can push through that as well, so there's two things. You need to override what your body's telling you, but heart rate is the one honest signal that you can't push through . . . because there's nothing on the other side of that.

Here, we can see how a particular type of topography when assembled with self-tracking technology, and the human body generates particular practices and ways of feeling. This way of using self-tracking was also described by another participant, Per in Sweden, in a slightly different way but with the same focus on how it could be used in relation not only to how his body moved, but also in connection with how he ran in relation to the environment. As a non-professional runner, Pers main interest lied in feeling good when running long distances and he used the app RunKeeper to keep track of his pace so he would not run too fast even though he was encouraged to run faster by different features in the environment. He explained that he used the app to organise his running cadence in relation to what he was going to run through in terms of terrain and topography. For him, it was all about maximising the experience of running as it unfolded, not keep track on statistics afterwards. One example of this was when he planned for running the New York marathon and he had decided not to use any self-tracking equipment because he wanted to appreciate the situation fully and 'high-five my children, enjoy myself and take photos'. However, in the preparation for the race, he joined a guided tour with a race coach who guided the participants through the whole track and warned for pitfalls where people usually ran too fast for their own good. As he explained it,

> The runcoach told us 'Here, in spite of that we have run 25 kilometers, the most of the people do their fastest kilometre precisely here. And that is not good. People run too fast here because people stand here cheering and there is a totally mad DJ who stand down here and play music that pushes you to run faster'. And time to time during the guided tour the run coach gave examples where people usually run too fast depending on elements in the environment. . . . And then I thought I just might wear the equipment anyway, just so I won't be carried away. . . . And when I was running I watched my running clock and realised that I actually ran too fast at these places even though I knew that I shouldn't. . . . I also realised that it took four whole days before I looked at the data I had recorded during the marathon. And it didn't give me any new information.

In Jason's description, the relationship between the hills, pain, data and chemical processes in the body formed an entanglement of sensations, processes and representations that produced certain meanings within a specialised training context. Here data were much more than a representation of the self or the body, but rather an outcome of particular configurations and relationships between body, mind, technology and environment. Because Jason's example was extreme, it demonstrates the complexity behind the configurations that self-tracking data emerges from and at the time helps constitute. Pers' example shows this in a less extreme way, but again emphasises how topography, data and bodies came together to define the experience of self-tracking. That is, it showed how self-tracking is concerned with the body–mind as part of the environment not as separate from it. Furthermore, like the example of Jens' use of the 10,000 step circle display, both of these examples show how self-tracking data can be not simply an outcome of the context, but it is embedded in the question of what happens next: it is part of the ongoingness of the way the body moves through the environment, the experiences that are forged, and how we learn incrementally as we go along.

Through self-tracking technologies, participants were able to reflect on their relationships to the ground/topography and on what and how they knew through their encounters with it. The examples also show how the mind–body–environment comes into play in particular ways when self-tracking technologies are discussed and demonstrated, and that the technologies and the data

representations that they produce are part of the ways in which these everyday worlds and activities are encountered and known. Self-tracking makes explicit not just new knowledge about the body, but is part of a particular way of being in the world.

Conclusion

In this article, we have argued that the growing phenomenon of locative and mobile self-tracking offers us new ways in which to understand how everyday lives and worlds are experienced and mediated. To a certain extent, the possibilities of self-tracking correspond with those of camera phone photography and the form of 'emplaced visuality'[69] associated with it, in that its outcomes can be seen as representations of our incremental ways of knowing and learning as we move through an experiential, material and digitally mapped world. Yet self-tracking provides a further perspective. Like other locative and mobile media, self-tracking technologies and activities are spatial technologies that render our worlds as meaningful because of the ways in which they configure, and are in turn configured by, relationships between mind, body, technology and environment.

Self-tracking technologies are becoming part of our ways of being in the world, and are implicated in both our ongoing everyday activity in the world and our perception of the environment and of ourselves as part of it. This is not to place self-tracking technologies at the centre of a research agenda, or to argue that they are leading to momentous technology-driven change in our everyday worlds. Rather we are concerned with how self-tracking is implicated in shifts in how many people's embodied routes through the digital materiality of the everyday are experienced. This is not simply part of a new quantified/quantifiable environment, but equally part of the sensory, affective, qualitative and often unspoken world. As we have also noted earlier, this denotes a departure from existing approaches to how digital, material, technological and human assemblages have been understood in human geography. Recent work, in particular by Kinsley and Ash has put at its core a concept of 'technicity' which refers to the human–technology relationship in terms of 'the (emergent) qualities of that relationship as it is performed'.[70] While, for instance in Ash's rendering of technicity in the context of video game players, there is concern for the 'body-brain-environment relationship assemblage as they go',[71] here the reference is to the environment of the game, rather than to environment in the sense that we have developed it; that is, to refer to the ongoingly moving and emergent configurations of processes and things that constitute the worlds we are part of. Therefore, while we would agree with Kinsley that 'to study digital technologies in terms of technicity offers a means of studying contemporary socio-technical situation that recognizes the inherently material character of "virtual geographies"',[72] the example of self-tracking urges us to take a further theoretical step. This requires us to go beyond the socio-technical to an understanding of digital materiality, which as we have emphasised above sees digital technologies, their content and their presences as part of our environments. As part of this digital materiality[45] – 'a process, and as emergent, not as an end product or finished object' and 'not to a state or a quality of matter' – self-tracking technologies are involved in the complexities and contingencies of wider environmental configurations with humans, rather than simply being technological objects which can be studied for their capacity to generate contingent affects or other qualities with humans. These theoretical moves have substantive and methodological implications.

First, methodologically they allow us to consider new ways that researchers can collaborate with participants to co-produce understandings of tacit or unspoken ways of knowing. If self-tracking technologies participate in the generation of modes of knowing and being in the world, working with participants in their uses of them offers us new ways to encounter other people's experiential and non-representational worlds with them through such technologies. The example of

self-tracking, and a focus on the experience of users of self-tracking technologies invites us into a world of measurement in ways beyond the emphasis in existing literatures about non-representational approaches, on how calculation, measurement, code and the imaginations of technology designers will shape the way people experience technological futures. Researching with self-tracking technologies enables us to focus on how the technological present, as it ongoingly slips over into the future, is entangled with mind, body and environment as these elements co-constitute present, anticipated and future experiential worlds.

Second, the agenda we propose has implications for how to situate studies of human–technology relationships in a world where digital data increasingly (albeit differently) compose our environment with the ground underfoot, sky and wind. Here, we argue for attention beyond the material qualities of the digital/virtual and the affects of human–technology interaction, and towards their often less visible or less obvious co-constituents. It is, we argue, through engaging with this deeper situatedness that we can further understand the contingent and emergent ways of being in the world related to technology design and use. This refers not simply to self-tracking technologies but to the wider range of already existing and emerging technologies that involve elements such as tracking through the environment, play and data visualisation.

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