Digital Healing? Digital Capitalism?

Neoliberalism, Digital Health Technologies, and Citizen Health

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Abstract The emergence of digital health and illness technologies and the digitisation of capitalist economic production reflect the increasing cyborgisation of organic matter within current economic and social relations. In this paper I employ a materialist and posthuman approach to 'digital health', investigating micropolitically what digital technologies and apps actually do, within the contexts of contemporary social relations and the emergence of digital capitalism. This enables new insights into the impacts of the digital upon social production, making sense of the contribution of both human and non-human matter both to digital health and to the wider economics and politics of neoliberal health care. The paper evaluates four digital health technologies to consider what capacities they produce in bodies and the micropolitical impact of the technology in terms of power, resistance and social order. I then consider how these micropolitics might be changed by altering the contexts or other forces, and argue that this opens up ways for digital technologies to be used to promote radical and transgressive possibilities, by re-engineering the interactions between technologies and other materialities. I conclude by discussing 'digital activism'. I examine how technologies and apps may be engineered to democratise data: to enable collective responses to health issues, to challenge health policy and to organise against health corporations, environmental polluters, and purveyors of fast and processed foods. This collective, bottom-up model of 'citizen health' (Rimal *et al.* 1997) counters both the marketisation of health and the paternalism of health care.

Keywords capitalism – citizen health – digital health – micropolitics – new materialism

Introduction

The medical device market was estimated to be worth $512bn in 2022, with an annual growth of six per cent (Fortune Business Insights 2023). Medical devices range from CAT scanner to hospital bed; surgical instrument to hearing aid (Topham 2003). Personal medical devices (PMDs) are a defined sub-category, comprising near-body devices or technologies designed for use by a single individual, primarily outside healthcare facilities (Ren & Batra 2013). Many PMDs enable monitoring of body functions or performance, and are used either for self-care purposes or with medical oversight; some have capacities for an associated therapeutic intervention.

Personal or 'near-body' medical devices are nothing new: early examples include false teeth from Roman times (Crubézy & Girard 1998) and spectacles from the medieval period (Cashell 1971). Later devices included artificial limbs and wheelchairs, and more recently, contact lenses, cardiac pacemakers and joint prostheses. Since the 1980s, however, a new range of near-body devices have emerged that build in some kind of connectivity using wireless internet or radio-frequency (RF) technology (Pantelopoulos & Bourbakis 2010), Internet of Things (IoT) technologies (Karthick, Ramkumar, Akram & Kumar 2021) or other information or communication technology (ICT) affordances (Lupton 2021). For example, a monitoring device may link to a remote health care facility and transmit clinical data on blood pressure or blood sugar, to be collected and aggregated remotely by biomedical personnel. Alternatively, devices may process this data themselves and respond – for instance to deliver medication or actuate a heart pacemaker. This new

generation of PMDs will be described here as *digital health technologies* (DHTs).

Many of these DHTs monitor body parameters, from blood pressure and chemistry, to food intake or hours slept per night, while others sense body motion or activity (Kaplan & Stone 2013: 478; Lupton 2013: 393–394). Longitudinal monitoring can be used to manage diet or exercise regimes (Till 2014), to identify rare or irregular events and syndromes that develop slowly over time (Rodgers *et al*. 2012: 936), to monitor food intake, or to alert emergency services, for example in the event of a fall or loss of consciousness (Patel, Park & Bonato 2012: 2). Infusion pumps automatically deliver therapeutic doses of drugs such as insulin or analgesics, according to medically pre-designated schedules, while implantable devices both monitor and intervene, for example to provide heart pacing or – if needed – more dramatic interventions such as cardiac defibrillation (Goldenberg, Gillespie & Moss 2010).

The claimed benefits associated with the clinical DHTs are improvements in health care delivery to an ageing population that requires more frequent health monitoring (Silicon Labs, n.d.: 1). Networking devices via digital mobile technology can reduce costs in care delivery by connecting people to their health care providers, while improving access by patients and providers to reference materials, lab tests, and medical records (West 2013: 1). However, warnings have been raised concerning security risks – in particular for those implanted in patients – from both malicious attacks and accidental breaches (Maisel & Kohno: 2010).

Devices with a specific medical application are subject to regulatory authority – for example by the Food and Drug Administration (FDA) in the US and Medical and Healthcare Regulatory Authority (MHRA) in the UK. However, others – such as the *Fitbit* and Apple Watch, or apps for mobile phones such as *WellnessConnected* or *Map My Fitness* that monitor body activity are marketed commercially. Some of these devices have become part of a 'Quantified Self' self-tracking movement (Lee 2013, Lupton 2014; Lupton 2019: 2004–2006) that encourage people to evaluate their fitness and health indicators, their time use or hours of sleep, with the aim of enhancing wellbeing and personal efficiency (Paddock 2013; Thomas Lupton & Pedersen 2018). The digital data gathered by these devices can either be retained for private use, or uploaded to servers provided by their manufacturers, enabling data analysis and data sharing with other users (Lupton 2013: 394). In 2015, 63 per cent of US citizens wished to monitor their health using connected devices (Salesforce 2015), while the market for self-care monitors was $18b in 2016, with projected growth of almost 20 per cent per annum to 2023 (Loomba & Khairnar 2018).

Critiques of these DHTs argue that they are part of a neoliberal trend towards 'digital capitalism' (Fuchs 2018; Schiller 2000; Staab 2017). This has been defined as the facilitation of capitalist social relations such as free trade, globalisation, privatisation and individualism by digital technologies (Barassi 2015). It reflects both the emergence of a capitalist knowledge economy, and the development of web-enabled digital technologies for commerce and marketing, and as a platform for consumerism. The growing digitisation of capitalist economic production (Schiller 2000) has facilitated not only the development of DHTs but also the emergence of a wide range of digitally-enabled commerce and services, from Amazon to Uber (Grabher & van Tuijl 2020). These opportunities have accelerated the move toward the privatisation and marketisation of health care and other personal services (Faulkner-Gurstein & Wyatt 2023), and have consequently made the digital technology sector a growth area for investment and take-overs (Schiller 2011), while undermining traditional modes of retailer/consumer or provider/client interactions (Staab 2017: 289). In relation to healing, digital capitalism supplies opportunities to replace conventional professional/client models with market- and data-driven care (Fox 2017: 144–145).

In this paper, I shall consider the social, economic and political implications of these developments for care and healing, by examining the micropolitics inherent in the networks/assemblages surrounding DHTs. I will explore 'digital health' via a materialist and posthuman approach (fully described in the next section), investigating micropolitically what digital technologies and apps actually *do*, within the contexts of contemporary social relations. This enables new insights into the impacts of the digital upon social production,

making sense of the contribution of both human and non-human matter both to digital health and to the wider economics and politics of neoliberal health care (MacGregor 2001; Mooney 2012). However, I also consider how DHTs may be re-engineered to counter digital capitalism and foster new forms of collective activism around health and well-being.

A new materialist framework for analysing digital health

To assist in analysis of the micropolitics of digital health technologies, I apply a new materialist framing (Barad 1996; Coole & Frost 2010; Fox & Alldred 2017. The new materialisms focus upon the interplay of material forces within the unstable assemblages that emerge around bodies and technologies such as DHTs. They have been informed by a disparate skein of social theories including actor-network theory (Latour 2005), biophilosophy (Ansell Pearson 1997; Massumi 1996), feminism and queer theory (Braidotti 2006; Grosz 1994; Haraway 1997), philosophical posthumanism (Braidotti 2013), quantum physics (Barad 1996) and Spinozist monism (DeLanda 2006; Deleuze 1988). Like post-structuralism, this 'new' materialism is concerned fundamentally with the workings of power within physical and social spaces, but is focused firmly upon social production rather than social construction (Coole & Frost 2010: 7), and emphasises matter rather than textuality.

As an approach to studying social and natural phenomena, new materialism steps back from an anthropocentric emphasis upon the consequences of human social processes (in the current case, DHTs and their application) for human health and human subjectivities. In place of this anthropocentric focus, the new materialisms adopt a post-human or 'more-than-human' breadth, acknowledging the capacities of all matter to affect. This more-than-human breadth shifts the ontological focus of social inquiry from entities to relationality: from what humans, their bodies and their identities *are*. Instead it explores what relational networks or *assemblages* of animate and inanimate entities *do*. The aim of such an inquiry is consequently to examine how bodies and non-human matter affect and are affected (DeLanda 2006: 4), and what capacities to do, think and feel are thereby produced in bodies, collectivities of bodies, and in other matter. Significantly, this shift from a privileged and agentic human to 'flows of affect' in assemblages acknowledges that things, organisations, social formations and concepts contribute to social production as much as – if not more than – human bodies/subjects.

However, this ontology also extends materialism beyond traditional concerns with structural and 'macro' level social phenomena. Power is explored not by positing 'causal' or 'explanatory' social structures such as 'capitalism' or 'biomedicine', but by unpicking the play of forces or 'affect economy' (Clough 2004: 15) that assemble around the actions and events that produce and reproduce the world and human history. These forces may be physical, psychological or cultural, and – importantly, include the material products of thoughts, desires, feelings and abstract concepts (Braidotti 2000: 159; DeLanda 2006: 5), thereby cutting across both the nature/culture and mind/matter dualisms that invest much social theory (van der Tuin & Dolphijn 2010: 155).

Applied to empirical research, an ontology of assemblages and affects requires an approach to data that can reveal the web of material relations surrounding DHTs and their use (Fox & Alldred, 2015). These materialities range from the manufacturers and retailers that market these devices, the science, engineering and design that makes them work, the medical and information technology professionals that develop DHTs or assess data they produce, through to the domestic and other spaces where these technologies are used, the physiological and biomedical processes that they monitor or manage, and the desires, expectations and concerns of users. As such, new materialist analysis dissolves boundaries between what are conventionally regarded as the 'macro' level of institutions and social organisation and the 'micro' level of human desires and experiences, recognising that what these aspects of the social have in common is an ability to affect or be affected.

The task of analysis will therefore be to document the assemblages of bodies, technologies and other relations that accrete around DHT use; to explore how these relations affect and are affected during DHT use; and to assess the micropolitics of these assemblages and the consequences for DHT

users and others involved with them. The first step in this analysis is to examine four different DHTs – selected to present a range of devices, from those with a biomedical objective to those intended for use by individuals or organisations independently of clinical oversight. For each of these DHTs, the analysis will examine the relational assemblage surrounding its development and use, consider what this assemblage does, and evaluate the micropolitics that link the particular device to bodies, organisations, ideas and desires. These micropolitical analyses will then be used to explore the different interests that may be served by DHTs, and what these suggest for the future development of such devices.

The micropolitics of digital health technologies

The four DHTs to be analysed in this section range from a monitoring app to support clinical decision-making through to an app that links consumers to virtual health and fitness coaches. Based on the available literature and manufacturers' online marketing materials, I will first describe the DHT, and then analyse it micropolitically to understand what it does, not only functionally, but also in terms of the capacities it produces: in users and in other interested parties (for example, health professionals and/or commercial or corporate interests).

MS Mosaic: A multiple sclerosis management app

MS Mosaic is an iPhone app developed by researchers at North Carolina's Duke University, US.[1] It aims to enable multiple sclerosis sufferers to monitor their condition on a daily basis, but also provide clinicians with data on their patients' disease between check-up consultations to assist in disease management and medication prescribing.

The app incorporates a range of different data collection techniques, including a daily survey of changes to sufferers' symptoms, a battery of performance tests to assess hand coordination and walking speed, and tests of memory and attention. It also gathers data from the iPhone's built-in sensors, such as steps taken or hours slept per day. Users can send a report to their doctor summarising trends since their last check-up. The developers suggest that such additional data will assist clinicians to more successfully manage this progressive but unpredictable disease via medication and other therapies (Lewis 2017).

This summary allows identification of the key material elements within the *MS Mosaic* assemblage. These can be summarised as comprising at least:

> body; disease; symptoms; iPhone; sensors; app; clinicians; researchers; pharmaceutical industry

In addition to the stated functions, a range of other micropolitical effects can also be identified. While the app supplies users with a capacity to monitor their disease on a daily basis, the principal beneficiaries are clinicians, however. By gathering a range of data, *MS Mosaic* provides the clinicians with a capacity to assess disease progression 'objectively': they can now interrogate the disease directly, without recourse to patients' memories and subjective reports of their symptoms. Consequently, patients are disempowered during check-ups, with their accounts of disease progression sidelined in favour of data gathered by the app.

Fitbit: A self-tracking DHT

The *Fitbit* is one of a number of commercial devices (similar devices include the *Nike+ Fuelband*, the *Apple Watch* and *Garmin Vivofit*) that can be worn or carried on the body. The device monitors various body parameters including heart rate, and incorporates an accelerometer to monitor and record motion and posture, hours slept and so forth. Data is sent wirelessly to a computer or mobile phone where it can be displayed graphically and can calculate calories burned and other functions; this also enables data to be shared.

The *Fitbit*-user assemblage comprises at least the following relations:

> body movements; terrain; device; wearer; manufacturer; associates

The key affect driving this assemblage is the *Fitbit*'s capacity to gather data on posture, movement and heart rate and turn these into quantifiable outputs that can be displayed, analysed and inter-

preted. However, the affect economy that links assembled relations produces not only the device's specific functionalities but also new capacities in the user (including motivations towards certain behaviours such as exercise or sleep), new opportunities to share and compare behaviours with peers. At the same time, this affect economy also provides the device's manufacturers with the capacity to exploit the data gathered for commercial purposes.

These complex affective flows generate a specific micropolitics that has the outcome of responsibilising the user, but at the same time – by quantifying and making explicit certain aspects of daily life, and enabling comparisons with other users – encouraging certain normative behaviours around fitness, sleep, weight etc, creating new body routines and regimens, and producing competitiveness with self/others. By drawing users into an assemblage with commercial interests, private aspects of a user's life are commodified and commercialised (Till 2014).

Splendid project

Splendid is a European Union-funded project still in its pilot stage that aims to reduce obesity among adolescents and young adults by providing personalised services to guide users toward healthy eating and encourage exercise.[2] It uses an interactive system to accurately track eating and physical activity, and provides goal-oriented feedback to the user. The programme uses a range of body sensors (a mandometer to monitor eating behaviour, an accelerometer to assess physical activity, and a chewing sensor). Outputs from these devices link by smart-phone to clinicians, who provide advice on nutrition and exercise to participants.

The *Splendid*-assemblage comprises at least the following elements:

body; food; terrain; sensors;
phone; clinicians; population

The DHT serves its stated aims by gathering detailed data on eating and exercise and crunching this data using algorithms to process and evaluate the behaviour of participants. More broadly, *Splendid* creates capacities for public health professionals to obtain detailed data on users' eating and exercise behaviour, allowing them to personalise their advice and diet plans.

This has a number of micropolitical effects. First it biomedicalises eating and exercise and locates them as elements at a population level that contribute to 'problem' categories such as overweight and obese. Second, it places assessment of these in the hands of the technology, disempowering users from assessing their own food consumption and health needs. Finally, it aggregates its target users (who may be profoundly different on many variables) as an 'at risk' population.

Vida: Virtual health and wellness coaching

Vida is a digital platform developed by Vida Health. This is one of a small number of US commercial start-ups that provides virtual coaching: to address 'unhealthy' behaviours associated with chronic conditions such as obesity, hypertension and diabetes, as well as a range of mental health issues.[3] At the core of *Vida* is a mobile phone app, which can be linked to a wide range of trackers and monitors, including pedometers and wireless scales. These enable needs for behaviour change to be identified, and progress towards targets assessed. Participants can select a coaching style such as 'cheerleader' or 'drill sergeant' to suit their own preferences; they are then matched by the app with a list of virtual coaches recommended by Vida. Coaches include nutritionists, physical therapists, cognitive behavioural therapists and social workers (Mao *et al.* 2017: 3). Participants enter into a commercial subscription to Vida that covers the costs of the app and the health coaching. The app is marketed to individuals, but primarily to US employers who wish to introduce a tailored health programme for their staff.

The Vida-assemblage comprises at least the following relations:

body; app; monitors; coach;
health programme; employer;
Vida Health; shareholders; profit

According to its website, the stated objective of the Vida app is to 'support individuals with evidence-based programs that address their behav-

iors and underlying health conditions'. Analysing the app micropolitically, the approach replaces a conventional patient/professional relationship with a consumerist and privatised model, in which individuals (or their employers) pay for coaching to achieve health promotional and public health objectives. The app serves as an intermediary between consumers and health coaches, providing users with the capacity to access a wide range of health coaches suited to their individual needs. However, the main outcome of the app's business model is to supply Vida Health with a capacity to monetise the data gathered by its body-monitors by putting clients and coaches together. In addition, by marketing directly to employers, the company gains a capacity to enrol organisations as a third party in their business.

This materialist and micropolitical analysis of these four DHTs provides the basis for the following discussion of contemporary moves towards digital health and digital capitalism as drivers in healing relationships.

From digital health to digital capitalism

The four DHTs assessed in the previous section, while having in common similar technical functions (variously linking body sensors or monitors to phone or internet platforms), diverge significantly once analysed micropolitically. At one end, *MS Mosiac* supplies a digital solution to support a conventional interaction between patient and health professional. As such it may be considered as medico-centric, serving principally to enhance clinical decision-making. At the other, *Vida* replaces this patient/professional model with a consumer relationship, in which paid-for commercial services assist individuals to achieve behavioural changes.[4] Between these extremes, the *Splendid* project uses digital monitoring to address public health objectives, targeting at-risk individuals and this improve population-level health, while *Fitbit* and similar platforms offer means for individuals to track aspect of their daily activities and fitness, and their parent company's to gather a wide range of health data from users, with potential commercial uses.

These four case studies together summarise the contemporary spectrum of DHTs, supplying a snapshot of the ways in which digital health technologies and apps are currently being used. This spectrum ranges from supporting traditional clinical activities through to a full-blown digital capitalism that privatises and individualises many features of health care. The issues around patient/professional interactions and recent trends towards self-care have been very well addressed by social scientists researching health. However, it is the emergence of 'digital health capitalism' upon which I wish now to focus in this chapter, before then offering an alternative perspective: 'citizen health' (cf. Rimal *et al*. 1997).

In the introduction I outlined the main features of digital capitalism, and it is worth summarising these briefly once again. Specifically, digital capitalism may be understood as the enabling of marketised, privatised and individualised social relations via digital technologies (Barassi 2015). These technologies increase efficiency by reducing overheads associated with physical business infrastructure such as offices or retail outlets; they bring together a wide range of providers and consumers; they remove geography as a factor in providing goods or services; they mirror or mimic many aspects of conventional markets. These features enable digital commerce to reduce margins and hence increase competitiveness, at the expense of traditional providers. *Amazon*, *AirBnB*, *Uber* and *Asos* are well-known examples of digital capitalist enterprises.

The *Vida* app described earlier reflects all these aspects of digital capitalism. It overcomes a need for premises such as gyms to deliver fitness coaching; it connects clients to a wide range of potential coaches independent of physical location, increasing the likelihood of achieving a 'good fit' and hence continued purchase of services; it mimics the conventional relations between client and coach without physical co-presence. Finally, by providing a 'one-stop shop' for coaching across both physical and mental health it drives down cost margins for purchasers of services (both individual consumers and employers), undercutting other non-virtual providers of health and wellness therapies.

The critique offered earlier of *Vida* serves to offer a more generalised commentary on what might be termed 'digital health capitalism'. First, it substitutes social relations between 'patient' and 'health professional' with market relations,

in which health and fitness are commodities to be purchased alongside other goods. These marketised relations privatise health care, replacing both clinical care and public health with monetised services. In this way, they consolidate and potentially extend globally a neoliberalised and marketised model of care, in which consumers (or in the case of the *Vida* model, employers) have both moral and financial responsibility for health and fitness, rather than communities or governments. Digital health capitalism consequently undermines conventional health and welfare service delivery, potentially disadvantaging those least able to afford privatised care, and consequently increasing health inequalities.

While this critique of *Vida*'s business model does not diverge notably from a standard political economy assessment, the materialist and micropolitical perspective offered in the previous section provides a further twist to the analysis. The *Vida*-assemblage engages client bodies at the level of their behaviour, with the objective (via coaching) of establishing new health and fitness capacities, while removing capacities deemed unhealthy or negative. The micropolitics of this DHT excludes any acknowledgment of extraneous or underlying causes that may be producing such 'unhealthy' behaviours. These may include poverty or lack of access to resources or health care; natural or sociocultural environmental causes; problems or issues in home or work lives; and inequalities or discrimination deriving from an individual's social identity or social position. *Vida*'s business model thus implicitly individualises and de-socialises health. This model of health care gains a further twist, given Vida Health's main customer target (US employers responsible for staff health through insurance schemes), such that employee health emphasises personal responsibility for ceasing 'unhealthy' behaviours.

This analysis reveals digital health capitalism not simply as the most recent development in contemporary health care, but as also reflecting features of neoliberal marketisation of services. The importation of privatised and individualised social relations into health care undermines social and public health models of health and illness, and contributes to the current dismantling of socialised health and welfare systems in many jurisdictions. However, a micropolitical perspective enables not only the analysis of DHTs, but also potentially the re-engineering of such technologies to meet alternative micropolitical objectives. It is to this task that I turn in the final section of this chapter.

Digital health activism and citizen health

I have shown, with recourse to four case studies, that digital health technologies have been used to support health care models, including a clinician-focused approach, self-care, and the commercial endeavours that I have labelled as 'digital health capitalism'. In the previous section I focused on the last of these, identifying the affective movements that this approach to health care mediates. However, I now wish to suggest that – just as commercial interests may seek to establish marketised and neoliberal DHTs – there is an alternative and diametrically-opposed model of care possible. DHTs may be used to foster what might variously but described as 'digital health activism' or 'citizen health'.

Underpinning this approach is resistance and refusal of models of health care that constrain action to promote health and wellbeing, not only individually, but also collectively. Hence, in opposition to a top-down public health model, health activism resists surveillance and responsibilisation of individuals for their health and wellness, and re-emphasises a range of forces beyond individual control. Against a biomedical approach to health care, it rejects medicocentric emphases on disease entities in favour of positive understandings of health and wellness. And in opposition to commercial or corporate interests, it counters marketised approaches to health and wellness, while also identifying the negative consequences of markets for both human health and environmental sustainability (Fox & Alldred 2020).

My proposition here is that DHTs may be co-opted as part of this resistance: to establish some very different capacities in their users. DHTs developed according to a health activism agenda would:

• Promote health and illness not in terms of a biomedical model – linking health not to individu-

al biology or psychology, but to the capacities of people and collectivities to engage productively with their social, economic, political and cultural milieux.

• Provide a means for collective and intersectional responses to health and illness issues – enhancing capacities for people and communities to address health and illness threats and opportunities together and across sectional (social class, gender, sexuality, race etc.) divides, rather than as individuals.

• Counter marketised health care initiatives that turn users of services into consumers, and monetise health and wellness services.

• Challenge and develop health policy – providing data and analytical capacities and resources that can inform health policy development or campaigns for health-related improvements to a locale or sector.

• Organise against health corporate interests – offering a means to challenge the power of corporations such as environmental polluters, purveyors of fast and processed foods, and against corporate health care providers.

• Synchronise health and environmental sustainability – rejecting policy initiatives that seek human health or development gains at the expense of the environment and sustainability.

Elsewhere (Fox 2017) I have outlined an example of a DHT that could deliver on some or all of these objectives, based on existing digital technology solutions. A network of health devices could be used by users to gather and crunch relevant health data (physiological, social, environmental) in order to assess health status and risks to health across a locality (or a specific sub-community such as LGBT citizens or teenage parents). This DHT would be based on different communication architecture from a many-to-one or 'hub-and-spoke' model underpinning apps such as those described earlier in this chapter that link bodies individually to health professionals or to corporate databanks. Instead, it would use a many-to-many communication protocol to build networks of connected bodies and social formations that may challenge biomedical health care, neo-liberalism and individualising DHTs.

For example, air quality monitors could be installed across a neighbourhood to assess risks to health from traffic pollution, and crunch data into statistics that may be disseminated to local media and social media, and sharing knowledge resources via local libraries and universities. Data on health-related problems suffered by members of a community as a consequence of housing defects in social or rented accommodation (such as damp, poor loft or wall insulation, or costly energy sources) can be collated and sent to local government housing and public health departments. Evidence from such digitally-enabled networks may be used by community groups to co-ordinate action and build coalitions with health professionals, politicians, researchers and others, to engage local and national media, and to support local policy development.

A DHT such as this can contribute to what has been called a 'citizen health' agenda (Rimal *et al*. 1997), which rejects an individualised approach to health, and opposes biomedical or corporate interests, including the neo-liberalisation and privatisation of health care and the monetisation of health and wellness. Health activism may be regarded as 'a challenge to the existing order and power relationships that are perceived to influence some aspects of health negatively or impede health' (Zoller 2005: 344), often focusing on inequality or inequity, or facilitating collective mobilisation (Parker *et al*. 2012: 100). DHTs can be radically re-engineered to serve different, radical and critical, agendas. It is not hard to envisage producing apps for networked devices that can subvert the principles underpinning commercially-developed monitoring devices; indeed, some platform providers such as *Apple* apparently welcome app developers to contribute to their health-related app portfolio. It is not fanciful to see possibilities for DHTs that may deliver to collectivities some of the capacities suggested under the rubric of citizen health, or even transform the micropolitics of technologies such as *Splendid* or *Vida* that were discussed earlier.

Concluding remarks

The materialist and micropolitical analysis conducted here has considered DHTs not as pre-existing, stand-alone entities, but in terms of what they do, in the widest sense, within the assemblages of human and non-human relations that enable them work. By exploring different DHTs in this way, it has been possible to reveal the specific affect economies that mediate the relations between bodies and technology in each case, and by assessing these economies also to identify the micropolitics that these various DHTs manifest and sustain. This approach thereby enables a materialist reading of any specific DHT, and an opportunity to offer a critical assessment of how devices contribute to different agendas, for instance, of biomedicine, public health or digital capitalism.

The materialist approach offers the potential to design device assemblages with specific micropolitics and affect economies that can further such objectives, and the paper has offered the possibility of a 'resisting' device-assemblage that might achieve certain capacities to address community-level health needs or counter threats to health, for instance, from local polluters or developers. In part, such a resisting assemblage works because of the affects designed into the technology (for example, enabling many-to-many sharing of data and community information, and providing access to resources), but it also inheres in the affectivity of its users, which in the example articulated earlier within this resisting perspective included a collective rather than individualised orientation and an antagonism to top-down power associated with both biomedicine and digital capitalism.

If the last century saw the rise of industrialised medicine, and the dominance of a biomedical model of health, I would suggest that we are now living in an era in which digital technologies open the door to the colonisation of health care by digital capitalism, undermining those jurisdictions in which socialised medicine and not-for-profit welfare systems have until now resisted the full-blown marketisation of health. As such, DHTs pose a clear and present danger. However, I have argued here that they also supply opportunities for community, public health and activist groups to contribute to an agenda for health activism and citizen health. In this alternative future, a new generation of DHTs that resist and subvert the consumerisation, biomedicalisation and individualisation of health can play their part.

Notes

1 See https://analogrepublic.com/work/ms-mosaic.
2 See https://splendid-program.eu/.
3 See http://www.voda.com.
4 Vida Health's business model also establishes employee health as a core concern for business and public sector organisations, introducing a neo-paternalist (Schram *et al.* 2010) element into workplace relations.

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