# Quantified Sex: A Critical Analysis of Sexual and Reproductive Self-tracking Apps

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**Abstract**

Digital health technologies are playing an increasingly important role in healthcare, health education and voluntary self-surveillance , self-quantification and self-care practices. This article presents a critical analysis of one form of these technologies: mobile apps used to self-track features of users' sexual and reproductive activities and functions. After a review of the content of such apps available in the Apple App Store and Google Play store, some of their sociocultural, ethical and political implications are discussed. These include the role played by these apps in participatory surveillance, their configuration of sexuality and reproduction, the valorising of the quantification of the body in the context of neoliberalism and self-responsibility and issues concerning privacy, data security and the use of the data collected by these apps. It is contended that the apps represent sexuality and reproduction in certain defined and limited ways that work to perpetuate normative stereotypes and assumptions about women and men as sexual and reproductive subjects. Furthermore there are significant ethical and privacy implications emerging from the use of these apps and the data they produce. The article ends with suggestions concerning 'queering' such technologies in response to these issues.

## Introduction

The term ‘digital health’ (or alternatively, eHealth, mHealth, Health 2.0 or Medicine 2.0) has become frequently used to describe the various ways in which digital technologies can be employed in medicine and public health. Recent writings on digital health have presented a future in which digital technologies are able to promote ‘patient engagement’ and encourage individuals to monitor their bodies in the interests of preventive medicine and self-care, thus not only improving health and healthcare but reducing healthcare expenditure (Levina 2012; Lupton 2012, 2013a). Advocates of these technologies describe the benefits they see of ‘digitising the patient’, or rendering people’s bodies into digital data formats. It is contended by these commentators that bringing together sensor-based technologies and wearable computing with the potential of both ‘small data’ (detailed data one collects about oneself) and ‘big data’ (large masses of aggregated data) will inform lay people and healthcare and public health professionals alike (Smarr 2012; Swan 2012a, 2012b; Topol 2012).

In this article I present a review and critical analysis of one particular digital device: computer software applications (commonly referred to as ‘apps’) that have been designed to be used voluntarily for the self-monitoring and self-quantification of sexual and reproductive activities and functions. The ubiquity and widespread use of apps is such that they constitute an important genre of new digital technologies. Millions of apps have been developed for downloading to mobile devices such as smartphones and tablet computers. Yet thus far there has been little detailed social or cultural analysis of their production, content, function or use (Goggin 2011; Krieger 2013).

The research outlined in the article contributes my research program in critical digital health studies, a term that I have adopted to encompass a perspective that addresses the social, cultural and political aspects of the digital health phenomenon. Previously published

work in this program has examined such topics as digitised health promotion (Lupton 2012, 2013a, in press-a), the digitally engaged patient (Lupton 2013b), the quantified self and self-tracking devices (Lupton 2013c), the commodification of patient opinion websites (Lupton 2014) and the digital cyborg assemblage as it is enacted via digital health technologies (Lupton in press-b). This research program incorporates a sociomaterial perspective on digital health technologies that considers them to both assume and configure certain kinds of capacities, desires and embodiments. Apps are new digital technology tools, but they are also sociocultural products located within pre-established circuits of discourse and meaning. They are active participants that shape human bodies and selves as part of heterogeneous networks, creating new practices and knowledges.

**Digital health technologies, sexuality and reproduction**

Since the turn of the twenty-first century, people's use of online technologies and associated computer devices has changed dramatically. What are now often referred to as 'Web 1.0' technologies, emerging with the opening of general access to the internet and the World Wide Web in the early 1990s, focused largely on static knowledge provision to passive users. There was comparatively little opportunity for users to contribute online content. Some websites, discussion boards and chat rooms, blogs, email lists and listservs did allow for some content creation and sharing of material by users, but this was limited.

The term 'Web 2.0' began to be used in the mid-2000s to refer to a move from the 'information web' to the 'social web' (Rogers 2013). A new range of technologies emerged that facilitated and encouraged active participation by users. These include mobile wireless computers that allowed connection to the internet in almost any location and social media platforms such as Facebook, Twitter, Instagram and YouTube. The new digital media technologies give people the opportunity to create and upload content such as status updates,

links to other material, audio-visual material, comments and detailed personal data. Such activities are often referred to as ‘prosumption’, a neologism combining ‘consumption’ and ‘production’ to suggest the dual nature of contemporary online participation (Beer and Burrows 2010).

Creating or sharing health-related content is a major feature of prosumption activities. In relation more specifically to sexuality and reproduction, websites providing information, health education and peer support for people living with HIV/AIDS and other sexually transmissible diseases or dealing with sexuality, contraception issues and unwanted pregnancies have existed since the early days of the web (Boonmongkon et al. 2013; Courtenay-Quirk et al. 2010; Davis 2009; Horvath et al. 2010; Wynn, Foster and Trussell 2010). Many other sexuality- and reproductive-health related websites have been in use since this time (Buhi et al. 2009; Gold et al. 2011; Jacobs 2010; Magee et al. 2012; Tanner and Bhaduri 2003), including those that have provided a space for people with non-normative sexual identities to interact with each other, provide support and arrange sexual encounters (Davis et al. 2006; Nodin et al. 2011; Robinson and Moskowitz 2013; Ross et al. 2006). These have evolved to encourage greater interactions by users with each other and the sharing of personal data that may then be aggregated and archived (Divecha et al. 2012; Gabarron et al. 2012; Gold et al. 2011; Horvath et al. 2012). Platforms such as PatientsLikeMe and Patient Opinion give people with specific illnesses or conditions, including sexually transmissible diseases, the opportunity to upload illness and treatment narratives, recount their experiences with treatments and drug therapies and to rate and comment upon healthcare providers (Lupton 2014).

Part of this move towards prosumption is the introduction of digital devices and associated apps, platforms and websites that allow people to monitor and measure their bodily activities and functions and render these into quantifiable digital data. These practices

are often referred to as ‘self-tracking’ or ‘quantifying the self’. They tend to be portrayed as contributing to users’ efforts to learn more about themselves in the interests of improving their lives (Lupton 2013c; Ruckenstein 2014). A large commercial market has developed with the idea of voluntary self-tracking as its basis. Digital technologies such as smartphones with accelerometers, global positioning systems, microphones, cameras, gyroscopes and compasses and wireless devices embedded with sensors that are small enough to wear upon or even insert within the body allow users to collect data about their everyday activities and bodily functions which can then be uploaded to their health care professionals, social media networks or vast numbers of anonymous others. Wearable devices and even clothing embedded with sensors are currently available on the market that allow users to digitally record such features as body mass index, dietary intake, physical activity, calories burnt, sleep patterns, pulse and heart rate. Such devices thus offer an unprecedented opportunity to monitor and measure individuals’ habits, practices and bodies.

Tens of thousands of health-related or body-tracking apps for mobile devices are now available for downloading. These apps provide a range of medical and health information, from assisting users in self-diagnosing illness, displaying detailed anatomical information about the human body and allowing users to monitor, log and graph numerous bodily functions and habits. Some apps are able to connect wirelessly to technologies such as heart pressure monitors and digital body weight scales. To motivate users, other apps include built-in reward or docking systems so that points, badges or real money can be collected or paid if various commitments (to regular exercise or weight loss goals, for example) are either met or unmet. Data collected from many of these apps can be uploaded to related websites or to social media platforms and thus can be shared with many others.

Sexual and reproductive activities and functions have increasingly become experienced and configured via these and other technologies. Contemporary digital media

technologies, including online websites, platforms, apps and mobile and wearable devices provide many opportunities for users to learn about and discuss sexual and reproductive activities, illnesses and conditions with others, monitor, measure and record their own sexual and reproductive activities or symptoms and observe or make their own pornographic images (Davis 2009; Gold et al. 2011; Ray 2007). Using geolocation details, apps such as Grindr, Tingle and Blendr can now be used to locate potential sexual partners to arrange 'hookups' (Quiroz 2013).

The possibilities of digital technologies have also interested professionals working in healthcare and public health related to sexuality and reproduction. Some researchers have begun to comment on the potential of new media technologies such as mobile devices, apps and social media platforms for healthcare delivery, contact tracing and partner notification related to sexually transmissible disease control and health promotion activities (Cugelman 2012; Gupta, Tyagi and Sharma 2013). Several writers have promoted the use of digital health technologies for sexual and reproductive health education (Divecha et al. 2012; Muessig et al. 2013a; Muessig et al. 2013b). Young people, in particular, as so-called 'digital natives', are positioned as appropriate targets for health promotion relating to sexuality and reproduction using such technologies (Guse et al. 2012; Levine 2011; Selkie, Benson and Moreno 2011). Apps and other digital health technologies, therefore, are represented as offering positive benefits in two distinctly different but intertwined contexts; that of voluntary use in relation to achieving personal goals related to monitoring one's body data and that of health education and promotion, healthcare and patient engagement.

**Quantifying the sexual and reproductive body**

In late 2012 a Pew Research Center survey found that 85 per cent of adults in the US owned a mobile phone. Fifty-three per cent of these were smartphones, and one fifth of smartphone

users had used their phone to download a health-related app. The most popular of these apps were related to monitoring exercise, diet and weight (Fox and Duggan 2012). Many apps focus on sexual and reproductive behaviours and functions, although they are not as numerous as other health-related apps. A study of paid health and fitness apps available in February 2011 found that those directed at sexual health and fertility were fewer in number than those related to diet and exercise (West et al. 2012). Another study of all health- and medical-related apps available from the Apple App Store as of June 2013 identified over 23,000 of them. The majority of these apps (almost half) simply offered information. However one-fifth of the apps were directed at the practices of tracking or capturing personal health and medical data (IMS Institute for Healthcare Informatics 2013).

My own review of apps related to sexuality and reproduction available in Google Play and the Apple App Store conducted in November 2013 (using the search terms 'sex', 'sexuality', 'sex education', 'conception', 'reproduction', 'ovulation' and 'fertility') revealed a wide range. Some of these apps were clearly intended for health promotion and information purposes while others were more directed at sexuality and reproduction in general. The vast majority of the apps listed under 'sex' were frankly pornographic, with many more of these on Google Play compared with the Apple App Store. (This reflects differing policies of the two companies in the approval of apps. Apple engages in stringent efforts as part of its app review process to not approve apps for entry into their App Store that are viewed as presenting 'offensive material', as outlined in their guidelines for app developers [*App Review* 2013].)

The apps that were not pornographic ranged from those that claimed to calculate the calories burnt during sex to those providing sex jokes or outlining sexual positions for enhanced enjoyment. More serious apps designed for medical and health education purposes provided information on sexually transmissible diseases, contraception, premature ejaculation

and other sexual dysfunction, claimed to help with 'sex addiction' or assisted people to determine their risk of contracting HIV or other sexually transmissible diseases or to self-diagnose these conditions.

More relevant to the focus of this article was the sub-set of apps that promoted self-tracking practices by users of their sexual or reproductive activities (these were identified using the search terms 'sex tracking', 'ovulation tracking' and 'fertility tracking'). These included the following:

- *Sex Planner and Diary*. This allows users to record details of past and current sexual activities and partners, to sort the data by partner, date or sexual position, plan the user's next sexual encounter with the help of a sexual position planner and to upload data gathered on the users' sexual positions to share with Facebook friends and Twitter followers (see also *My Sex Life*).
- *Sex Partner Tracker*. This app provides users with the opportunity to document number of partners, geographical location and the frequency of sexual activity. The data then allow users to determine how 'promiscuous' they are within their region and 'who is the lover with the highest score within your region/world'. The app also purports to demonstrate who among other users had sex with each other, identifying sexual networks between partners.
- *Sex Stamina Tester*. Users are invited to place their smart device on their beds and measure their sexual stamina (glossed as how long sex lasts). The app's publicity encourages users to employ their data to compare with others using the device ('Try to rank top 10 and show off your ability worldwide!' and 'check your Sex Stamina Age'). This app is obviously directed at men, but women are also encouraged to upload it to measure their partner's stamina and identify their partner's 'rank' among

sexual athletes. The *andThrust* (for Android phones) and *iThrust* (the version for iPhones) apps perform similar functions, claiming that the data collected allow users to determine if they are 'good enough to compete with the Don Juans in the Top 10' (another example is *Sex Skill Evaluator*).

- *Enigma Sex Tracker*. An app that is directed at men but involves the use of data from their female partners concerning their ovulation and menstrual cycles. These data are input to a calendar along with data concerning frequency of sexual activity so that 'both you and your partner become more satisfied with your love life'. According to the blurb 'men do not always understand women' and knowing more about their reproductive cycles and associated hormonal changes ('how the woman's biological clock is running') will help male partners determine when their female partners will be more likely to be 'sexually receptive'.
- *Sexperience*. This is an app allowing users to keep records of how many sexual partners they have had, how many times they have had sex and where it occurred. ('Sometimes you may sit and ponder the number, and wish you knew the exact amount just for personal satisfaction.') This app also allows users to record 'how good' the experience was (solo or with a partner) and how long it was, and thus 'lets you generate all kinds of exciting and mathematical reports') (see also *SexTracker*, *Sex Period Calendar*, *Intimacy Tracker*, *Sex Partners* and *Bedpost*).
- *Sex Counter Tease* ('Make love and burn calories with your partner'). When this app is uploaded, the user places their smart device on the bed and the app promises to measure 'strokes', 'time elapsed' and 'calories burned in sex'. Users can keep a log of their sexual activity, including such details as how often sex took place and in what location (see also *Sex Calories* among several others).

- *Spreadsheets*. This app not only measures movement during sexual encounters with a mobile device but also uses the device's microphone to measure sound levels emitted during sexual activity. The app's algorithms then uses these data to give a statistical analyses of performance, providing a visual display of noise level, average thrusts per minute and duration of intercourse. The developer's website claims that 'your partner will support your commitment to improving sexual activity through performance tracking'. The *Bed Buddy* app does similar tracking, and its blurb contends that the data collected will 'improve your sex duration and power to increase your intensity'. The description of a similar app, *iBang*, notes that it produces graphs visualising the data collected (including such details as how many thrusts were made and how many of these were slow, medium or fast), which 'for the brave' can be shared to Facebook or Twitter.

There are many self-tracking apps for fertility and reproductive functions. Nearly all of these are directed at women. Most are aimed at assisting them to map their ovulation and menstrual cycles using various bodily indicators and to use these to either to avoid pregnancy or facilitate successful conception. As such, these apps conform to the long-established self-tracking habits of women related to their ovulation and fertility. However the advantage that they promise is a more exact, detailed and scientific approach that is able to produce data on a range of bodily functions that when aggregated can provide greater accuracy than more traditional forms of self-tracking. Apps available for these purposes include *OvuView*, which tracks and predicts menstrual cycle, pre-menstrual symptoms, ovulation and fertility using physical indicators and body temperature manually input by the user. Other similar apps include *Ovulation Calendar*, *Fertility Calendar*, *My Days*, *Period Diary*, *Period Tracker*, *Maybe Baby* and *Fertility Friend*.

The *Glow* app brings male partners into the equation by sending them a digital message when their partner is in her fertile period and reminding them to bring her flowers or recreate their first dates as seduction techniques. This app also tracks menstrual and ovulation indicators, as well as asking women to enter details of their sexual encounters, including sexual positions used, whether or not they had an orgasm and whether they experienced emotional or physical discomfort during sex. It employs the aggregated data from other users to refine predictions of ovulation and fertility for the individual user. Its tagline is direct about this, claiming that 'We use data science to help you create your tiny miracles'.

*Glow* and *Ovuline* take self-tracking a step further by also using data from smart devices such digital ovulation monitors, digital wireless weight scales, body mass index calculators and diet and fitness trackers to provide more details on the user's biometrics into the database. Employing the user's self-reported data as well as details from her devices and the aggregated database from other users, *Glow* and *Ovuline* use their algorithms to provide what the latter's website describes as 'data-driven advice' about what it identifies as health risks: for example, sending messages to warn the user that if she has had a poor night's sleep or is feeling high levels of stress this may affect her fertility. Women are also given the option of sharing their data online with their partners and healthcare providers.

**The sociocultural implications of self-tracking apps**

Digital health technologies offer new ways to undertake surveillance that have significant implications for concepts of subjectivity and embodiment. Now that mobile digital technologies that can be used for surveillance are part of everyday social life (such as image and sound recording functions on smartphones), the opportunities to become both the target and the promulgator of surveillance have proliferated and spread across many sites (Lyon and Bauman 2013). The social sphere has become heavily mediated, with new technologies

extending the field of vision in public space and opportunities for monitoring and recording the actions of individuals (Biressi and Nunn 2003; Bossewitch and Sinnreich 2013). Users of these technologies can 'watch each other' constantly and record and then share their observations with many others.

In this 'post-panoptic society' (Caluya 2010), coming under the surveillance of others using apps is a largely voluntary practice. What has been described as 'participatory surveillance' (Albrechtslund 2008; Best 2010) involves the voluntary turn of the gaze upon oneself for one's own purposes. Participatory surveillance in relation to self-tracking technologies tends to be implicated with self-reflection and examination (Lupton 2013d). In this respect it adheres to Foucault's (1988) concept of the technologies or practices of the self: those activities that are directed at self-care, self-management or self-improvement.

The new self-tracking affordances offered by wearable and other digital technologies allow for much more detailed and continuous self-surveillance than in previous times. Such self-surveillance is undertaken for many reasons. For quantified selfers and other self-trackers, collecting data about themselves using digital and other technologies is an important route to understanding their bodies, selves and social relations (Lupton 2013a, 2013c; Ruckenstein 2014). Using digital devices and apps to generate data on sexual or reproductive activities and habits may be considered yet one more valuable way of learning more about oneself, with the aim of achieving the objectives of improving one's life in some way: gaining greater sexual pleasure, for example, or positioning oneself as a sexual athlete, or achieving conception. In this context, surveillance that is self-imposed becomes playful and enjoyable or a means of achieving an important personal goal (Albrechtslund 2008; Boellstorff 2013).

In participatory surveillance for sexual and reproductive self-tracking, the data that the user collects may be shared with others via social media outlets, but may also be kept

private to the user (or perhaps shared only with their intimate partners or doctors or other healthcare providers). Here Foucault's (1978) writings on the documentation of sexual behaviour as part of the interaction of knowledge, truth and power in *The History of Sexuality Volume 1* are apposite. Where once people were incited to confess their sexual activities to another individual as part of research or a therapeutic encounter, the existence of apps that are able to record, document and communicate sexual and reproductive data brings intimate revelations to a potentially far greater audience.

There is a strong focus on numbers in the discourses and technologies associated with the digital self-tracking of the sexual and reproductive body. Self-knowledge and detailed understanding of one's body and its functions are achieved primarily via numbers, as is evident in the emphasis on 'data-driven advice' and 'data science' in the *Glow* and *Ovuline* apps' blurbs or the *Sexperience* app's focus on calculating the 'exact amount' of sexual partners 'just for personal satisfaction'. As is evident in many other accounts of self-tracking in popular culture as well as the medical and public health literature, quantitative data are represented as objective forms of information compared to the information that is gathered from people's own 'subjective' experiences of their bodily sensations and rhythms. The production of quantitative data via digital technologies is portrayed as contributing to their objective neutrality, supposedly removed from the subjective actions of humans (Lupton, 2013a, 2013c; Ruckenstein 2014).

The body/self as it is enacted through these self-tracking apps is both subject and product of 'scientific' measurement and interpretation. Using these technologies encourages people to think about their bodies and their selves through numbers. Sexual activity becomes reduced to 'the numbers': how long intercourse lasts for, how often it takes place, how many thrusts are involved, the volume of sound emitted by participants, how good it is and with how many partners and so on. The comparisons that some of these apps allow for emphasise

the notion of sexual experience as a performance, an activity that can and should be compared with the experiences of others as they are rendered into digital data form. The association of sex with burning calories also suggests the concept of sexual activity as a physical exercise like running or swimming, to be engaged in as part of fitness or weight-control pursuits (activities that are also the target of many digital self-tracking devices and data collection).

These technologies, therefore, act to support and reinforce highly reductive and normative ideas of what is 'good sex' and 'good performance' by encouraging users to quantify their sexual experiences and feelings in ever finer detail and to represent these data visually in graphs and tables. The discourses of performance, quantification and normality suggest specific limited types of sexualities. Gender stereotypes are reinforced by the focus on male performance (quantifying thrusts and duration of intercourse) and comparing sexual achievements (number of sexual partners, how often sex takes place, the quality of the experience). To become ranked highly as a 'Don Juan' or 'top sexual performer', men must achieve the norms set by the algorithms of these devices as desirable and evidence of superior sexual prowess. As such, they allow for the competitive and comparative aspects of sexual performance to be promoted. Sexuality becomes gamified via the confession of details about one's sex life in the public space that is configured by the affordances of such apps.

By contrast, when the focus is on women's bodies there is more emphasis on medicalisation and risk. The ovulation and fertility apps and devices represent a female body that is amenable to intense data collection and self-surveillance in the interests of providing better knowledge about the reproductive cycles and ovulation symptoms of the user. As in broader discourses on female fertility and reproduction (Lupton 2013d), women who are attempting to conceive are positioned as ideally taking responsibility to achieve an ideal, timely pregnancy by avoiding risk (such as stress or not sleeping enough). Many of these

self-tracking apps seek to impose order on otherwise disorderly or chaotic female bodies, using data to do so. Here again quantification and the supposed benefits of neutrality offered by digital data are promoted and valued over people's own embodied knowledges of their bodies. The rhetoric used to promote the apps and in the text of the apps themselves suggests that the apps allow women to achieve a greater level of knowledge about their bodies than they otherwise might through observing and recording their bodies' signs, symptoms and sensations using 'data science'.

Further very important dimensions of the use of sexual and reproductive self-tracking apps are those of privacy, data security and the commercialisation of big data. Many app developers store their data on the computing cloud, and not all name identifiers are removed from the data uploaded by individuals. Once data have been uploaded and archived, it can be very difficult to erase them. It has been argued, indeed, that we are now living in an era characterised by 'the end of forgetting', in which digital data linger indefinitely as forms of recording and archiving information (Bossewitch and Sinnreich 2013). Privacy issues are a concern in relation to any use of data drawn from users' interactions with digital technologies, but never more so than in relation to sexuality and reproduction, where the data are extremely personal. One well-publicised data breach occurred in 2011 when FitBit accidentally posted data on the internet about users' sexual activities they had recorded as part of their exercise activities.

The rhetoric of prosumption and participatory surveillance tends to obscure the uses to which the data generated by users' employment of digital technologies are put by their developers and third parties. As developers have realised the commercial possibilities of the data produced by people monitoring their bodies and health status, many have begun to on-sell the data to third parties for commercial use (Lupton 2014, Neff 2013). Companies that have developed self-tracking technologies such as FitBit and BodyMedia are now selling

their devices and data to employers as part of workplace 'wellness programs' and also to health insurance companies seeking to identify patterns in health-related behaviours in their clients (McCarthy 2013).

When sexual and reproductive practices and functions are logged by users employing the types of apps and devices described above and uploaded to the archives of their developers, there is no continuing guarantee of security of these data. Questions remain about the future linking of users' health-related data to their health insurance policies in such platforms, and what might happen in the future if these companies purchase control over health app data by buying the apps and their data (Dredge 2013). By connecting several large data sets, previously anonymous individuals may be identified, along with detailed data about their health conditions and health-related behaviours (Neff 2013).

Further concerns have been raised about the use of digital data sets to engage in racial and other profiling that may lead to discrimination, over-criminalisation and other restricted freedoms. It has been argued that the big data era has resulted in a major policy challenge in determining the right way to use these data to improve health, wellbeing, security and law enforcement but also ensuring that these uses of data do not infringe on people's rights to privacy, fairness, equality and freedom of speech (Polonetsky and Tene 2013). The potential for individuals who do not conform to hetero-normative norms of sexuality to be exposed, or for individuals to suffer embarrassment or discrimination due to their personal and intimate data being revealed is apparent.

**Concluding comments**

In this article I have identified some of the social, cultural, political and ethical dimensions of new technologies that encourage users to engage in self-tracking of their sexual and reproductive practices and functions. Digital health devices such as self-tracking apps are

representative of a more general privileging of the technological in health-related matters, in which problems are identified and then solutions provided using digital technologies. Given the newness of such apps, social researchers have only just begun to explore their implications for the ways in which bodies and selves are configured via their use. We know little as yet about how people are using and giving meaning to these devices (or, conversely, resisting or subverting their use). Nor are we fully aware of the uses by other parties of the very personal and intimate data that are created and archived by self-tracking apps. Such inquiries are vital, however, in a context in which economic imperatives, neoliberal politics and a general techno-euphoria for the potential of digital health technologies and big data to 'disrupt' healthcare and public health combine to present these technologies in ways that fail to recognise their broader implications and the possible negative as well as positive ramifications for their users.

These technologies do offer undoubted uses and benefits to their users. The self-surveillance and data-sharing capacities of self-tracking apps, as in other forms of participatory surveillance, are generative, contributing to various forms of subjectivities, embodiment and social relations. Self-tracking can help people feel more in control of their lives and may assist them to achieve their personal goals (Ruckenstein 2014). More specifically, sexuality and reproduction self-tracking practices can deliver useful health information, help women to keep track of their ovulation and menstruation cycles and manage their fertility or simply offer fun ways of documenting or enhancing people's sexual activities. However, as I have demonstrated, these technologies also serve to represent sexual activity and reproductive functions in certain defined and limited ways that work to perpetuate normative stereotypes and assumptions about women and men as sexual and reproductive subjects. Those apps that focus on sexual performance and competitiveness have the potential to incite anxiety and feelings of inadequacy in men, while women's bodies are

further medicalised via the practices of intensive documentation and self-management these apps invite.

The practices of wellness and self-quantification these technologies champion comply with an increasing focus in neoliberal politics on emphasising the personal behaviour and self-responsibility of citizens. This is occurring simultaneously with the withdrawal of state funding for social support and healthcare programs. In both the areas of healthcare delivery (McGregor 2001; Mooney 2012) and health promotion (Adam 2005; Ayo 2011; Lupton 1995; Petersen and Lupton 1996), neoliberal approaches seek to direct the management of health away from the state towards the citizen. There is significant potential in these approaches for the stigmatising of and discrimination against individuals who are viewed as not appropriately responsible if they choose not to engage in self-monitoring of health-related behaviours or if they fail to attain norms of behaviour (Mello and Rosenthal 2008). Indeed the ever-increasing forms of data that are collected by self-tracking apps work to configure new norms of behaviour, based on the patterns that these large masses of aggregated data reveal. Once these new population norms are established, those behaviours that lie outside these norms become viewed as aberrant or deviant (Andrejevic 2013).

These devices could therefore be regarded as disciplinary, working to tame the sexual and reproductive body by rendering it amenable to monitoring, tracking and detailed analysis of the data thus generated, and producing ever-more-detailed categories of behaviour. These technologies configure a certain type of approach to understanding and experiencing one's body, an algorithmic subjectivity, in which the body and its health states, functions and activities are portrayed and understood predominantly via quantified calculations, predictions and comparisons. They also work to externalise sexuality and reproductive capacities by turning them into digital data and making them visible and sharable. Thus quantified and digitised, the messy and multiple complexities, sensual experiences, perversities and quirky

contradictions of sexual and reproductive desires and capacities are rendered flat, one-dimensional and dull, subjected as they are to rigid normalised categories.

Until very recently, many mobile app users viewed the information stored on their apps to be private, not realising the extent to which the app developers used these data for their own purposes (Urban, Hoofnagle and Li 2012). This may be changing in the light of the revelations in classified documents released in 2013 by former American security data contractor Edward Snowden, which have made it ever more apparent that the security of private information is much less than many people have realised. Snowden's documents revealed that apps are one among many types of digital technologies that national security organisations have targeted as part of their data collection on their citizens (Ball 2014). Some people engaging in voluntary self-tracking are beginning to question how their data are being used and to call for access to their data so that they can use and manipulate these data for their own purposes (Lupton 2013c; Watson 2013). This critique, however, is essentially a politically conservative endeavour and supports rather than challenges the normative aspects of the types of self-tracking apps that have been described in this article.

More political challenges are currently being undertaken by data 'hactivists' or critical citizen scientists, who seek to 'queer' data that may be collected on them or their communities (McQuillan 2013). This approach to digital data offers an avenue for people to challenge taken-for-granted assumptions about what data are appropriate to collect and visualise, who should do this and how these data should be used, often in ways that were unintended by the generators or archivers of the data. Data hactivism offers an intriguing way forward for people who may be interested in self-tracking for reasons other than proving their sexual prowess or attempting or avoiding conception. It is in this context that one might talk about 'queering data' in both senses of the word: first, in terms of the practice of hacking

forms of data collection and utilisation; and second, in relation to users seeking to upload 'queer' data that challenge normative assumptions about sexuality and reproduction.

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