Emerging Technologies, Ethics and International Affairs
Series Editors: Steven Barela, Jai C. Galliott, Avery Plaw and Katina Michael

This series examines the crucial ethical, legal and public policy questions arising from or exacerbated by the design, development and eventual adoption of new technologies across all related fields, from education and engineering to medicine and military affairs. The books revolve around two key themes:

- Moral issues in research, engineering and design; and
- Ethical, legal and political/policy issues in the use and regulation of technology.

This series encourages submission of cutting-edge research monographs and edited collections with a particular focus on forward-looking ideas concerning innovative or as yet undeveloped technologies. Whilst there is an expectation that authors will be well grounded in philosophy, law or political science, consideration will be given to future-orientated works that cross these disciplinary boundaries. The interdisciplinary nature of the series editorial team offers the best possible examination of works that address the 'ethical, legal and social' implications of emerging technologies.

Most recent titles

1. Social Robots: Boundaries, Potential, Challenges
   Marco Nørskov
2. Legitimacy and Drones: Investigating the Legality, Morality and Efficacy of UCAVs
   Steven J. Barela
3. Super Soldiers: The Ethical, Legal and Social Implications
   Jai Galliott and Mianna Lotz
4. Commercial Space Exploration: Ethics, Policy and Governance
   Jai Galliott
5. Healthcare Robots: Ethics, Design and Implementation
   Aimee van Wynsberghe

Surveillance Futures

Social and ethical implications of new technologies for children and young people

Edited by
Emmeline Taylor and Tonya Rooney

Routledge
Taylor & Francis Group
LONDON AND NEW YORK

First published 2017
by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

and by Routledge
711 Third Avenue, New York, NY 10017

Routledge is an imprint of the Taylor & Francis Group, an informa business

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data
Names: Taylor, Emmeline (Convenor of criminology), editor. | Rooney, Tonya.
Title: Surveillance Futures/ edited by Emmeline Taylor and Tonya Rooney.
Description: Abingdon, Oxon ; New York, NY : Routledge, 2016. | Includes bibliographical references.
Identifiers: LCCN 2016008652| ISBN 9781472455635 (hardback) | ISBN 9781315611402 (ebook)
Subjects: LCSH: Electronic monitoring of youth. | Electronic monitoring of children. | Electronic monitoring of students. | Electronic surveillance. | Schools—Safety measures. | Parent and child. | Technology and youth—Social aspects.
Classification: LCC HQ799.2.E54 S87 2016 | DDC 303.48/30835—dc23
LC record available at https://lccn.loc.gov/2016008652

ISBN: 978-1-4724-5563-5 (hbk)
ISBN: 978-1-315-61140-2 (ebk)

Typeset in Times New Roman PS
by diacriTech, Chennai

MIX
Paper from responsible sources
FSC® C013985

Printed in the United Kingdom
by Henry Ling Limited

An important collection that addresses the place of children as vital targets of new (as well as longstanding) surveillance practices. Contributors raise important questions about transformations in power, privacy and identity, accentuating how concern for the wellbeing of children can often culminate in forms of coercion and control.

Kevin D. Haggerty, University of Alberta, Canada

Youth today are exposed to an overwhelming and diverse array of surveillance applications. Creepy spy toys, drug tests, GPS location tracking, mobile phone monitoring, extractive games, and social media sites represent just some of the many controlling mechanisms that shape kids' lives. This book offers a remarkable multi-disciplinary investigation into this understudied but hugely important area.

Torin Monahan, The University of North Carolina, United States

This timely volume advances our understanding of how it is to grow up in the surveillance age. It documents how surveillance technologies and practices saturate the years from early childhood to adolescence and beyond. The collection provides an outstanding contribution to literature on the changing nature of surveillance in the 21st century.

Heidi Mork Lomell, University of Oslo, Norway

Contents

1 Digital playgrounds

Growing up in the surveillance age

Emmeline Taylor and Tonya Rooney

Surveillance has always been a feature of childhood. However, recent technological innovations have enabled the monitoring of young people to reach unprecedented levels of intensity and ubiquity. Children now find themselves navigating a network of surveillance devices that attempt to identify, quantify, sort and track their thoughts, movements and actions. This collection explores surveillance practices across multiple spheres of childhood and youth, from birth to adulthood. Numerous surveillance apparatus and tools are examined, including, but not limited to, mobile phones, surveillance cameras, online monitoring and GPS tracking. In addition to chronicling the steady rise of such surveillance practices, the chapters in this volume identify and problematise the consequences of technological surveillance from a range of multidisciplinary perspectives. Bringing together leading scholars working across diverse fields – including health, education, sociology, anthropology, philosophy, criminology, media and information technology – the collection draws together a range of perspectives on the social and ethical impacts of technological surveillance throughout childhood and youth.

Emerging trends in childhood surveillance

Childhood is a relatively new concept (Ariès, 1962) and understandings of this formative period continue to shift and evolve. Children have historically been viewed in conflicting ways. Drawing from Nietzsche, Jenks (2005) identifies two archetypal categories of children in Western culture: the 'Apollonian child', perceived as innocent and pure, and the 'Dionysian child', viewed as uncivilised, immoral and potentially evil. In contemporary society, arguably the former is subjected to surveillance mechanisms to preserve this innocence and protect them from the harms prevalent in the world, whereas the latter group receives routinised monitoring by omnipresent and diverse surveillance mechanisms to contain their perceived incivility. Common idioms, such as 'keeping an eye on the kids', expose the inherent complexities and contradictions harboured by surveillance practices; on the one hand, surveillance can be perceived as a protective measure to stave off exposure to potential dangers; on the other hand, it can refer to assurance that

young people do not cause trouble or mischief (Taylor, 2013). There is certainly ambiguity regarding the applications of surveillance. Lyon (2003) suggests that the underlying reasons for surveillance can be situated along a 'continuum from care to control', arguing that 'some element of care and some element of control are nearly always present'. Similarly, Nelson and Garey (2009: 8) view the motivations of care and control 'in a dialectical relationship with each other, and not a simple dichotomous one'.

Complicating things further, surveillance is often viewed as being imposed on reluctant subjects, but this 'fails to recognise that often individuals are complicit in their own surveillance and at times even court the salacious opportunity for exposure that various forms of surveillance provide' (Taylor, 2013: 9). In this sense, children are viewed here as active agents in the emerging forms of subjectivity, creativity, performativity and resistance that arise through the possibilities and challenges of living in the contemporary surveillance society. The relationship between children and technology is (re)configured in a number of ways, ultimately revealing a fluid and emerging notion of subjectivity where children and technologies both shape and are shaped by the world around them (Prout, 2005). A central aim of this collection is to make visible the concealed workings of the multiple surveillance technologies that increasingly permeate the lives of young people and explore the significant social and ethical issues they animate.

Even before birth, surveillance technologies make their presence felt. With developments in pre-natal ultrasound and imaging techniques, the level of information available about the child before he/she is born is expanding, as are the corresponding challenges and pressures on parents to obtain information and make decisions for and about their unborn child. It is no longer unusual for pre-natal scan images of a foetus in utero to be shared via social media (Leaver, 2015; Lupton, 2013a), resulting in the most intimate of realms, the child in the mother's womb, being offered for public consumption. Utilising social media sites, such as Facebook and Instagram, the progress of the child is charted through infancy and beyond. For example, a survey of parents in ten countries revealed that more than 80 per cent of parents with a social media profile had shared images of their child under the age of two years (Holloway *et al.*, 2013). Once parents could playfully tease their children by threatening to show a new girlfriend or boyfriend pictures of them when they were babies, now the images are stored in perpetuity, a potential source of embarrassment for future selves but, more importantly, compromising their right to be forgotten.

Once a baby is born, surveillance of the infant child often begins in the hospital. This includes many measures of health and well-being, but increasingly is augmented with a range of new surveillant technologies. One of the most long-standing applications of radio frequency identification (RFID) is in the paediatric area of hospitals (Baldwin, 2005). Some hospitals place a bracelet around the baby's ankle embedded with an RFID chip that is matched to the mother's. For example, 'Hugs' is an RFID system that can be linked to the hospital's security system so that if the signal between reader and receiver is interrupted, security cameras are activated, electronic doors are locked, elevators cease operating and

essentially the ward is placed in 'lockdown' (Wyld, 2009). Furthermore, if the bracelet is cut or tampered with, it will trigger an alarm. Wyld (2009) outlines how the Hugs RFID system was credited with assisting in preventing the abduction of a baby in 2005 from a hospital in North Carolina, which has since secured the system as a 'necessary precaution'. Despite the rarity of newborn abduction (Goodman, cited in Wyld, 2009) and the 'exceedingly small' likelihood of this happening, the use of RFID on newborn infants is steadily becoming the accepted standard in the safeguarding of babies. But it's not just the threat of abduction, the RFID-enabled system also has a complementary component, 'Kisses', which links the child to its mother. Should a baby be 'mismatched' with the wrong parent, an audible alarm sounds (Wyld, 2009), whilst the correct pairing results in a gentle lullaby being played. The use of terms of affection such as 'hugs' and 'kisses' to promote an infant security system is an example of how surveillance marketers can co-opt 'care' discourses in an attempt to personalise what is a highly impersonal, and arguably excessive, response system.

At home, the devices available to parents to watch and monitor their child now extend far beyond baby monitors that transmit sound from the child to apparatus and even clothing that measure a baby's breathing and conditions, such as temperature and humidity and that send alarms or messages to parents if any unusual datum presents itself. Child-monitoring products are often placed in objects that portray a sense of fun or benignity, including the 'My Little Eye' baby monitor fitted with an infrared camera mounted in a large plastic flower with a flexible stem to enable the live streaming of video, and the 'Vtech Sleepy Bear Digital Baby Monitor'. Whether this is for discretion or to reassure parents they are practising care, not surveillance, remains ambiguous. Drawing together multiple developments, the Mimo™ group is developing what they call the 'Smart Nursery', comprised of products that can communicate with one another and are accessible and controllable from a parent's smart device. One such product is what the Mimo™ website describes as the 'world's smartest baby monitor', which is a wearable babygrow fitted with numerous sensors that collect information about the baby's breathing, body position, sleep activity and skin temperature, as well as audio. Data collected by the sensors are transmitted, via Bluetooth, to the cloud and are accessible on any connected smart device. Whilst the website cautions that the Mimo™ Baby Monitor 'is not to be used as a substitute for adult supervision', it declares that: 'It's going to change the way parents think about and learn about their babies'. Indeed, such artefacts of monitoring represent a cultural shift in what it means to be a responsible parent and benchmark expected levels of digitally enhanced care. As Lupton (2013b: 46) articulates:

> The infant's body becomes the focus of the intense, anxious parental gaze in the context of a culture in which parents – and particularly mothers – are held accountable for any harm that may befall their infants or any failure to conform to accepted measures of health, growth and development.

Furthermore, the normativity of these devices quickly overrides other concerns, such as the safety of early and sustained exposure to wireless microwave radiation

or the interception of devices. There are numerous reports of connected devices, such as baby monitors and toys, being hacked by outsiders who are then able to view live footage of the child (and family), talk to the infant and even control the camera remotely (Computerworld, 2015; Taylor and Michael, 2015). The digitised swaddle that now surrounds the newborn is supposed to reassure anxious and responsible parents who are eager for objective indicators of the health and well-being of their infant. But, far from soothing worries, the extent to which devices can preoccupy and consume the new parent can itself become a source of anxiety and stress. In a study of parental views on baby monitors, it was noted how these technologies 'make parental anxiety the expected state of parenthood' (Nelson, 2009: 225). It is easy to see how parental doubts regarding their human capability alone can set in when adrift in the sea of gadgets and gismos that can quantify and externalise the inner workings of an otherwise apparently indecipherable tot.

In early childcare centres too, combinations of surveillance practices that are dually cast as mechanisms of care and a source of information to alleviate the concerns of parents are emerging. For example, many early childcare institutions allow parents to view their children via webcams (Jorgensen, 2004). Originally introduced as devices to allow parents to watch over their children's carers, these systems transmit images of the children and have become just as much a vehicle for parents to monitor their child's development and day-to-day activity.

These types of surveillance opportunities and practices challenge notions of parental responsibility. If products, such as wearable sensors rigged to smart devices, become socially normalised, then choosing not to use such devices may be seen as irresponsible, lacking in care, reckless even. In this vein, the infant child is viewed as permanently '"at risk" from harm, unpredictable, never far from the threat of illness or death. It is a body that is culturally primed for intense and continuous surveillance on the part of its anxious parents' (Lupton, 2013b: 45). The surveillance device itself becomes seen as a greater source of knowledge or truth about the child's well-being over and above the multiple ways in which children may be cared for by those around them (Rooney, 2012). The sudden swell of wearable electronics and biosensor devices transform the child's body into a site of scrutiny and measurement: 'bodies are experienced and conceptualized in relation to other bodies, as well as to discourses, practices, spaces, ideas and non-human objects and other living things' (Lupton, 2013b: 39).

Along with the intensification in the biomedical monitoring of infants, there are other ways in which behaviour, movement, thoughts and actions are scrutinised throughout a child's life.

The modern school is a key site of surveillance, but in many ways this is 'nothing new' (Taylor, 2013: 3) since many common aspects of schooling have inherent surveillance properties: 'registration confirms attendance, student reports compound activity, continual examination and assessment monitors progress, the containment of pupils on a bounded campus enables close observation of behavior, and the contravention of rules attracts swift and often visible punishment' (ibid). But, for all the structurally integrated modes of surveillance in the school, the technological sophistication of recent processes and apparatus presents a radical

shift in the intensity of surveillance experienced by schoolchildren, which in turn advances new ethical and social implications. New technologies – including, biometrics, digital imaging, fingerprinting and RFID tags – are increasingly deployed to identify, profile and track pupils. Moreover, their sophistication and potency have intensified as high-end military and defence apparatus find use in everyday environments (Casella, 2006; Haggerty and Ericson, 1999), notably the lucrative education market. Schoolchildren have emerged as one of the most heavily surveilled populations in many countries. Such 'surveillance schools' (Taylor, 2012) or 'dataveillance schools' (Williamson, Chapter 4 in this collection) are installing sensor-based and visual-recording devices that continually harvest data about schoolchildren in ever-finer detail.

School can be viewed as part of the socio-cultural landscape of society, a key institution, with considerable flows between it and other institutions, such as the family, community, corporations, government and media. The use and application of surveillance originating in the school often materialises and circulates openly in society, generating claims that schools have become test-beds for new technologies. Conversely, events and behaviours that originate in society can soon influence school practices. Moral panic around youth violence, drug use, obesity and sexting, to name but a few, can import major changes to the school campus. The scope of school surveillance is expanding and there have been many exposés of schools extending their reach beyond the campus walls and into the family home via surveillance technologies. For example, a school in Pennsylvania was sued in 2011 for allegedly activating a school-owned laptop's built-in webcam to watch a student at home and using the information gathered for disciplinary means (Clarke, 2010).

Whilst schools are infused with surveillance practices, when children are at home there are also multifarious ways in which surveillance continues to shape their world. Webcams and surveillance cameras allow parents to remotely view their children over the internet from anywhere, such as from a workplace or while travelling overseas. Security devices can be set up with a variety of alerts that send a message to the parent when their child arrives home from school: for example, devices such as 'Z-Wave Home Monitoring' or 'Total Connect'; the latter allowing parents to automatically receive a video of the child entering the home. In the expanding market of surveillance devices, companies play not only on parents' anxieties about the safety and well-being of their child, but also on their fear of, or guilt about, missing key childhood moments due to other commitments. As one security article promises parents:

> You can watch your children sleep, eat and play … Your home coming will always be a happy event. You can show off that you've never missed a day with your kids because of your hard-working video surveillance. It's like you've been home all the time. (Roberts, 2007)

In this example, the video camera becomes the surrogate parent, observing the child's activity and development, absent yet continually 'present'. Hofer *et al.*

(2009) describes what they term an 'electronic tether', which could itself be considered as a digitised extension of the umbilical cord, and has come to typify relationships between parents and their children, particularly in emerging adulthood. An important avenue for future research will be to explore the impacts of digitised parenting on family dynamics and childhood relations.

Information about children accessed from the sanctity of the family home is now routinely being transmitted to external databases for viewing and analytics by external agencies and corporations. For example, not content with the 'Barbie Video Girl', which has a camera lens disguised as a pendant embedded in the doll's chest, Mattel's latest doll, 'Hello Barbie' is pioneering a new trend in 'smart toys'. The doll uses voice-recognition software, an evolving database of recordings and access to the internet via Bluetooth and Wi-Fi to attempt to engage the child in intelligible and free-flowing conversation by asking and responding to questions. Algorithmic software enables the doll to *learn* about its users over time. Illustrating this, at the New York Toy Fair in 2015, a journalist writing for the *Washington Post* (Halzack, 2015) reported:

> [T]he Mattel representative chatting with Hello Barbie mentioned that she liked being onstage. Later in the conversation, when the Mattel representative asked Hello Barbie what she should be when she grew up, the doll responded, 'Well, you told me you like being onstage. So maybe a dancer? Or a politician? Or how about a dancing politician?'

The Barbie doll is a powerful example of the reach of large corporations into the privacy of the home via ostensibly benign products. Children often do converse with toys, share their innermost thoughts and act out various scenarios; clearly, this is without any knowledge that this information might be accessed, analysed and exploited for commercial gain. Not only can parents choose to receive daily or weekly emails with access to the audio files of their children's conversations with Hello Barbie, all audio recordings from Hello Barbie are uploaded to ToyTalk, which operates the speech processing services for Mattel. A review of their privacy policy reveals that the information recorded could be used in a variety of ways, including being shared with third parties:

> [W]hen we believe in good faith that we are lawfully authorized or required to do so or that doing so is reasonably necessary or appropriate to (a) comply with any law or legal processes or respond to lawful requests or legal authorities, including responding to lawful subpoenas, warrants, or court orders; or (b) protect the rights, property, or safety of ToyTalk, our users, our employees, copyright owners, third parties or the public, to enforce or apply this Policy, our Terms of Use, or our other policies or agreements. (ToyTalk Privacy Policy cited in *The Vigilant Citizen*, 2015: n.p.)

In this manner, and alongside many examples of the blurring of the boundaries between private and public, the family perimeter has become porous and

commercial entities are encroaching further into children's lives, using surveillance techniques that are increasingly difficult for children and families to resist. Barbie has become a 'sophisticated surveillance device masquerading as an innocuous child's toy' (Taylor and Michael, 2015, n.p.).

Just as the reach of schools and mass corporations has been shown to extend into the home, the parental gaze is now transported with young people wherever they go. Mobile phones are increasingly being used as surveillance devices by parents, as they enable parents to monitor phone usage, including the content of SMS messages sent and received, identify callers (even when caller ID is withheld), approve or block contacts, as well as a range of other functions. With almost ubiquitous use of mobile phones by teenagers, the proliferation of teen-tracking apps is notable. For example, parents can use an iRecovery Spy Stick to access and download mobile phone web history, emails, photographs and text messages, even the deleted ones retrospectively, or alternatively install 'Mobile Spy', which provides real-time tracking of online activity and geographical location, providing electronic 'breadcrumbs' that reveal where the child has been and when. There are also apps such as 'Teensafe' and 'Family Tracker'. The use of such apps highlights the tensions between safety and trust (Rooney, 2015).

As children get older and move into their teenage years, the marketing of surveillance devices to parents persists. Home drug-testing kits, such as the 'First Check Home Drug Test Kit', is an example of the types of tools offered as 'responsible' practices to parents (Marx and Steeves, 2010; Moore and Haggerty, 2001). Vehicular surveillance devices are also available to parents and use GPS technology or satellite services to monitor driving speed and location, and send an email or SMS to the parent if any of the boundaries, predefined by the parents, are breached. If speeding is detected, it is possible for parents to remotely trigger the car's horn or flash the lights until the driver slows down (for example, see products such as 'Motosafety' or 'SafeDriver'). Some devices monitor smartphone activity while driving (such as the 'Canary' app) and send a message to parents if their child is texting or talking on the phone while driving. In a world where parental monitoring is a growth industry, spying in effect 'becomes an enhanced parenting tool' (Marx and Steeves, 2010: 205). The prevailing messages about parental responsibility become confused; on the one hand, encouraging parents to continuously monitor the whereabouts of their children through electronic devices, whilst, on the other, communicating that parents no longer need to be present or available to discuss with their children where they are, what they are doing and with whom they are hanging out, so long as they are tracking them.

Information and communications technologies (ICTs), and notably social networking, are becoming embedded in the lived experiences of children of all ages, and some commentators now claim that it is increasingly difficult to separate the virtual and non-virtual domains of children's experiences. Marsh (2010: 25), for example, describes this as a 'continuum in which children's online and offline experiences merge'. A survey conducted across 25 European countries indicated that 'one third of 9–12 year olds and three quarters of 13–16 year olds who use the Internet in Europe have their own profile on a social networking site'

(Livingstone *et al.*, 2011). Even though many social networking sites state that account holders must be over the age of 13, the report by Livingstone *et al.* (2011) confirms that nevertheless many users are 'under age', with children simply providing incorrect age information online. Online activity, increasingly viewed as criminogenic, has become a focus of surveillance with internet tracking and what Hope (2008) describes as a 'culture of over-blocking' websites. For example, in England under the Counter-terrorism and Security Act 2015, there is a requirement that schools 'have due regard to the need to prevent pupils being drawn into terrorism'. This has resulted in the emergence of several companies providing anti-radicalisation software products to schools, such as Future Digital, Securus and Impero, to monitor schoolchildren's online activity. The software operates by detecting the use of keywords included in a glossary of terminology that supposedly could indicate radicalisation.

These examples provide only a small snapshot of the proliferation of surveillance devices available to parents, schools, companies, governments and children themselves that are being increasingly used to monitor, observe, calculate and control different aspects of children's lives. Of course, technologies (and indeed non-technological modes of surveillance) evolve, are updated and fall in and out of use. At the same time, there are often shifts in the parameters of what is viewed as acceptable, ethical and desirable in the lives of young people. The overview, however, illustrates the growing complexity of the ways in which children's lives are increasingly caught up in a vast array of surveillance practices that require us to attend more closely to what it means to grow up in a 'surveillance society', including what it means for parents, schools and governments to make decisions that impact on surveillance in young people's lives.

Growing up in a surveillance society: social and ethical implications

Surveillance brings with it numerous profound changes. Amongst these are the significant socio-political and ethical implications raised by the increasing use of surveillance to monitor the young lives of the next generation. This book navigates the tensions between the positive aspects of surveillance processes whilst cautioning, where applicable, about the dangers and risks that are often embedded in their uncritical appropriation. Importantly, whilst several authors highlight the potential negative ethical and societal impacts of unfettered surveillance, contributors are keen to highlight that not all aspects of surveillance are inherently bad. Indeed, they bring many benefits and conveniences. For example, location-based services (LBS), such as GPS and RFID, provide the convenience of route-finders, locating lost items, assisting with emergency responses and safeguarding vulnerable people. Along with these benefits, however, multiple issues are raised relating to autonomy, location privacy, trust, freedom of movement and expression of identity. These issues are not insignificant. As Dobson argues, 'human-tracking devices pose the greatest threat to personal freedom ever faced in human history'

since they have the potential to 'alter social relationships … more dramatically than any other product emerging from the information revolution' (2006: 187). Similarly, Arnold (2010: n.p.) argues that children can be 'denied personhood by being reduced to digits traversing the virtual spaces found in Google Maps and similar geospatial services'. Of these issues, the brief analysis below focuses on the tensions surrounding the experience of privacy and trust as examples of the inherent complexities in the relationship between children, technologies and surveillance practices.

Surveillance and privacy are often presented as being in opposition – 'a tug of war between two social forces' (Taylor, 2013: 62). Many argue that sacrificing some privacy is necessary for the security benefits that surveillance provides. The trouble with presenting the surveillance/privacy debate in this way is that it obscures the more complex motivations and workings that underpin surveillance practices, such as how they interrelate with ideology and inequality, and whether surveillance practices are actually effective solutions to the problem (Fussey, 2008).

There are salient reasons why the concept of a 'right to privacy' is far from straightforward. It is 'an extremely slippery virtue – intangible, hard to define and harder still to measure' (Madgwick and Smythe, 1974: 9) and perhaps one of 'the most equivocal of all human rights in terms of definition and circumscription' (Taylor, 2010: 383). Some have even gone so far as to say that privacy 'is beyond the scope of the law' (Hixson, 1987: 98). When applied to children, the issue is even more complex. In many legal and policy contexts, children are often deemed too young to be afforded a sense of privacy in their own right, despite the UN Convention (1989) that simultaneously enshrines the child's right to privacy and acknowledges that children also need special safeguards, care and legal protection. Exploring the complexities of children's need for and understanding of what it means to have some sense of privacy provides insight into some of the broader intricacies of privacy/surveillance discourses.

As noted by Rooney (Chapter 11 in this collection), children's sense of and need for privacy are more acute than is often acknowledged. Children, from an early age, are aware of the presence of a surveillance gaze; they play differently, for example, when being watched by others. However, with the rise of new forms of exposure and self-revelation, particularly prominent on social networking sites, it has been contended that we are witnessing 'the end of privacy', that we are now living in a 'participatory panopticon' or a state of 'total surveillance' (Whitaker, 1999: 139) in which we are all complicit. The nature of the way teenagers engage online, for example, to some, demonstrates that young people no longer care for their privacy, particularly given the increasing evidence that 'teens flock to the Internet to share their intimate thoughts' (Barnes, 2006). In parallel, teens also 'develop intricate strategies to achieve privacy goals', which often 'challenges the ways in which privacy is currently conceptualized, discussed, and regulated' (boyd and Marwick, 2011: n.p.). For example, according to boyd (2012), they often rely on 'in-jokes' and 'encoded messages', which can limit access to the meaning of the information, even if not the content itself.

Clearly, the boundaries between private and public spheres have become increasingly blurred, raising challenges for children and young people who want to have 'private lives' (for example, from their parents or teachers) in these new spaces. The complexity of understanding what it means to have 'privacy' in these new contexts and the type of choices children and others will face within a multi-layered surveillance network requires more nuanced attention beyond public/private and privacy/security distinctions. Young people often lack the resources required to effectively express their desire and need for privacy, as well as the ability to negotiate with those who seek to control it. This becomes particularly problematic when the dominant discourse tramples on the complex and subtle ways that young people construct privacy. Corporations are particularly conversant in peddling the view that young people voluntarily relinquish all semblances of privacy (Steeves, 2012; Taylor, 2013). In a context where the right to privacy is not just under threat, but becoming more difficult to articulate and define, the chapters in this collection highlight how the experience of children and youth can shed light on the inherent tensions and need for new directions in thinking about privacy in the digital age.

In addition to challenging privacy, surveillance has the potential to bring ambiguity to established means of developing trust. It has been claimed that surveillance practices 'embody a mistrust that corrodes personhood' and are often 'an electronic substitute for the trust and risk-sharing that we might see as fundamental to family life' (Arnold, cited in the *Canberra Times*, 2011: n.p.). Supporting this view, empirical research exploring the impact of CCTV found that schoolchildren perceived visual surveillance to be 'equated with mistrust', since 'to demonstrate trust is not to surveil' (Taylor, 2013: 52; see also Chapter 2). Trust is bound up with responsibility; the more children are trusted, the more they learn to be responsible for themselves and those around them. An additional complexity is that messages about trust are often difficult to interpret, as 'the ambiguity of the surveillance gaze makes it unclear who in the population cannot be trusted' (Rooney, 2010: 352).

While, on the one hand, children find the minutiae of their day-to-day lives controlled to a level of detail that has previously not been possible, on the other hand, somewhat paradoxically surveillance technologies can provide more freedom. A parent anxious about the safety of their child riding their bike with friends might feel reassured by the use of GPS tracking (Chapter 9) or concern about allowing a child unsupervised internet access might be alleviated by the use of software apps that monitor activity while blocking sites deemed inappropriate. These examples highlight how the notion of 'trust' can become a point of negotiation in deciding how much freedom of movement or association a child is afforded. If a parent trusts a child to go out on the condition he/she take a mobile phone with a GPS tracking system enabled, then although the child may have more freedom, it is nonetheless a conditional freedom where that condition is enacted through a surveillance device. This tension serves to highlight the complicated relationship between trust and surveillance. Despite the opportunities for freedom that tracking devices may present,

for children, it may not always be clear whether they are not trusted or whether a surveillance device is there to protect them – yet another representation of the shifting and ambiguous boundaries between care and control mentioned earlier.

Seen but not heard? The absence of children's voices in the study of surveillance

Despite the overall sensitisation to the concerns of subjects of surveillance, children and young people have historically been 'hidden'. Highlighting the need to understand how, why and to what effect young people are subjected to an intensification of surveillance, a study of CCTV in a British city found that teenagers were targeted by camera operators 'for no apparent reason', whereas in contrast, 'those over thirty years old are rarely the subject of surveillance' (Norris and Armstrong, 1999: 9). As the surveillance of young people intensifies, it is paramount to privilege accounts of the impacts and effects on their lives. Just as childhood voices have at times been '"muted" within the social sciences' (Christensen and James, 2003: 1), it has been claimed that until recently, the child's body has similarly been 'an absent presence' in the new social studies of childhood (Colls and Horschelmann, 2009; Lupton, 2013b; Woodyer, 2008). Several chapters in this collection draw upon empirical research conducted with young people to provide an avenue for them to voice their own views and opinions regarding surveillance practices and the impact on their worlds. Other chapters grapple with the conceptual ethical and social implications for future generations growing up in a surveillance society, raising a number of significant questions regarding how we envisage childhoods of the future and what this means for regulatory and policy frameworks that are designed to protect, educate and govern young people.

Structure of the book

The book is organised around three key spheres of children's day-to-day life: schooling, the self and social lives. Of course, these zones are inextricably intertwined, and the structure is not intended to impose any superficial parameters around different aspects of children's being, but to recognise substantial flows between them. The parts, taken as a whole, highlight the extent to which surveillance now pervades every aspect of a child's life as he/she moves between different institutions, places and spaces. The aim is to provide analyses of some of the multiple ways in which contemporary modes of surveillance are being shaped by and are, in turn, shaping what it means to be young and living in a surveillance society.

Schooling and education

The chapters in Part I, 'Schooling and education', focus on institutional-level technological surveillance that children experience in contemporary schooling. In Chapter 2, Emmeline Taylor explores CCTV, the most common method of

electronic visual surveillance in schools. Drawing on media analysis and empirical research in schools, the chapter highlights how the media representation of CCTV in schools presents it as largely unproblematic, in contrast to the impact it has on students. Taylor argues that the use of CCTV, particularly in classrooms and student toilets, can radically change the school environment with important ramifications for the growth and development of young people. In Chapter 3, Deborah Lupton and Michael Gard chart the close historical connection between health and education, arguing that 'it is difficult to think of a public health matter, large or small, which has not at one time been given to schools to solve'. They pay special attention to the 'algorithmic authority' projected on digitised children in educational contexts and the potential socio-political, material and health implications this gives rise to. Ben Williamson in Chapter 4 focuses on two components of what he terms 'dataveillance schools': learning analytics (which capture data from children's educational activities) and personal analytics (which track, monitor and assess schoolchildren's bodies and functions). Like Lupton and Gard, Williamson highlights the ways in which 'algorithmic power' is shaping children's lives, providing a critically informed account of the implications for schoolchildren. The final chapter in Part 1, 'Teaching us to be "smart"', draws on the example of RFID tracking in schools to examine how weaving new technologies 'into the institutional fabric of the school' can serve to normalise them. Taylor describes schools as 'institutional incubators' for new surveillance technologies and practices and, furthermore, environments within which the ostensible neutrality of surveillance technologies can be constructed before they are circulated in society. The chapter outlines how schoolchildren are also tracked beyond the school premises, sometimes overtly as part of initiatives designed to encourage cycling or walking to school or whilst travelling on school buses, but sometimes unwittingly as a result of the reach of the transmitter, raising issues of safety, privacy and ethics.

Self, body and movement

Part II focuses on the ways in which the child's body is made readable, rankable and regulatable through surveillance practices. This section seeks to outline how the body has become a site on which surveillance is enacted. This raises important questions regarding the digitisation of the self and how this potentially and profoundly influences understanding of the self, identity and body. In the opening chapter of this section, Murray Lee and Thomas Crofts examine the regulation of childhood sexuality using the phenomenon of 'sexting' as an example. They seek to bring to the fore the pejorative policing of sexting and intimate the body as a new site on which control can be exerted. Following on, Jacqueline Vickery examines the media discourses that surround mobile phone technology and how they serve to normalise surveillance in domestic spaces in the United States. Drawing on empirical qualitative data, Vickery argues that rather than being passive subjects of surveillance, teen girls can resist aspects of the parental gaze using their mobile phones. Carol Barron in the next chapter takes an anthropological approach to the ways in which mobile phones are increasingly used by parents in a bid to monitor

and control their children. Rejecting dominant perceptions that subjects of surveillance are passive and powerless, Barron emphasises that children are able to successfully negotiate and resist parental surveillance via this means. Jessica Nihlén Fahlquist explores the moral implications of GPS tracking young people in Chapter 9. Describing GPS as 'part of a parent's tool box', she explores some of its uses before considering what some of the impacts might be, particularly for a child's development of a sense of responsibility. 'Children need to become autonomous individuals, able to take care of themselves and others', she argues, and the use of GPS tracking could potentially stunt 'their progress towards self-sufficiency'. Charting the growth of mHealth technologies in Chapter 10, Emma Rich attends to the child's body as a site of regulation on which various cultural normativities are played out. Rich identifies a trend towards digitised health and physical education (HPE) or what Gard (2014) has termed 'eHPE', and uses the 'health crisis' that is childhood obesity to discuss the ways in which childhood bodies are scrutinised through a range of different health apps and technologies.

Social lives and virtual worlds

The third and final part turns to children's social and playful encounters. As Whitson and Simon (2014: 309) remind us, 'there is something primordial about the relationship between surveillance and games'. Opening this section, Tonya Rooney explores the importance of play and childhood games as spaces in which children can learn about and 'grapple with issues such as power, exposure, secrecy and deception'. Of salience to surveillance studies, Rooney observes that private spaces are often a prerequisite for experimental and creative play, cautioning against the erosion of these spaces through 'increasing forms of control, supervision and surveillance'. In Chapter 12, 'World of Spycraft', Andrew Hope considers the variant ways in which online gaming domains have become sites of surveillance by government agencies, as well as the game corporations themselves. Hope argues that 'children's use of gamified devices and video games have increasingly become embroiled in practices of almost relentless monitoring', which opens up discussion of the notions of responsibilisation, desensitisation and marketisation of online spaces frequented by young people. In Chapter 13, Valerie Steeves draws upon her research involving 5,436 young people in Canada. The chapter outlines the surveillance of the top fifty sites most frequented by the young people in her sample. While Steeves notes that 'the commercialisation of young people's online environment has been taking place for some time', she highlights the ways in which the 'major players', including Google and Facebook, operate increasingly integrated information-collection systems, sharing personal information and data between the various sites that they own. Far from being willing participants in the commercialisation of online space, Steeves highlights how young people are unhappy about their personal data being accessed and used, raising issues with the current regulatory framework. In the final chapter, drawing on a case study from the RYOGENS (Reducing Youth Offending Generic Electronic National Solution) database, Rosamunde Van Brakel examines the advent of pre-emptive

surveillance practices. The database was developed to improve communication and co-ordination between partner agencies in order to identify children who were at risk of harm or of engaging in criminal activity. While conceived out of a genuine desire to improve service delivery, this 'pre-emptive turn' has important social and ethical consequences, which Van Brakel documents. She uncovers the implications of the ways that surveillance technologies are used not only to control, monitor or care for children, but also, arguably, to pre-define the possibilities for selfhood in ways that may limit or restrain a child's future potential.

The intensity with which surveillance practices and technologies have begun to saturate the years from early childhood to adolescence and beyond raises numerous ethical and social concerns. As a whole, the chapters in this collection provide important conceptual foundations for future theoretical and empirical research, inviting us to find new ways to question the often taken-for-granted surveillance creeping into children's lives. The volume will contribute to the broader debates on emerging surveillance practices, while at the same time bringing into focus the implications for children and young people. After all, it is the young people of today who will shape the surveillance scape of the future. The chapters in this collection offer a vital opportunity to consider the intricate and dynamic workings of surveillance in society and provide an important stepping stone towards new discussions and future directions for research in this field.

References

Ariès, P. (1962) *Centuries of childhood: a social history of family life*. New York: Vintage Books.

Arnold, B. (2010) 'Digital handcuffs or electronic nannies: children, privacy and emerging surveillance technologies', paper presented at the Children, Young People and Privacy Conference, Melbourne, 21 May.

Baldwin, G. (2005) 'Emerging technology: hospitals turn to RFID', *SnapsFlow Healthcare News*. Available at http://snapsflowhealthcarenews.blogspot.com/2005/08/emerging-technology-hospitals-turn-to.html (accessed 20.07.2015).

Barnes, S. (2006) 'A privacy paradox: social networking in the United States', *First Monday* 11(9). Available online at http://firstmonday.org/issues/issue11_9/barnes/index.html (accessed 22.03.2016).

boyd, d. (2012) 'Networked privacy', *Surveillance and Society*, 10(3): 348–50.

boyd, d. and A. Marwick (2011) Social steganography: privacy in networked publics, paper presented at ICA, Boston, MA, 28 May.

Canberra Times (2011) 'Helping, handcuffs or both?', 16 Jan.

Casella, R. (2006) *Selling us the fortress*. London: Routledge.

Christensen, P. and A. James (2003) 'Researching children and childhood: cultures of communication', in P. Christensen and A. James (eds), *Research with children: perspectives and practices*. London: Falmer Press.

Clarke, S. (2010) 'Pa. school faces FBI probe, lawsuit, for using webcams on laptops to watch students at home', ABC News. Available online at http://abcnews.go.com (accessed 20.07.2015).

Colls, R. and K. Horschelmann (2009) 'The geographies of children's and young people's bodies', *Children's Geographies* 7 (1): 1–6.

Computerworld (2015) '2 more wireless baby monitors hacked: hackers remotely spied on babies and parents'. Available online at www.computerworld.com/article/2913356/cybercrime-hacking/2-more-wireless-baby-monitors-hacked-hackers-remotely-spied-on-babies-and-parents.html (accessed 21.07.2015).

Dobson, J. E. (2006) 'Geoslavery', in B. Warf (ed.), *Encyclopedia of human geography*. London: Sage, pp. 186–8.

Fussey, P. (2008) 'Beyond liberty, beyond security: the politics of public surveillance', *British Politics*, 3(1): 120–35.

Gard, M. (2014) 'eHPE: A history of the future', *Sport, Education and Society*, 19(6): 827–45.

Haggerty, K. and R. Ericson (1999) 'The militarization of policing in the information age', *Journal of Political and Military Sociology*, 27(2): 233–45.

Halzack, S. (2015) 'Privacy advocates try to keep "creepy," "eavesdropping" Hello Barbie from hitting shelves', *Washington Post*. Available oneline at www.washingtonpost.com/blogs/the-switch/wp/2015/03/11/privacy-advocates-try-to-keep-creepy-eavesdropping-hello-barbie-from-hitting-shelves/?tid=sm_tw (accessed 21.07.2015).

Hixson, R. (1987) *Privacy in a public society: human rights in conflict*. New York: Oxford University Press.

Hofer, B. K., C. Souder, E. K. Kennedy, N. Fullman, and K. Hurd (2009) 'The electronic tether: communication and parental monitoring during the college years', in M. K. Nelson and A. I. Garey (eds), *Who's watching? Daily practices of surveillance among contemporary families*. Nashville: Vanderbilt University Press, pp. 277–94.

Holloway, D., L. Green, and S. Livingstone (2013) 'Zero to eight: young children and their internet use', EU Kids Online: LSE. Available online at http://eprints.lse.ac.uk/52630/1/Zero_to_eight.pdf (accessed 22.03.2016).

Hope, A. (2008) 'Internet pollution discourses, exclusionary practices and the "culture of over-blocking" within UK schools', *Technology, Pedagogy and Education*, 17: 103–13.

Jenks, C. (2005) *Childhood*, 2nd ed. London: Routledge.

Jorgensen, V. (2004) 'The apple of the eye: parents' use of webcams in a Danish day nursery', *Surveillance and Society*, 2: 446–63.

Leaver, T. (2015) 'Researching the ends of identity: birth and death on social media', *Social Media + Society* (Apr–June): 1–2.

Livingstone, S., K. Olafsson, and E. Staksrud (2011) 'Social networking, age and privacy', LSE Research Online Report. Available online at http://eprints.lse.ac.uk/35849/1/Social%20networking%2C%20age%20and%20privacy%20%28LSERO.pdf (accessed 22.03.2016).

Lupton, D. (2013a) *The social worlds of the unborn*. Basingstoke, UK: Palgrave Macmillan.

Lupton, D. (2013b) 'Infant embodiment and inter-embodiment: a review of sociocultural perspectives', *Childhood*, 20(1): 37–50.

Lyon, D. (2003) *Surveillance as social sorting: privacy, risk and digital discrimination*. London and New York: Routledge.

Madgwick, D. and T. Smythe (1974) *The invasion of privacy*. Pitman: Oxford.

Marsh J. (2010) 'Young children's play in online virtual worlds', *Journal of Early Childhood Research*, 8: 23–39.

Marx, G. and V. Steeves. (2010) 'From the beginning: children as subjects and agents of surveillance', *Surveillance and Society*, 7(3): 6–45.

Moore, D. and K. Haggerty (2001) 'Bring it on home: home drug testing and the relocation of the war on drugs', *Social and Legal Studies*, 10(3): 377–95.

Nelson, M. K. (2009) 'Watching children: describing the use of baby monitors on Epinions.com', in M. K. Nelson and A. I. Garey (eds), *Who's watching? daily practices of surveillance among contemporary families*, pp. 219–38. Nashville: Vanderbilt University Press.

Nelson, M. K. and A. I. Garey (2009) 'Who's watching? An introductory essay', in M. K. Nelson and A. I. Garey (eds), *Who's watching? Daily practices of surveillance among contemporary families*, pp. 1–16. Nashville: Vanderbilt University Press,

Norris, C. and G. Armstrong (1999) *The maximum surveillance society: the rise of CCTV*. Oxford: Berg.

Prout, A. (2005) *The future of childhood: towards the interdisciplinary study of children*, London: Falmer Press.

Roberts, N. (2007) 'Don't shortchange your family: get video surveillance'. Available online at http://ezinearticles.com/?id=798152 (accessed 31.07.2015).

Rooney, T. (2010) 'Trusting children: how do surveillance technologies alter a child's experience of trust, risk and responsibility?', *Surveillance and Society*, 7(3/4): 344–55.

Rooney, T. (2012) 'Childhood spaces in a changing world: exploring the intersection between children and new surveillance technologies', *Global Studies of Childhood*, 2(4): 311–42.

Rooney, T. (2015) 'Spying on your kid's phone with Teensafe will only undermine trust', *The Conversation*, 29 Apr. Available at online at https://theconversation.com/spying-on-your-kids-phone-with-teensafe-will-only-undermine-trust-40385 (accessed 22.03.2016).

Steeves, V. (2012) 'Hide and seek: surveillance of young people on the internet', in K. Ball, K. D. Haggerty and D. Lyon (eds), *Handbook of surveillance studies*, pp. 352–60. London: Routledge.

Taylor, E. (2010) 'I spy with my little eye: the use of CCTV in schools and the impact on privacy', *Sociological Review*, 58(3): 381–405.

Taylor, E. (2012) 'The rise of the surveillance school', in K. Ball, K. D. Haggerty and D. Lyon (eds.), *Handbook of surveillance studies*. London: Routledge.

Taylor, E. (2013) *Surveillance schools: security, discipline and control in contemporary education*. Basingstoke, UK: Palgrave Macmillan.

Taylor, E. and K. Michael (2015) 'Hello Barbie, hello hackers: accessing your data will be child's play', *The conversation*. Available online at https://theconversation.com/hello-barbie-hello-hackers-accessing-personal-data-will-be-childs-play-52082 (accessed 06.01.2016).

The Vigilant Citizen (2015) 'Hello Barbie: the creepy doll that spies on kids … and their parents'. Available online at http://vigilantcitizen.com/latestnews/hello-barbie-the-creepy-doll-that-spies-on-kids-and-their-parents/ (accessed 24.07.2015).

UN General Assembly, Convention on the Rights of the Child, 20 November 1989, United Nations, Treaty Series, vol. 1577, p. 3. Available online at www.refworld.org/docid/3ae6b38f0.html (accessed 31.07.2015).

Whitaker, R. (1999) *The end of privacy: how total surveillance is becoming a reality*. New York: New Press.

Whitson, J. and B. Simon (2014) 'Game studies meets surveillance studies at the edge of digital culture: an introduction to a special issue on surveillance, games and play', *Surveillance and Society*, 12(3): 309–19.

Woodyer, T. (2008) 'The body as research tool: embodied practice and children's geographies', *Children's Geographies*, 6(4): 349–62.

Wyld, D. (2009) 'Preventing the worst case scenario: an analysis of RFID technology and infant protection in hospitals', *Internet Journal of Healthcare Administration*, 7(1): 1–7.

Part I

Schooling and education

3 Digital health goes to school

Implications of digitising children's bodies

Michael Gard and Deborah Lupton

All public health policies and interventions are an expression of competing narratives about the past, present and future. They all say something about the causes of ill health and pass explicit or implicit judgement on previous attempts to solve particular health problems. They are shaped by contemporary socio-political conditions and prioritise specific areas of concern over others. Perhaps above all else, they attempt to describe a world that is better than the one we currently live in and the path that should be followed to get there. In sum, they are never simply disinterested, evidence-driven forms of action. Much the same can be said about any educational endeavour, and particularly those that sit at the intersection between schools and public health, which is our subject in this chapter. In fact, school-based public health initiatives are worthy of scholarly attention, we will argue, precisely because of the tensions that lie behind what might seem their common-sense appeal.

As a field of study and practical intervention, school health is difficult to define for two related reasons: the conceptual elasticity of 'health'; and the tendency for almost everything that schools do to be seen as having health implications. Nonetheless, it is possible to outline pragmatically a set of school-based practices that have been and are currently justified on physical and mental health grounds. The curriculum area of physical education is perhaps the most familiar and long-standing of these, but we could also include drug, alcohol and tobacco education, the provision of food, anti-bullying initiatives and mental health programmes. For the sake of brevity, we will group all of these under the term 'school health'.

School health is in the early stages of its engagement with digital technology. For this reason, the developments that we write about in this chapter are relatively new and have not yet been the subject of extensive scholarship. Still, two guiding insights drawn from history are likely to be relevant to school health's digital future. First, despite the idealistic rhetoric that tends to frame it, school health interventions are never solely concerned with the health of students. The sale of food in schools, for example, is in many countries a lucrative commercial enterprise (Levine, 2008), whereas sex education, regardless of what form it takes, is unavoidably a form of moral instruction (Di Mauro and Joffe, 2007). Second, while

important exceptions exist, the amount of time, energy and resources that has been devoted to school health initiatives far exceed their measurable effect, a point that explains the long list of scholars who have questioned the worth of school health initiatives (including Cuban, 1986; Tupper, 2008) and cautioned against unrealistic hopes for their impact on the health of students (St Leger, 2004).

For both of these reasons – that school health is never just what it purports to be and doubts about its efficacy, interest in a digital approach to school health is growing. In what follows, we contextualise this enthusiasm against a broader set of educational, medical, economic and technological developments. We then go on to discuss one concrete example – the US-developed school students' physical fitness programme 'Fitnessgram' – that, at least to our eyes, exemplifies why digital school health needs to be the subject of more penetrating critical reflection than has yet been the case (see Chapter 4).

Educational politics of school health

From their inception, educational systems in Western countries have always been premised, at least in part, on public health grounds. Many educational reformers of the eighteenth, nineteenth and early twentieth centuries, for example, saw schools as a way of producing a physically and psychologically robust population (Urban and Wagoner, 2000). Both eugenic and imperial concerns with racial purity and vigour were fundamental motivating forces for the bodily inspection programmes that sprang up in English-speaking schools in the first half of the twentieth century (Martineau, 1996). Likewise, Cold War tensions and growing anxiety about the physical capacities of American children led directly to the US government creating a series of school-based fitness interventions (McElroy, 2008).

Against this backdrop of enduring belief in their public health mission, schools have proven to be a remarkably flexible discursive tool in the hands of health advocates, social reformers, politicians and ideologues of virtually any persuasion. In fact, it is difficult to think of a public health matter, large or small, which has not at one time been given to schools to solve; skeletal posture, infectious disease, non-infectious disease, mental health, under-nutrition, over-nutrition, social cohesion, sexual behaviour, moral rectitude, alcohol and drug use, road safety and the perceived perils of urban living are among the most long-standing and best known, but are by no means an exhaustive list (Gard and Pluim, 2014). In each case, however, school health interventions have been the culmination of professional and political struggles and compromises. To take just one example, the introduction of subsidised school lunches in American public schools immediately following World War II was presented to the electorate as a public health measure to feed under- or malnourished children. But as Levine (2008) has demonstrated, the programme was originally developed as an economic measure to support the incomes of struggling American farmers and, perhaps more importantly, as a product of the suspicions, antipathies and deal-making that have long characterised the North–South divide in US party politics.

This essentially symbolic dimension of school health is captured in the shifting classroom practice of physical education since its emergence in the late nineteenth century and the various arguments that have been mobilised by its advocates. At various points in history, physical education's purpose was variously seen as readying working-class children for factory work, preparing young men for war, liberating children's innate corporeal and artistic creativity, inculcating self-control and a love of play, promoting social cohesion and producing future sporting champions (Kirk, 1992, 1998). From the 1950s onwards, however, a more bio-medical mission emerged. In fact, given growing concerns about overweight, obesity and chronic disease in recent years, physical education's public health role has grown steadily into a moral obligation in the eyes of many within the profession itself (Himberg, 2005). This is interesting because evidence for a physical education 'effect' on health has proven to be extremely elusive, despite the efforts of many researchers to demonstrate it (Green, 2014). But as Wright (1996) and Kirk (2000) have pointed out, the reorientation of physical education towards a more scientific and bio-medical outlook is less a matter of evidence and more the product of the struggles between different knowledge traditions for resources and institutional prestige, particularly within universities.

While the insights we might draw from this history are potentially numerous, for our purposes, what matters is the enduring power of the *idea* of schools as an instrument of public health policy. Although their motivations have been hugely varied, it has suited a broad cross-section of interests to believe in (or at least to claim to believe in) the ameliorative potential of schools. This convergence of interests helps to explain why this belief has proven to be impervious to the steady flow of contrary evidence.

In some respects, trying to prioritise public health outcomes cuts against schools' primary mission to educate children, a point which partly explains why so many school health initiatives are unsuccessful or prove unsustainable. This is especially true given the growing tendency for Western educational authorities to devote time and resources to improving student performance on standardised high-stakes numeracy and literacy tests. Looked at from a more broadly sociological perspective, however, there are reasons to suspect that a *digitised* school health movement might be well placed to ride the waves of global educational change.

We will have space here only to summarise what has been described by scholars, mostly pejoratively, as the global educational reform movement, referred to by its acronym, GERM (Macdonald, 2014). Scholars have characterised this as the reconfiguring of educational processes and outcomes according to neoliberal principles of market forces, consumer choice and accountability (Ball, 2003). In particular, the focus on accountability partly explains why regimes of standardised and (allegedly) internationally comparable testing have emerged so rapidly in recent years. It also explains the re-emergence of performance pay schemes for teachers in some parts of the world. But, as many researchers have argued, systems of this kind are designed to measure and reward things that can be measured, leading,

they suggest, to both a narrowing and vulgarising of educational aspirations (Rizvi and Lingard, 2009).

The champions of educational reform emphasise what they claim will be the energising effect of free market forces on education, leading to both innovation and efficiency. Two factors are fundamental to this vision: first, increased involvement of the private sector in the supply of educational resources and the delivery of educational services; and second, the role of digital technology. As a result, educational systems worldwide are now experimenting with various kinds of partnerships with a range of edu-businesses, including the global giant Pearson Education and News Corporation's educational subsidiary Amplify (Ball, 2013). In this version of educational reform, the synergy of capital and technology is fundamental; virtual schools, computer-generated learning plans for individual students and wearable digital technology are already a feature of the educational landscape. These changes are happening for many reasons, including the potential for digitally delivered educational services to turn a profit and generate large amounts of data about children, teachers, schools and entire educational systems. Thus, the exploitation of large digital data sets, or 'big data', is held up as yet another reason why private investment and digital technology will lead to superior education outcomes.

If we combine an appreciation of the broader global educational landscape, the aspirations of school health's many advocates, and the increasing sophistication of mobile and pervasive computing technologies, a formidable field of possibilities for digital school health presents itself. At the relatively low-tech end, there are already examples of businesses, like the Coca-Cola company, delivering online health education instruction to schools (Powell, 2014). However, our focus in the remainder of this chapter considers a more hi-tech future for school health, based on the collection, analysis and dissemination of digital data.

Digital data and education

It is important to recognise the broader sociocultural, political and material context in which school health is moving towards digitisation. When we use the term 'material', we are referring to the physicality of digital technologies and the ways in which they are entangled with human and other non-human actors to form dynamic assemblages (Gillespie *et al.*, 2014). This perspective draws on sociomaterialism (Fenwick and Edwards, 2011) and the new materialism (Coole and Frost, 2010) in emphasising the embodied interactions of people with objects: in this case, such objects as wearable self-tracking devices, mobile or desktop computers, software and algorithms and the digital data on people's behaviours, emotions and thoughts that are generated from these interactions.

A growing body of literature is beginning to examine the implications of digital software and hardware on people's concepts of embodiment, selfhood and social relations. Writers have pointed to the ways in which knowledge has become digitised and is increasingly controlled by the internet empires – Google, Apple,

Amazon, Facebook and Twitter – and other digital corporations (Franklin, 2013; Fuchs, 2014; Lash, 2007; Van Dijck, 2013). Digital scholars have emphasised the ways in which computer software and hardware are sociocultural artefacts, the products of human decision-making and political as well as commercial agendas (Manovich, 2013). The structuring role played by algorithms, or 'algorithmic authority', has also attracted critical attention. Scholars writing on this topic have noted that software algorithms are increasingly playing a part in shaping knowledge and information and determining futures (Cheney-Lippold, 2011; Mackenzie and Vurdubakis, 2011; Totaro and Ninno, 2014).

The notion of lively data (Lupton, 2016) also requires attention as part of recognising the materiality of digital technologies. Digital data are ceaselessly collected on the users of digital technologies, from their search engine encounters to their online shopping habits and social media status updates. Qualculation (quantitative calculation) (Thrift, 2004) underpins concepts concerning how digital data should be gathered and acted upon. Qualculation has been intensified by digital technologies that are able to monitor and record continuously minute details of people's bodies and behaviours (Thrift, 2004), including the generation of personal and big digital data sets. According to Thrift (2004: 584), these forms of qualculation are generating new ways of understanding and experiencing space and embodiment, changing what he describes as the 'human sensorium', or humans' embodied and sensual experiences of their world. Instead of fixed numerical values being configured, the flow of data that is afforded by digital technologies generates new values incessantly, involving endless calculations and recalculations, which we are required to assess and act upon. People come to view themselves not only as the subjects of continual measurement and quantification but also as interpreters and actors upon these forms of information who are moving around in environments in which they are data-emitting objects feeding into the digital data economy.

The questions of how data are understood and represented and the recursive effects they have on human cognition, embodiment and social relations in these new conditions of digitised qualculation remain to be explored in any great depth. In the context of school health, it may be argued that such technologies configure qualculated assemblages, in which digital data are represented as vital to both generating detailed information on students' bodies and as motivating students by allowing them to 'see' what they have achieved via what are considered to be the neutral, objective insights of digitised quantified data. These ideals are routinely expounded in the devices, discourses and practices related to self-tracking or 'quantifying the self' (Lupton, 2013a, 2013b, 2014a).

In the digital knowledge economy, such data have become valuable commodities, viewed as producing important insights into human behaviours. They also contribute to people's attempts to optimise themselves: to be self-entrepreneurs. In discourses on using personal data for improving health, well-being and productivity, algorithmic authority often plays an important role. The digital data that are collected on individuals, either on their own behalf or by other actors and agencies,

such as social media sites, customer loyalty programmes or search engines, are represented as providing important information that people can employ to engage in work on themselves as part of the project of selfhood (Lupton, 2013a, 2016). In the case of children, parents and teachers employ monitoring and surveillance technologies in the interests of optimising children and maximising their health, well-being, learning and life skills. This is, therefore, a form of imposed or even coercive self-tracking, in which external actors or agencies seek to persuade or force people to collect data on themselves. When these data are employed principally for the benefit of others (for commercial, managerial or research use) rather than those who have generated the data, they contribute to the mode of exploited self-tracking (Lupton, 2016).

In recent years, the domain of school education more generally has been increasingly digitised; yet, the perspectives on digital technologies that we have outlined above are only beginning to be incorporated into the sociology of education, much less the more specific sociology of school health. This is partly because this field has not traditionally devoted much attention to a theoretically informed analysis of digital technology, tending to view such objects as useful or even revolutionary tools (or what Selwyn (2012) refers to as the 'ed-tech bubble' perspective) rather than as sociocultural artefacts worthy of sustained critical attention (Edwards, 2015; Selwyn, 2012, 2015).

In countries such as the UK and USA, the spaces of the classroom and playground, and even changing rooms and lavatories in many schools, are monitored by CCTV cameras. Some schools require students to wear RFID chips in badges or incorporated into clothing to monitor their movements, and use biometric technologies, such as fingerprint recognition devices, to identify them (Taylor, 2013). Students' use of digital technologies in school is frequently monitored as part of ensuring that they are not accessing inappropriate websites or engaging in cyberbullying. Such surveillance technologies are often justified in the name of improving security and reducing the risks to which students may be exposed. However, digital technologies in schools are expanding well beyond security devices. A number of monitoring devices are beginning to focus on students' learning achievements, using software algorithms to closely track progress and predict future learning (learning and predictive analytics) (Edwards, 2015; Selwyn, 2013; Williamson, 2013, 2015a).

In the context of schools, algorithmic decision-making comes to bear on the ways in which student behaviour is monitored and measured and the predictions that are made about future behaviour. The development of the 'smart school' (Williamson, 2015b) or 'sentient school' (Lupton, 2015a) has configured a space in which tracking software and sensor-based and visual-recording technologies are able to track students in ever-finer detail, continually generating various forms of data sets about them. Given the increasing prevalence of digital technologies in schools, it has been contended that software and hardware should be viewed as elements of the 'hidden curriculum' of education that require identification and critical analysis (Edwards, 2015). The commercial elements of these

technologies, as we noted earlier, require attention. Not only are digital companies and entrepreneurs profiting from selling software and hardware to schools in the name of innovation, security and better learning and teaching, but the digital data that are generated from students' use of these technologies are also highly valuable in the digital knowledge economy and for government policy development.

The health and physical education curriculum is also moving towards the use of digital devices for student surveillance. We see here a merging of pedagogical with surveillance rationales. Student learning objectives are represented as accomplished via the instructional attributes of quantifiable data. To view one's data, it is assumed, is to achieve greater knowledge about one's body and its functions and sporting performance. The use of digital technologies in school health is just one iteration of a number of developments in the digitising of health, fitness and sporting practices. The apparatus of digital health incorporates such technologies as patient monitoring and self-care devices, telemedicine (remote clinical care), diagnostic, risk management and decision-making tools for healthcare workers and managers, digital devices for administering medicine or regulating body functions, digital imaging and 3D printing, digitised medical education, health promotion using digital technologies (for example, text messages, apps and wearable self-tracking devices), online platforms, blogs and other social media for the sharing of information and experiences by patients and healthcare workers, digital epidemiology, 'smart' healthy cities initiatives, electronic patient records and healthcare management software, 'smart homes' designed to support assisted living initiatives for the elderly and digital games for sport and fitness (Lupton, 2014b, 2015b).

Sporting and fitness activities are now frequently monitored by digital devices. These include technologies that are able to film physical motion and apply algorithms to analyse the movement, and wearable devices that track a range of bodily functions and activities and generate digital data. A form of applied computer science, often referred to as sport/s informatics, has developed, which capitalises on the plethora of digital monitoring and sensor-based devices and software available for athletes and sportspeople at all levels to analyse performance (Sykora *et al.*, 2015). As in many other domains in which digital data are used, these data are viewed as offering new insights by virtue of their volume and apparent accuracy and opportunity to generate fine-grained, continuous information on active bodies.

Health and physical education teachers are beginning to see the potential of using these technologies as part of measuring their students' physical fitness and sporting prowess and engaging students' interest in the curriculum. The concept of 'gamification' is central to recent initiatives in school health. Gamification, or the rendering of aspects of using digital technologies and self-tracking as games, is an important dimension of new approaches to self-tracking. The principles of gamification have entered many social domains, including education, the home and the workplace. Gamification is viewed as a motivating factor in inspiring people to compete with others, achieve their own goals or simply have fun while engaging in mundane, difficult or repetitive tasks and activities (Jagoda, 2013; McCormick, 2013; O'Donnell, 2014). In the context of schools, digital game technologies (sometimes referred to as 'exergames'), such as Wii Fit, Xbox Kinect, and a multitude of apps, have been advocated to address a range of 'problems', including children's lack of physical activity, body weight, mental health, diet, smoking and skin cancer prevention, physical rehabilitation and co-ordination and asthma and diabetes self-management (Öhman *et al.*, 2014; Reddy, 2014).

The digital gamification of school health has a number of potential consequences. One is the rendering of external surveillance objectives into internalised desires to monitor and measure one's physical activities and capacities. By making an act of surveillance playful and voluntary, it becomes far more acceptable compared to those acts of surveillance that are perceived to be imposed on oneself by others. Another consequence is rendering activities that might otherwise be viewed and experienced purely as ludic into the apparatus of self-management and bodily regulation for the sake of good health and physical fitness. Fun becomes subject to various forms of monitoring and measuring as part of achieving standard approved outcomes in the interests of good health.

Case study: Fitnessgram

Finally, we turn to a more detailed example of the digitisation of school health. The programme known today as Fitnessgram, began as a computer-generated fitness report card system in a group of Texas schools in the late 1970s. The system's creator, Charles L. Sterling, later joined the Dallas-based Cooper Institute, founded in 1970 by the so-called 'father of aerobics', Ken Cooper. With the support of the Cooper Institute, Sterling spent the following decades developing, refining and promoting Fitnessgram (Plowman *et al.*, 2006). According to publicity material, Fitnessgram is now used in tens of thousands of American schools and, like its predecessors, is exported around the world (Cooper Institute, 2014a).

Fitnessgram's advocates have been at pains to describe it as 'driven by data', while also tapping into the growing prestige of and interest in digital technology. For example, while there has been little change over time in the fitness-testing protocols used, each new version of Fitnessgram has invariably been distinguishable by increasingly sophisticated software systems for recording and disseminating data and their ability to integrate with other digital platforms. The recent release of version 10.0 is particularly interesting in this respect. While earlier versions had simply instructed teachers in how to conduct fitness tests and communicate the results, version 10.0 now includes systems for capturing data about what children eat and the amount of physical activity they do, additions the Cooper Institute calls 'Nutrigram' and 'Activitygram'. As an integrated surveillance system, Fitnessgram 10.0 is now being advertised as a way to 'complete the equation for good health' by focusing on the 'whole child' (Cooper Institute, 2014a). In the case of Nutrigram, children are required to take periodical surveys that then generate reports about their nutritional knowledge and behaviour. For Activitygram, a three-day survey period is recommended, in which children log their physical activity in 30-minute increments.

In short, Fitnessgram is steadily evolving into physical education's equivalent of the high-stakes literacy and numeracy testing that we described earlier in this chapter. A number of US states have already passed legislation making Fitnessgram testing compulsory in government-funded schools, and others are preparing to follow suit. Enacting legislation, in most cases, requires data to be analysed at the school, district and state level and then reported to state legislatures on a yearly basis. Fitnessgram 10.0 appears to have been developed precisely with the collection, aggregation and reporting of large amounts of data in mind.

Whether or not these developments are to be welcomed is something people might legitimately disagree about – and perhaps somewhat beside the point, given this volume's focus on surveillance. We will suggest here only that the philosophy repeatedly articulated by Fitnessgram's advocates – that data and information drive behavioural change – is very much at odds with mainstream health education thinking. In fact, Fitnessgram's explicitly deficit-model approach – that we need to understand where children are going wrong so that we can then fix them – has been the subject of sustained and explicit critique by health educators for some time (Antonovsky, 1996; Morgan and Ziglio, 2007). With respect to surveillance, however, two points are worth making.

First, it is generally argued by researchers that self-reported measures of both eating and physical activity are unreliable, particularly when data is supplied by children (Tremblay, 2004). This is important because, as we described above, research into ever more sophisticated and physically unobtrusive biometric surveillance systems is now underway. In this light, the published leadership groups of the Cooper Institute are instructive. For example, alongside politicians, banking, oil, finance and retail CEOs, owners and chairmen of professional baseball and football teams, motivational speakers and medical researchers and clinicians, the Cooper Institute's Board of Trustees and advisory committees are populated by leaders from large data management (such as Digital Equipment Corporation) and computing hard- and software (such as Electronic Data Systems) corporations (Cooper Institute, 2014b).

It is surely not overly conspiratorial to assume that future versions of Fitnessgram will be designed primarily to interface with increasingly sophisticated digital devices that capture and analyse biometric data. Fitnessgraph apps are already available for both children and teachers. The app for children encourages them to take tests to assess their health and fitness 'literacy' and monitor their physical activity and sedentary levels before, during and after school. It also produces 'personalised reports' for each user based on these data. The teachers' app facilitates the testing and measurement of students on mobile devices, allowing data entry in a diverse range of locations. While the Fitnessgram platform does not yet include self-tracking devices for automatic monitoring of students' physical activity levels, it is no doubt only a matter of time, given the gradual spread of these devices into domains such as the workplace, customer loyalty programmes, health and life insurance and in other health and fitness initiatives in schools (Gard, 2014; Lupton, 2015a, 2016). There also appears to be no reason why these data

will be limited to physical fitness, food and physical activity. Given Fitnessgram's recent rhetorical shift towards the 'whole child', there is obvious scope for it to branch out into a wide range of other health-related areas, such as drug use, sexual behaviour and mental health.

Second, while the Cooper Institute is officially a non-profit organisation, Fitnessgram is not. This perhaps explains why the Cooper Institute appears to put so much energy into cultivating relationships with political and business leaders and, by extension, why it has been so successful in marketing and selling Fitnessgram across the USA. For example, Fitnessgram was recently endorsed as the recommended school fitness-testing system by the federally funded Presidential Youth Fitness Program. In fact, it is now an apparently successful and important commercial entity in its own right. For example, the publishing house Human Kinetics sells and distributes Fitnessgram materials globally. In the USA, the commercially and culturally powerful National Football League (NFL) recently partnered with Fitnessgram, so that many Fitnessgram products now carry the NFL logo. The Cooper Institute has also begun to expand its product range by rebranding Fitnessgram for sale to the military, ambulance and fire services. In each case, the formula is the same: a simple – we might even say crude – set of physical fitness tests supported by a rapidly developing set of digital paraphernalia. So, while Fitnessgram looks very much like a case of the Quantified Self movement being transplanted from the wider culture to schools, there are some signs that the flow of surveillance technologies might also stream in the other direction.

With money to be made, elections to be won, a war on obesity to be waged and neoliberal accountability regimes to be implemented in public education systems, Fitnessgram has an obvious list of potential and actual allies. Perhaps most surprising, though, is that few ethical or educational concerns have been raised. In fact, press reports of children and parents refusing to comply with particular aspects of Fitnessgram, most notably body weighing, suggest that resistance will come from those with the least to gain from it (Svokos, 2014).

We referred above to the hidden curriculum promulgated by digital technologies in schools. In the case of digitised school health technologies, certain tacit assumptions, beliefs and practices are represented and reproduced. Those devices and technologies that are directed at qualculative rationales render the human body – and in the case of digitised school HPE, children's bodies – into a narrowly defined set of attributes. These include the notions that physical fitness is essential for good health, that good or poor health status can be assessed via levels of physical fitness and even knowledge about exercise (as in 'physical literacy'), that physical fitness and health can be readily discerned by using measurements that can be compared against norms, and that certain set standards are evidence of either a lack of fitness or a high enough level of physical activity or appropriate fitness and activity levels. As the Fitnessgram website puts it, their assessments are designed to measure not skill or agility but 'health-related fitness'. Students are 'not compared to each other, but rather criterion-based Healthy Fitness Zone standards, carefully established for each age and gender, that indicate good health'. Such a

position on the inextricable relationship between health status and physical fitness (as well as body weight: body mass index is one of the criteria) suggests that it is well nigh impossible for children to be healthy if they are not physically fit, as determined by the standards that are set by the programme. More broadly, these technologies both support and reproduce the discourses of techno-utopianism, data-centricism and technological solutionism that are evident in popular perspectives on digital health and educational technologies.

Conclusion

As school health curricula and practice become increasingly influenced by digitisation, there are significant consequences for the ways in which both children and teaching staff are monitored, measured and evaluated. The introduction of online assessments and sensor-based tracking technologies into school health, often by commercial developers seeking to profit both from selling their software and devices and the digital data that are generated by users, has afforded continuous and detailed surveillance of students and teachers. Critical analyses of the implications and consequences of the digitisation of school health need to reach beyond the standard theoretical perspectives that have traditionally been adopted in the sociology of education to embrace sociocultural investigations into the power and structuring role played by software and code, algorithms, hardware devices and big data in contemporary social life and social relations. There is also a pressing need to connect the somewhat insular academic field of school health with the broader sociology of the body literature, in order to trouble naive assumptions about the impact of and motivations for digital school health interventions.

The emotional repercussions of digitising children's bodies require attention as well. While educational and other data on children's bodies are typically represented as neutral fonts of information, they can have significant affective effects, not only for the children themselves but also for their teachers and parents (Sellar, 2014). Like other social institutions, schools have become code/space assemblages (Kitchin and Dodge, 2011), in which computer software and hardware are entangled not only in pedagogies and curricula but in the very ways in which students' bodies are represented, investigated, monitored and understood. As we have shown in this chapter, in the case of digitised school health, older forms of the privileging of health and physical fitness and notions of ideal bodies, as well as the acceptance of the entry of commercial entities into schools, are taken up and interpreted via the discourses and practices of informatics, the quantified self and big data.

References

Antonovsky, A. (1996) 'The salutogenic model as a theory to guide health promotion', *Health Promotion International*, 11(1): 11–18.

Ball, S. J. (2003) 'The teacher's soul and the terrors of performativity', *Journal of Education Policy*, 18(2): 215–28.

Ball, S. J. (2013) *Global policy networks, social enterprise and edu-business*. London: Routledge.

Cheney-Lippold, J. (2011) 'A new algorithmic identity: soft biopolitics and the modulation of control', *Theory, Culture and Society*, 28(6): 164–81.

Coole, D. H. and S. Frost (2010) *New materialisms: ontology, agency, and politics*. Durham, NC: Duke University Press.

Cooper Institute (2014a) Fitnessgram. Available online at www.cooperinstitute.org/youth/fitnessgram (accessed 10.12.2015).

Cooper Institute (2014b) Board of Trustees. Available online at www.cooperinstitute.org/board/ (accessed 10.12.2015).

Cuban, L. (1986) 'Sex and school reform', *Phi Delta Kappan*, 68(4): 319–21.

Di Mauro, D. and C. Joffe (2007) 'The religious right and the reshaping of sexual policy: an examination of reproductive rights and sexuality education', *Sexuality Research and Social Policy*, 4(1): 67–92.

Edwards, R. (2015) 'Software and the hidden curriculum in digital education', *Pedagogy, Culture & Society*, 23(2): 265–79.

Fenwick, T. and R. Edwards (2011) 'Considering materiality in educational policy: messy objects and multiple reals', *Educational Theory*, 61(6): 709–26.

Franklin, M. (2013) *Digital dilemmas: power, resistance, and the internet*. Oxford: Oxford University Press.

Fuchs, C. (2014) *Social media: a critical introduction*. London: Sage.

Gard, M. (2014) 'eHPE: a history of the future', *Sport, Education and Society*, 19(6): 827–45.

Gard, M. and C. Pluim (2014) *Schools and public health: past, present, future*. Lanham, MD: Lexington Books.

Gillespie, T., P. J. Boczkowski, and K. A. Foot (2014) 'Introduction', in T. Gillespie, P. J. Boczkowski and K. A. Foot (eds), *Media technologies: essays on communication, materiality, and society*, pp. 1–19. Cambridge, MA: MIT Press.

Green, K. (2014) 'Mission impossible? Reflecting upon the relationship between physical education, youth sport and lifelong participation', *Sport, Education and Society*, 19(4): 357–75.

Himberg, C. (2005) 'The great challenge for physical education', *Teachers College Record* (11873). Available online at www.tcrecord.org/PrintContent.asp?ContentID=11873 (accessed 05.12.2015).

Jagoda, P. (2013) 'Gamification and other forms of play', *boundary 2: An International Journal of Literature and Culture*, 40(2): 113–44.

Kirk, D. (1992) *Defining physical education: the social construction of a school subject in postwar Britain*. London: Falmer Press.

Kirk, D. (1998) *Schooling bodies: school practice and public discourse 1880–1950*. London: Leicester University Press.

Kirk, D. (2000) 'The reconfiguration of the physical activity field in Australian higher education, 1970–1986', *Sporting Traditions*, 16(2): 17–38.

Kitchin, R. and M. Dodge (2011) *Code/space: software and everyday life*. Cambridge, MA: MIT Press.

Lash, S. (2007) 'Power after hegemony: cultural studies in mutation?', *Theory, Culture and Society*, 24(3): 55–78.

Levine, S. (2008) *School lunch politics: the surprising history of America's favorite welfare program*. Princeton: Princeton University Press.

Lupton, D. (2013a) 'Understanding the human machine', *IEEE Technology and Society Magazine*, 32(4): 25–30.

Lupton, D. (2013b) 'Quantifying the body: monitoring and measuring health in the age of mhealth technologies', *Critical Public Health*, 23(4): 393–403.

Lupton, D. (2014a) 'Self-tracking cultures: towards a sociology of personal informatics', paper presented to the Australian Conference on Human-Computer Interaction (OzCHI), Sydney.
Lupton, D. (2014b) 'Critical perspectives on digital health technologies', *Sociology Compass*, 8(12): 1344–59.
Lupton, D. (2015a) 'Data assemblages, sentient schools and digitised health and physical education (response to Gard)', *Sport, Education and Society*, 20(1): 122–32.
Lupton, D. (2015b) 'Health promotion in the digital era: a critical commentary', *Health Promotion International*, 30(1): 174–83.
Lupton, D. (2016) *The quantified self: self-tracking cultures*. Cambridge: Polity Press.
McCormick, T. (2013) 'Gamification: anthropology of an idea', *Foreign Policy*, 201(Jul./Aug.): 26–7.
Macdonald, D. (2014) 'Is global neo-liberalism shaping the future of physical education?', *Physical Education and Sport Pedagogy*, 19(5): 494–9.
Mackenzie, A. and T. Vurdubakis (2011) 'Codes and codings in crisis: signification, performativity and excess', *Theory, Culture and Society*, 28(6): 3–23.
Manovich, L. (2013) *Software takes command*. London: Bloomsbury Publishing.
Martineau, S. (1996) 'Dangerous liaison: the eugenics movement and the educational state', in J. Ross Epp and A. Watkinson (eds), *Systemic violence: how schools hurt children*. London: Routledge Falmer.
McElroy, M. (2008) 'A sociohistorial analysis of U.S. youth physical activity and sedentary behavior', in A. L. Smith and S. H. Biddle (eds), *Youth physical activity and sedentary behavior: challenges and solutions*. Champaign, IL: Human Kinetics.
Morgan, A. and E. Ziglio (2007) 'Revitalising the evidence base for public health: an assets model', *Promotion and Education*, 14(2 suppl): 17–22.
O'Donnell, C. (2014) 'Getting played: gamification, bullshit, and the rise of algorithmic surveillance', *Surveillance and Society*, 12(3): 349–59.
Öhman, M., J. Almqvist, J. Meckbach, and M. Quennerstedt (2014) 'Competing for ideal bodies: a study of exergames used as teaching aids in schools', *Critical Public Health*, 24(2): 196–209.
Plowman, S. A., C. L. Sterling, C. B. Corbin, M. D. Meredith, G. J. Welk, and J. R. Morrow (2006) 'The history of FITNESSGRAM®', *Journal of Physical Activity and Health*, 3(Suppl. 2): S5–S20.
Powell, D. (2014) 'The corporatization of health education curricula: "part of the solution" to childhood obesity?' in K. Fitzpatrick and R. Tinning (eds), *Health education: critical perspectives*, pp. 142–56. London: Routledge.
Reddy, S. G. (2014) 'How gamification improves health and health education outcomes in children', *Nuviun*. Available online at http://nuviun.com/content/series/how-gamification-improves-health-and-health-education-outcomes-in-children (accessed 24.11.2014).
Rizvi, F. and B. Lingard (2009) *Globalizing education policy*. London: Routledge.
St Leger, L. (2004) 'What's the place of schools in promoting health? Are we too optimistic?', *Health Promotion International*, 19(4): 405–8.
Sellar, S. (2014) 'A feel for numbers: affect, data and education policy', *Critical Studies in Education*, 56(1): 131–46.
Selwyn, N. (2012) 'Bursting out of the "ed-tech" bubble', *Learning, Media and Technology*, 37(4): 331–4.
Selwyn, N. (2013) *Education in a digital world: global perspectives on technology and education*. New York: Routledge.
Selwyn, N. (2015) 'Data entry: towards the critical study of digital data and education', *Learning, Media and Technology*, 40(1): 64–82.

Svokos, A. (2014) 'Student sent to principal's office after refusing to be weighed', *Huffington Post Australia*, 10 Nov. Available online at www.huffingtonpost.com.au/2014/11/18/refusing-bmi-school-test_n_6180892.html?ir=Australia (accessed 05.12.2015).
Sykora, M., P. W. H. Chung, J. P. Folland, B. J. Halkon, and E. A. Edirisinghe (2015) 'Advances in sports informatics research', in S. Phon-Amnuaisuk and T. Wan Au (eds), *Computational intelligence in information systems*, pp. 265–74. Zurich: Springer.
Taylor, E. (2013) *Surveillance schools: security, discipline and control in contemporary education*. Houndmills, UK: Palgrave Macmillan.
Thrift, N. (2004) 'Movement-space: the changing domain of thinking resulting from the development of new kinds of spatial awareness', *Economy and Society*, 33(4): 582–604.
Totaro, P. and D. Ninno (2014) 'The concept of algorithm as an interpretative key of modern rationality', *Theory, Culture and Society*, 31(4): 29–49.
Tremblay, M. (2004) 'The need for directly measured health data in Canada', *Canadian Journal of Public Health*, 95(3): 165–6.
Tupper, K. W. (2008) 'Drugs, discourses and education: a critical discourse analysis of a high school drug education text', *Discourse: Studies in the Cultural Politics of Education*, 29(2): 223–38.
Urban, W. J. and J. L. Wagoner (2000) *American education: a history* (2nd ed.). New York: Routledge.
Van Dijck, J. (2013) *The culture of connectivity: a critical history of social media*. Oxford: Oxford University Press.
Williamson, B. (2013) 'The future of the curriculum: school knowledge in the digital age', in *The John D. and Catherine T. MacArthur Foundation reports on digital media and learning*. Cambridge, MA: MacArthur Foundation.
Williamson, B. (2015a) 'Governing software: networks, databases and algorithmic power in the digital governance of public education', *Learning, Media and Technology*, 40(1): 83–105.
Williamson, B. (2015b) 'Algorithmic skin: health-tracking technologies, personal analytics and the biopedagogies of digitized health and physical education', *Sport, Education and Society*, 20(1): 133–51.
Wright, J. (1996) 'Mapping the discourses of physical education: articulating a female tradition', *Journal of Curriculum Studies*, 28(3): 331–51