Tze Ming Mok, Flora Cornish, Jen Tarr

Too much information: visual research ethics in the age of wearable cameras

Article (Accepted version)
(Refereed)

Original citation:
Mok, Tze Ming, Cornish, Flora and Tarr, Jen (2014) *Too much information: visual research ethics in the age of wearable cameras.* Integrative Psychological and Behavioral Science, online. pp. 1-14. ISSN 1932-4502

DOI: 10.1007/s12124-014-9289-8

Too much information:

Visual research ethics in the age of wearable cameras

Tze Ming Mok, Flora Cornish, Jen Tarr

London School of Economics & Political Science

Abstract

When everything you see is data, what ethical principles apply? This paper argues that first-person digital recording technologies challenge traditional institutional approaches to research ethics, but that this makes ethics governance more important, not less so. We review evolving ethical concerns across four fields: Visual ethics; ubiquitous computing; mobile health; and grey literature from applied or market research. Collectively, these bodies of literature identify new challenges to traditional notions of informed consent, anonymity, confidentiality, privacy, beneficence and maleficence. Challenges come from the ever-increasing power, breadth and multi-functional integration of recording technologies, and the ubiquity and normalization of their use by participants. Some authors argue that these evolving relationships mean that institutional ethics governance procedures are irrelevant or no longer apply. By contrast, we argue that the fundamental principles of research ethics frameworks have become even more important for the protection of research participants, and that institutional frameworks need to adapt to keep pace with the ever-increasing power of recording technologies and the consequent risks to privacy. We conclude with four recommendations for efforts to ensure that contemporary visual recording research is held appropriately accountable to ethical standards: (i) minimizing the detail, scope, integration and retention of captured data, and limiting its accessibility; (ii) formulating an approach to ethics that takes in both the ‘common rule’ approaches privileging anonymity and confidentiality together with principles of contextual judgement and consent as an ongoing process; (iii) developing stronger ethical regulation of research outside academia; (iv) engaging the public and research participants in the development of ethical guidelines.

Too Much Information: Visual research ethics in the age of wearable cameras

Introduction

Digital data captured from a first-person perspective is rich in information. More data is recorded than required, and faces and places can be easily identified. This data-density is both an attraction for social scientists, and a source of ethical risks that escalate as technology advances. Devices with cameras are becoming smaller and more widespread, are able to gather more data faster and at higher resolutions, and have increasing capacity to store and share information indefinitely.

The devices we examine here all involve wearable cameras that record research participants' subjective perspectives, particularly three devices in current use: SenseCam, SubCam, and Google Glass. SenseCam is worn on a lanyard around the neck, and takes still photographs at pre-defined intervals (typically every 30 seconds). SubCam records video and audio from a miniature camera attached to glasses. Google Glass is worn on the face like a pair of glasses, and can record and play back video and audio as part of a hands-free system equivalent to a smartphone. Social science researchers have been using SenseCam and SubCam to record naturalistic social behavior (Doherty et al., 2013; Kelly et al., 2013; Lahlou, 2011), while the use of Google Glass has been studied in medical and health contexts (McNaney et al., 2014; Muensterer, Lacher, Zoeller, Bronstein, & Kübler, 2014). We also draw on related literature on other hand-held or body-worn recording devices, when relevant ethical issues arise.

This paper aims to identify the key ethical challenges and current safeguards in using mobile digital recordings as research data, through a review of the existing literature in four key fields: ‘visual ethics’ scholarship (which is mainly derived from still photography); ubiquitous computing (Ubicomp) and Human-Computer Interaction (HCI) literature; medical and public health uses of these devices, and grey literature from field trials, pilots and market research.

Throughout this review, we consider how new technologies reshape our assumptions and practices in relation to ethics. We address how the new ubiquity of first-person recording technologies may be altering social contexts and norms around what is acceptable, ‘normal’ and ethical research use, particularly with regard to the role of Institutional Review Boards (IRBs).

Some have argued that recent developments are making IRBs less relevant, or even obsolete. Scholars using visual methods for participatory research have argued that IRB ethics frameworks neglect important ethical issues and prioritise irrelevant ones (Prosser, Clark, & Wiles, 2008; Wiles, Coffey, Robison, & Prosser, 2012). Considering peer-to-peer, participant-driven research enabled by technological developments, O’Connor (2013) claims that changes to the power relation between researcher and participants invalidate traditional IRB concerns. Moreover, the bulk of research using new technologies is conducted in a corporate context exempt from IRB frameworks anyway.

How, then, should research ethics be governed?

Review: Research ethics guidelines and wearable cameras

Specific ethics guidelines for academic research using visual methods were developed by primarily American and British social science researchers in the late 2000s, in response to increasingly widespread use of still photographs and video in qualitative social research. This field came to be formally known as ‘visual ethics’. Key publications included statements and guidelines by the British Sociological Association (British Sociological Association, 2006), ESRC (Prosser et al., 2008; Wiles, Prosser, Bagnoli, & Clark, 2008), and the International Visual Studies Association (Papademas, 2009), and were concerned with how traditional ethical guidelines could be adapted to the burgeoning field of visual research. In HCI and Ubicomp literature, the treatment of ethics has traditionally been more concerned with the societal (rather than research) implications of surveillance. Steve Mann’s concept of ‘sousveillance’ (recording by ordinary people ‘from below’ rather than by states or corporations ‘from above’) was a key organizing strand of these ethics discussions (Mann, Nolan, & Wellman, 2002). HCI and Ubicomp literature has also raised the need for more guidelines and standards on research ethics, given computer science’s relative inexperience historically with human research subjects (Brown & Adams, 2007), and has also noted that the development of ethical, legal and institutional frameworks lags behind the pace of technological progress (Lahlou et al., 2005; Mann, 2005; Michael et al., 2008).

A review of ‘life-logging’ ethics literature, which deals with participants using multi-media technology to diaristically record their experience, largely for their own personal use (Jacquemard, Novitzky, O’Brolcháin, Smeaton, & Gordijn, 2014), notes that there has only been one contribution that has put forward a set of systematic guidelines for the use of such technology in research. Those guidelines, by Kelly et al. (2013) draw substantially on the ESRC visual ethics guidelines and discussions, developing them more explicitly, albeit for a narrow use with the SenseCam only. Third party consent, participants' control over the context of recording, and data protection/confidentiality issues are emphasized. The guidelines appear to have become a standard reference in health-related studies using SenseCam, which tend to include little further discussion of ethics (e.g., O'Loghlen, 2013; Barr, 2013). Growing studies on UbiHealth (ubiquitous health) or mHealth (mobile health) technologies, encompassing wearable cameras, have also been relatively thin on discussion of research ethics, although some pilot studies into 'acceptability' of new monitoring technologies for health have revealed persistent patient concerns about privacy and dignity (Dorsten, Sifford, Bharucha, Mecca, & Wactlar, 2009; McNaney et al., 2014). In the grey literature around industry field trials and market research, ethical considerations are unevenly applied if at all. However there are some relevant implications for this review regarding privacy and surveillance arising from Google Glass pilots (eg. McNaney et al., 2014; Muensterer et al., 2014), police use of body-worn cameras (Farrar, 2013), and educational use of 'point-of-view' recording devices very similar to Lahlou's SubCam (Dyson, 2012; Hayes, 2010; Walsh, Lemon, Black, & Collin, 2011).

The visual ethics literature suggests that visual research is challenging for standard ethics protocols and requires contextual judgement. Ubiquitous computing literature raises broader socio-political questions about privacy and disciplinary surveillance. Public health scholarship is optimistic that new protocols and guidelines can be drawn up to sufficiently protect human subjects. And in much of the grey literature the concern with ethics is minimal. Despite differences across the literatures, it is evident that wearable cameras pose challenges to traditional ethical guidelines around informed consent, anonymity and confidentiality, data protection and privacy, as we explore below.

Informed consent, third party consent and public recording

The key conceptual strand linking these literatures is the problem of informed consent, particularly for third parties in the context of public recording. This issue has implications for related ethical issues such as third party anonymity, confidentiality, data protection, privacy and disciplinary surveillance discussed further below.

The visual ethics literature pays substantial attention to the process of obtaining informed consent, typically framing it as a continual process. During the research a participant may give consent once, but the scope, methods and context of interaction with the researchers and data recording may change, expand, and become more intrusive as the research evolves. It can become unclear whether the subject has consented at every point. Beyond the data gathering, consent is also particularly important in the context of sharing or disseminating research findings, through exhibitions or in academic publications. This literature views these different contexts as being manageable through trust and relationship building.

Third party consent is discussed less often in this literature, although some problems have been addressed, such as when participants photograph others in their lives in photo-elicitation or photovoice studies. Here, participants are responsible for explaining ethical issues to those they photograph, despite not being trained researchers. Wang & Burris recommend that photovoice participant training involve discussions about cameras, ethics and power, and address questions such as “should someone take pictures of other people without their knowledge?” (1997, p. 378).

In general, the question of the ethical acceptability of recording in public places is a grey, and changing area. IVSA guidelines specify safeguards such as being overt about recording (e.g. with a red LED light display), but rely on local convention to provide benchmarks, writing that: “Confidentiality is not required with respect to observations in public places, activities conducted in public, or other settings where no rules of privacy are provided by *law or custom*” according to Papademas (2009, p. 254, our emphasis). Laws and regulations on filming in public places vary between countries, for example, France does not permit public filming in all public places, while the USA and the UK do, with some restrictions depending on political context. Moreover, norms, customs, and laws evolve in tandem with changing technologies and uses of those technologies.

There is some evidence in the HCI literature that pervasiveness of technological surveillance is shifting norms and lowering expectations of privacy and confidentiality. This appears to be more a matter of acquiescence when confronted with ubiquity, rather than active consent or public confidence in the beneficent use of information. Indeed, Nyugen et al.’s SenseCam acceptability study identified feelings among third parties of resignation and powerlessness at the thought of being filmed without their consent (Nguyen, Marcu, & Hayes, 2009). This study used ‘paratyping’ – a multi-country dry-run of trained participants wearing non-functioning SenseCams who solicited survey responses about reactions to the technology from people with whom they had everyday interactions. Research participants in smaller-scale ‘acceptability’ studies that included wearable cameras continue to raise privacy concerns (Dorsten et al., 2009; McNaney et al., 2014). Such findings complicate the principle of relying on contemporary customs; filming may be grudgingly accepted by potential research participants as ‘normal’ yet still be undesirable.

Moreover, the question of potential for harm as a consequence of filming becomes increasingly ambiguous as data collection and integration advance. The IVSA guidelines advise that naturalistic public observation, from which no harm could be reasonably supposed to come, does not generally require consent (Papademas 2009, p.255) As the use of data and metadata becomes more automated and able to be gathered and analysed on a mass scale, the potential for intrusiveness increases beyond what either the recorder or the person whose image is captured may ‘reasonably suppose’ at the moment of filming.

In contrast with the visual ethics literature, third party consent and related privacy issues are a major concern in most studies on the use of wearable cameras, particularly in the context of recording in public places. Studies using wearable cameras need to account for the fact that these cameras a) take pictures without the participant making a conscious choice, and b) take continuous images. They generally recommend two safeguards for dealing with third party consent: a) Taking informed consent from people familiar to the research participant who are likely to be recorded; and b) Minimising the recording of third parties, by reducing the scope of what is being recorded.

The Kelly at al. (2013) SenseCam guidelines provide detailed recommendations for obtaining third-party consent in advance with family, friends and work colleagues, and providing a convenient explanatory card to strangers in public settings. Training participants in providing explanations is also recommended. Similarly, Lahlou (2011) recommends for SubCam research, a clear statement in writing that no image will be used without written consent of those who appear. He notes that in public spaces this is a painstaking and almost impossible logistical task, and that SubCam use is easier "in a closed environment where subjects can be traced" (2011, p. 627). Hayes' summaries of applied pilots using SubCam-like "video-goggles" to engage marginalised youth using visual learning technology, avoided these ethical issues with public filming by constraining recording to limited records of creative and technical processes rather than full-scale life-logging (2010).

Anonymity, confidentiality & increasing data protection

Anonymity and confidentiality are generally seen as the gold standard, across the literature. However, in visual ethics literature, IRBs' traditional emphasis on anonymity and confidentiality has been presented as being in tension with researchers' interests in presenting meaningful visual data, and research participants' interests in being represented faithfully.

Persistent arguments are that "[v]isual methods lend themselves to participatory and emancipatory approaches", pointing to the tendency of participants waiving their rights to confidentiality and anonymity in these kinds of contexts (Prosser et al., 2008, p. 11). Prosser et al. also note that blanket assumptions of anonymity and confidentiality accorded in most social research are more problematic to ensure when visual methods such as photography and video are used, and may actually be counterproductive in cases where the images are produced for the purposes of an exhibition. Anonymity strategies such as blurring or pixelating facial features can also have unintended associations, as this practice is often associated with criminality in news media reporting. Generally, the literature argues that where IRBs expect a blanket application of anonymity standards, this is often inappropriate to visual methods, which call for a more contextual judgement of the need for and appropriate procedures for anonymity and confidentiality.

However, an empirical study by Wiles et al. (2012) on visual methods researchers' experiences with the ethics review process found no significant evidence of this kind of visual research being meaningfully restricted by IRBs. Although IRBs specialising in health research were considered to have poor understanding of how ethics should apply to qualitative visual methods, social researchers 'actively managed' the process to devise practices that would satisfy IRBs, while meeting their own research needs. Researchers reportedly considered ethical good practice in a far wider way (e.g. addressing issues of participant empowerment, or politics of representation) than the specific criteria raised by IRBs, with attention paid to the ongoing process of consenting to waive anonymity for different contextual uses of images and data, such as exhibitions or conference presentations.

Meanwhile, much of the public health-oriented first-person wearable camera literature influenced by the Kelly et al. guidelines (2013) has a more rigid approach, emphasizing a default to blanket protection of third-party anonymity in particular. For example, technology for automated anonymization of third parties, by blurring faces or bodies, is tested and recommended in several technical studies exploring how the SenseCam can be used (Doherty et al., 2011; Mégret et al., 2008).

This approach is possible because although wearable cameras record people other than the wearer (who cannot be seen), third parties are not the actual subject of the research so there is no reason to retain data that identifies them. Further, the purpose of the SenseCam/health related research is not so much to analyse qualitative or aesthetic aspects of imagery, but to analyse categorical data points. Presenting faces is not important to the findings or their dissemination. This adheres more closely to the traditional medical research model of anonymity for IRB review criticised by visual methods researchers in the Wiles et al. study (2012).

In terms of confidentiality, again there is a contrast between the two literatures due to differences in perceived levels of risk, which is again connected to the levels of technology being used. As part of the conceptualisation of consent as an ongoing process, the visual ethics literature emphasises giving research subjects a 'realistic' understanding of the extent to which confidentiality can be assured in the context of publication, dissemination, and potential data re-use by other researchers. Meanwhile, HCI and health literature place a more detailed emphasis on the technicalities of data protection in order to safeguard confidentiality and anonymity, due to the scale of data captured.

The rapid development of and public access to facial-recognition software is a particular risk (Kelly et al., 2013). Private companies have already made this kind of software available in smartphone app form (i.e. integrated with the camera function), and with reprogrammed or 'hacked' Google Glass sets. Google has publicly stated that they will not permit facial recognition apps in its official Glassware store due to privacy concerns “at this time” (Google, 2014). However, it cannot stop private use of such technology, or any other technology, with reprogrammed headsets.

SenseCam research has developed methods of automated image analysis for findings that do not require reproduction of human images, nor do they need humans to view the images (Doherty et al., 2011). Doherty notes that this removes some concerns about confidentiality and anonymity in the research context, as not even researchers see the third parties. However, not being viewed by a human researcher is no guarantee of data protection unless there is a clear technological and even physical separation between data capture, data storage and data analysis. For example, the stakes are raised if automated analysis, which requires certain forms of facial recognition software, took place on the same networked device or platform (say, a smartphone as a SenseCam-like alternative) that gathered the data and stored the data.

Broader Ubicomp ethics literature identifies related technical threats to research confidentiality such as programme error and hacking (Brown & Adams, 2007); and health research has given significant attention to data protection issues due to the potential sensitivity of the collected material. Discussion of ethics for digital public health research has highlighted the realities of frequent large-scale security breaches in information systems (Myers & Frieden, 2008). ‘Ubihealth’ or ‘mHealth’ trials and studies have included relevant ethical discussions that emphasise data protection protocols to protect doctor-patient confidentiality (Leijdekkers, Brakel, & Gay, 2009). Trials of Google Glass in a medical context expressed significant concerns about the ethical implications of data protection in ‘the cloud’ (Muensterer et al., 2014), which, in the UK context, can be a breach of the Data Protection Act, depending on where the data are stored. A group planning to market reprogrammed Google Glasses to the medical sector on general release has stated that all Google software will be wiped and replaced with software that complies with US Data Protection requirements for medical use (O'Connor, 2014). The general response of these studies to the increased risks posed by expansion and accessibility of data collection and storage, is the escalation of technical controls and defences.

Privacy, 'too much information', and narrowing the scope

Regarding privacy, visual ethics and HCI literatures have more in common. Following general ethical standards, visual ethics literature sets a consistent baseline of recommendations against gathering more information than is necessary, in order to safeguard privacy. The HCI literature elaborates extensively on privacy issues, particularly noting that automated processes of data-gathering (eg. in the context of life-logging technology) are increasingly capturing too much information (Jacquemard et al., 2014).

As an alternative to technical escalation of data protection, the HCI ethics literature also recommends a de-escalation of data collection upfront. For example, a key recommendation from Jacquemard, in the context of designing life-logging software for personal recreational use, is to narrow the scope of data that can be gathered by technology to no more than is absolutely necessary, reducing the risks of gathering sensitive or overly intrusive levels of information in the first instance (Jacquemard et al., 2014). Dodge & Kitchen have argued for integrating an ethical approach to 'forgetting' data in the life-logging process to mirror more natural processes of memory, and to “free pervasive computing from burdensome and pernicious disciplinary effects” (2007, p. 15). The research parallel would be to delete data after a specified period, possibly in graduated stages that distinguish between richer and sparser forms of data.

SenseCam is considered a more ‘manageable’ level of data with its occasional still shots; although technology is outpacing these limitations in wider research use. Yet even the SenseCam still has to deal with typical issues of lapses in participant memory or momentary awareness affecting privacy. The technology’s advantages of subtlety and unobtrusiveness make it easier to accidentally cross the line during the ongoing process of consent. Not only does this risk exposure of sensitive or embarrassing information (e.g. a SenseCam user who forgets to turn off their camera when they go to the bathroom), but also has concrete consequences when ‘unnecessary’ information captured documents illegal activity that researchers could be legally compelled to hand over, such as drink-driving (Kelly et al., 2013, p. 316).

Visual methods literature, like ethnographic literature more broadly, promotes a high degree of participant control over visual data including rights to access, reflect upon, or withdraw the data as part of the ongoing process of consent (British Sociological Association, 2006). Echoing this, Kelly recommends giving research subjects the ability to view and delete images privately before passing them over to the researcher (2013, p. 316). Some studies using first person mobile cameras specify that the participant can access the data during and after collection, and delete data (Marcu, Dey, & Kiesler, 2012), but this is not mentioned in others (Mégret et al., 2008; O’Loughlin et al., 2014). This form of participant curation of the data may result in questions over validity of data, but is also more ethical in giving greater control to the subject.

However, giving subjects full control over their data, particularly the ability to keep copies of and disseminate images and recordings, also leads to a loss of control over the ethical use of data on third parties. Kelly recommends not giving copies of SenseCam images to participants (2013, p. 316) but in practice, this is a line that is very easy to cross once SenseCam substitutes like smartphones are used, as recording and sharing functions are so integrated within those devices. Even if life-logging apps are specifically programmed to prevent the sharing of images, if an image can be viewed on a device, it can be screen-captured (i.e. copied) and then distributed.

Beneficence

In the visual ethics literature there is particular emphasis on the autonomy and empowerment of those participating in research. Ethnographic research using the ‘Subcam’ tends to emphasise emancipatory, revelatory and participatory analysis of images, similar to the qualitative approach to image-gathering as an elicitation device rather than data capture, for example in studies on understandings of what it means to ‘come home’, or of coming to realistic understandings of one’s own body size (Cordelois, 2010; Urdapilleta & Lahlou, 2012). However, this approach represents a very small proportion of research using first-person recording devices.

Elsewhere we see a trade-off between data restriction and the usability of technology by researchers and participants. This can create ethical tensions when the control over data collection, deletion and interpretation is in the hands of research subjects, particularly during the process of the data collection. For example, the Marcu et al. study (2012) used an iPod Touch as a more user-friendly and widely available SenseCam, which produced an unexamined conflict between ease of use and accessibility by research subjects on one hand, and rigorous data protection and protection of third parties on the other.

As in a later study on the use of smartphones as SenseCam substitutes (Gurrin et al., 2013), the wide availability, familiarity and hence accessibility of the technology used was seen as a more ethical and emancipatory alternative to the more obscure SenseCam. The data gathered was also more accessible to the participants. Apart from ‘hacking’ risks, unlike SenseCam the iPod Touch has a photo browser, allowing users to easily review their images, and also has Wifi internet connectability. This was an empowering aspect of the study, providing autistic children with a means to process their experiences and communicate them to their parents. At the same time, images, including those of private moments and third parties, could have been easily viewed by others, and shared online.

Maleficence/social acceptability

A consistent problem for research participants using wearable cameras has been third parties’ suspicion or hostility when they discover they are being recorded, or if they simply suspect that they could be recorded. Kelly et al. provide detailed instructions on how to train and protect SenseCam users from such hostility, via explanation and consent-seeking (2013), and Nyugen et al. found that there is higher acceptability for such devices if they are in the service of people with disabilities and chronic conditions (2009). Other studies indicate this is a pervasive concern or feature of third-party social response, related to the low social acceptability of being filmed without consent in either public or private settings. This contributes to self-consciousness and stigmatisation of the users of the technology. (Marcu et al., 2012; McNaney et al., 2014)

In the grey literature, the case of the Google Glass ‘Explorer’ programme is informative, as a pilot market research study on user experience and social impact. ‘Explorers’ were given no warnings or trainings in seeking informed consent or how to deal with assumptions of maleficence, which infamously put early users at risk of hostility and social exclusion (Castaneda, 2014).

Jacquemarde’s recommendation, regarding lifelogging tech design, is that being able to easily switch off or physically remove a device is an important safeguard against assumptions of maleficence. He notes greater challenges to this principle from the increasing integration of technology into devices upon which users rely for everyday or basic physical and medical functionality. The likely integration of Google Glass (or similar future competitors) with prescription glasses is given as an example of how being asked to ‘remove’ a device as a guarantee against maleficence could impose excessive burdens or harm on the user (Jacquemard et al., 2014, p. 403). The predicted rise of ‘wearables’ and incorporation of technology into clothing is likely to present similar challenges. It is possible that in the long-term, stakes may rise so much in the trade-off between privacy and connectedness, that the social or functional costs of removing a device from one’s person are too high to consider realistic.

Surveillance, intrusion and discipline

In light of concerns about capturing ‘too much information’, it has become evident that simply putting recording technology in the hands of lay users does not automatically make it a case of ‘sousveillance’ rather than surveillance (Dorsten et al., 2009; Marcu et al., 2012; McNaney et al., 2014; Nguyen et al., 2009). For example, some Parkinson’s sufferers feared that Google Glass devices would become a kind of leash that would never allow them to escape from contact with, and hence control by, their children or caregivers (McNaney et al., 2014). In the case of the Marcu et al. trial of the SenseCam with autistic children and their parents (2012), the tension was clear between the emancipatory intent of ‘giving voice’ to the experiences of nonverbal children, and parental enthusiasm for monitoring their children’s behaviour and surveilling the actions of their ex-partners and other adults. Some parents even desired to do so covertly, proposing more subtle or invisible cameras, which they thought would be less stigmatising for their children.

Ubihealth and mHealth research have examined technologies including wearable cameras, mobile sensors and other aids. Yet the field is notable for its general lack of attention to disciplinary control and biopower, even when considering highly vulnerable research subjects such as elderly dementia sufferers (Mégret et al., 2008). This contrasts sharply with fears of the panopticon and repressive, disciplinary health-monitoring technology found in Ubicomp literature (Brown & Adams, 2007, p. 56).

Discussion & recommendations

Our review has found that first person visual recording devices present significant ethical risks. These risks are not addressed fully by existing guidelines, which are in some areas, relatively coherent, but in others have been limited, piecemeal or reactive rather than pre-emptive. The context of rapid changes in the power of such technologies to record 'too much information', and the increasing normalization of these technologies in everyday life, make it difficult to write definitive guidelines. Nonetheless, the potential scale of these risks, we suggest, makes ethical regulation more important, not less.

In this section, we first discuss the main source of challenges to ethical governance of research using wearable cameras, namely the ever-increasing power to record 'too much information'. We then make four recommendations for ways to ameliorate this problem, by: (i) minimizing the detail, scope, integration and retention of captured data, and limiting its accessibility; (ii) formulating an approach to ethics that takes in both the 'common rule' approaches privileging anonymity and confidentiality together with principles of contextual judgement and consent as an ongoing process; (iii) developing stronger ethical regulation of research outside academia; (iv) engaging the public and research participants in the development of ethical guidelines.

Developments in technology often outpace the development of ethical guidelines. For example, in proposing functional ethical guidelines for the use of SenseCam, Kelly et al (2013) rely on the technology's technical limitations to limit the risks of the researchers' access to 'too much information'. Yet, in the very same journal issue, another article simultaneously makes the case for the use of smartphones as a cheaper and more widely available alternative that is purportedly more ethical because it could benefit more people (Gurrin et al, 2013). However, smartphones have a much broader capacity for multi-dimensional data capture and transmission, and therefore increase risks to confidentiality. This context of ever-increasing technological power provides the backdrop to our four recommendations.

The first recommendation is to limit the scale and scope of data captured as much as possible. On this, there is a consensus is the literature, which suggests recording the minimum necessary data, winnowing down information, 'forgetting' information, and building impenetrable firewalls around the remainder, including between the participant and their collected data. But here a technical problem arises that has not yet been clearly addressed in the literature, namely the failure of the 'separation of powers' in first-person recording devices. When devices in general use like smartphones are employed as research tools, research participants (and potentially their parents or carers, for example), can not only record, but review and share data on third parties. These third parties might accept their data being used and anonymised by researchers, but might think quite differently about giving control over their data to research participants. Individual studies using bespoke devices can devise workarounds, e.g., giving participants the power to review and delete images, but not 'possess' them. For example, the SenseCam has in-built technical limitations that allow for the strict separation of data collection, curation, analysis, and dissemination. However, if all these processes are carried out on one device that is networked, directly accessible, and in the hands (or on the body) of the participant rather than the researcher (e.g. a smartphone), then the task is far more difficult. Given that the next significant stage of popular use of integrated technology is being touted as the 'Internet of Things': a ubiquitous network of personal monitoring and surveillance embedded in myriad everyday objects, including wearable technology, this problem of ‘inseparability’ will become more pronounced. Researchers will need to be vigilant regarding the access that research participants have to others’ personal data – but also regarding the significance of being made aware of details of their own personal data. Organisations charged with producing guidelines should work to develop codes of practice applicable to a broad range of visual capture technology, rather than focusing on specific devices which are likely to be quickly outdated.

The second recommendation is that, particularly given the rapidly changing technology, and equally rapidly changing social norms, contextual judgement is often required when weighing ethical risks. The classic IRB ‘common rule’ approach to anonymity, confidentiality and informed consent; and the more contingent and contextual social scientific approach to participant consent as an ongoing process, should be viewed as complementary rather than in competition. The ‘common rule’ can establish a starting point or baseline for ethical scrutiny (e.g. assumptions that voluntary informed consent is essential and that data must be anonymized, and kept confidential). When participants’ behaviour, or research designs, are evidently not amenable to the full application of ‘common rule’ principles, then principles of contextual judgement and ongoing consent are suited to producing ethical alternatives.

The third recommendation is for increased ethical regulation of research taking place outside the boundaries of academia. Savage and Burrows (2007) have noted a ‘coming crisis’ for empirical social research with the emergence of ‘big data’ and mass corporate record keeping. The realities of the academic world are increasingly confronted by the realities of corporate-driven market research using online data, overtly disciplinary research by security services, or ‘peer-to-peer’ research, all applying far less rigorous ethical standards, using ever more advanced technologies, and with interests in connecting, not separating, the different functions of their recording devices. How can research ethics keep pace with this, setting the standards for corporate research rather than crippling its academic counterpart?

Most big data research is being driven by commercial market research or state security agencies, which are not bound by IRBs, the ‘common rule’ or by internal guidelines that approach the standards of academic research ethics. Mann’s sousveillance via life-logging is increasingly being repurposed *for* surveillance, and in the broader context, used as a conduit for abuses of data protection, privacy and informed consent. In the Police Foundation’s breakthrough study on policing with wearable cameras, the approach to surveillance, including of third-parties is, as we may expect, celebratory rather than suspicious (Farrar, 2013). The controversy over the recent Facebook Data Science Team’s experiment in ‘emotional contagion’, which sought to manipulate Facebook users’ emotions without their informed consent, drew attention to the weak (to non-existent) ethical governance of corporate market research, and the powerlessness of academic standards or IRBs in a corporate context. Given that research conducted by corporations such as Facebook is not subject to US federal research regulations (Meyer, 2014), the aspect of this study that could be officially faulted, according to ethics regulations, was the involvement of academics, who arguably should have operated to a higher ethical standard. This situation reveals a gaping hole in the ethical regulation of research conducted outside, on the fringes of, or even in collaboration with academic institutions.

In the wake of the Facebook controversy, proposals from HCI academics working with technology companies included possible alternatives beyond traditional governance: such as new consumer and grassroots-driven codes of research ethics applying to corporate and academic research alike (Boesel, 2014); voluntary codes and in-house ethics boards; and restriction of experimental research to voluntary participant pools (Crawford, 2014). This rediscovery of IRB-style first principles such as informed consent suggests that ethical priorities themselves have not changed and remain highly relevant to mass-scale user-generated data studies, but need to reach new audiences beyond academia. If we are concerned about the ethics of research using wearable cameras, research beyond the boundaries of academia needs greater ethical regulation, scrutiny, and guidance.

Our fourth recommendation is for ongoing research and consultation with the public regarding the acceptability of recording technologies. If, as we have argued, contextual judgement is needed in IRBs and among individual researchers, that judgement should be informed by an evidence-based appreciation of the context. Possibilities include national social attitudes surveys on acceptability, cross-national ‘paratyping’ studies, investigating responses to a particular technology (such as Nguyen et al, 2009), or iterative participatory methods to monitor participants’ views on ethical issues within individual research projects. This kind of research agenda should feed into efforts to increase public participation in defining the terms of ethical use of data gathered from public surveillance and social media sources, including increasing awareness of the rights of third parties; an agenda otherwise currently being predominantly set by the gatherers of data rather than the providers.

Rapid advances in the power of new technologies to record and integrate data on people's everyday lives no doubt hold much scope for informative and ethically acceptable research. Yet that rapid development means that social, scientific, and ethical norms often struggle to keep up with technological development. We hope that our review and recommendations contribute to an evolving critical reflection upon the risks of information-rich recording technologies, and the safeguards they require.

References

Boesel, W. E. (2014). Facebook's Controversial Experiment: Big Tech is the New Big Pharma. *Time Magazine*. Retrieved July 18, 2014, from http://time.com/2951726/facebook-emotion-contagion-experiment

British Sociological Association. (2006). *Statement of ethical practice for the British Sociological Association–visual sociology group*. (pp. 1–8).

Brown, I., & Adams, A. (2007). The ethical challenges of ubiquitous healthcare. *International Review of Information Ethics, 8*, 53–60.

Castaneda, C. E. (2014). Woman's Google Glass Attack In SF Bar Spurs Huge Social Media Backlash. *CBS Local*. Retrieved July 29, 2014, from http://sanfrancisco.cbslocal.com/2014/02/26/google-glass-attack-against-social-media-consultant-spurs-huge-backlash/

Cordelois, A. (2010). Using digital technology for collective ethnographic observation: an experiment on "coming home." *Social Science Information, 49*(3), 445–463.

Crawford, K. (2014). The test we can - and should - run on Facebook. *The Atlantoc*. Retrieved July 18, 2014, from http://www.theatlantic.com/technology/archive/2014/07/the-test-we-canand-shouldrun-on-facebook/373819/

Dodge, M., & Kitchin, R. (2007). "Outlines of a world coming into existence": Pervasive computing and the ethics of forgetting. *Environment and Planning B: Planning & Design*, 1–26.

Doherty, A. R., Caprani, N., Conaire, C. Ó., Kalnikaite, V., Gurrin, C., Smeaton, A. F., & O'Connor, N. E. (2011). Passively recognising human activities through lifelogging. *Computers in Human Behavior*, *27*(5), 1948–1958.

Doherty, A. R., Hodges, S. E., King, A. C., Smeaton, A. F., Berry, E., Moulin, C. J. a, … Foster, C. (2013). Wearable cameras in health: the state of the art and future possibilities. *American Journal of Preventive Medicine*, *44*(3), 320–3.

Dorsten, A.-M., Sifford, K. S., Bharucha, A., Mecca, L. P., & Wactlar, H. (2009). Ethical perspectives on emerging assistive technologies: insights from focus groups with stakeholders in long-term care facilities. *Journal of Empirical Research on Human Research Ethics : JERHRE*, *4*(1), 25–36.

Dyson, L. E. (2012). anzMLearn Transactions on Mobile Learning. *The Journal of the Australian and New Zealand Mobile Learning Group, 1*, 1–31.

Farrar, T. (2013). *Self-awareness to being watched and socially-desirable behavior: a field experiment on the effect of body-worn cameras on police use-of-force*, Police Foundation, (pp. 1–14).

Google. (2014). Glass Platform Developer Policies. Retrieved July 18, 2014, from https://developers.google.com/glass/policies

Gurrin, C., Qiu, Z., Hughes, M., Caprani, N., Doherty, A. R., Hodges, S. E., & Smeaton, A. F. (2013). The smartphone as a platform for wearable cameras in health research. *American Journal of Preventive Medicine*, *44*(3), 308–13.

Hayes, A. (2010). National snapshot: Current Use of POV Technologies. In *Mobilizethis 2010 Conference*.

Jacquemard, T., Novitzky, P., O’Brolcháin, F., Smeaton, A. F., & Gordijn, B. (2014). Challenges and opportunities of lifelog technologies: a literature review and critical analysis. *Science and Engineering Ethics*, *20*(2), 379–409.

Kelly, P., Marshall, S. J., Badland, H., Kerr, J., Oliver, M., Doherty, A. R., & Foster, C. (2013). An ethical framework for automated, wearable cameras in health behavior research. *American Journal of Preventive Medicine*, *44*(3), 314–9.

Lahlou, S. (2011). How can we capture the subject’s perspective? An evidence-based approach for the social scientist. *Social Science Information*, *50*(3-4), 607–655.

Lahlou, S., Langheinrich, M., & Röcker, C. (2005). Privacy and Trust Issues with Invisible Computers. *Communications of the ACM*, *48*(3), 59–60.

Leijdekkers, P., Brakel, J., & Gay, V. (2009). From The Hippocratic Oath To Electronic Data Storage: Ethical Aspects For M-Health Projects In Australia, 115–123.

Mann, S. (2005). Sousveillance and cyborglogs: a 30-year empirical voyage through ethical, legal, and policy issues. *Presence*, *14*(6), 625–646.

Mann, S., Nolan, J., & Wellman, B. (2002). Sousveillance: Inventing and Using Wearable Computing Devices for Data Collection in Surveillance Environments. *Surveillance & Society*, *1*(3), 331–355.

Marcu, G., Dey, A., & Kiesler, S. (2012). Parent-driven use of wearable cameras for autism support: a field study with families. In *Proceedings of the 2012 ACM Conference on Ubiquitous Computing*.

McNaney, R., Vines, J., Roggen, D., Balaam, M., Zhang, P., Poliakov, I., & Olivier, P. (2014). Exploring the acceptability of Google Glass as an everyday assistive device for people with Parkinson’s. *Proceedings of the 32nd Annual ACM Conference on Human Factors in Computing Systems - CHI ’14*, 2551–2554.

Mégret, R., Szolgay, D., Benois-Pineau, J., Joly, P., Pinquier, J., Dartigues, J. F., & Helmer, C. (2008). Wearable video monitoring of people with age dementia: Video indexing at the service of helthcare. In *2008 International Workshop on Content-Based Multimedia Indexing, CBMI 2008, Conference Proceedings* (pp. 101–108).

Meyer, M. N. (2014). Everything You Need to Know About Facebook's Controversial Emotion Experiment. *Wired*. Retrieved October 15, 2014, from http://www.wired.com/2014/06/everything-you-need-to-know-about-facebooks-manipulative-experiment/

Michael, M. G., Fusco, S. J., & Michael, K. (2008). A research note on ethics in the emerging age of überveillance. *Computer Communications, 31*(6), 1192–1199.

Muensterer, O. J., Lacher, M., Zoeller, C., Bronstein, M., & Kübler, J. (2014). Google Glass in pediatric surgery: an exploratory study. *International Journal of Surgery, 12*(4), 281–9.

Myers, J., & Frieden, T. (2008). Ethics in public health research: privacy and public health at risk: public health confidentiality in the digital age. *American Journal of Public Health, 98*(5), 793–801.

Nguyen, D., Marcu, G., & Hayes, G. (2009). Encountering SenseCam: personal recording technologies in everyday life. In *Proceedings of the 11th international conference on Ubiquitous computing.* ACM.

O'Connor, A. (2014, June 1). Google Glass enters the Operating Room. *The New York Times*.

O'Loughlin, G., Cullen, S. J., McGoldrick, A., O'Connor, S., Blain, R., O'Malley, S., & Warrington, G. D. (2014). Using a Wearable Camera to Increase the Accuracy of Dietary Analysis. *American Journal of Preventive Medicine*, *44*(3), 297–301.

Papademas, D. (2009). IVSA Code of Research Ethics and Guidelines. *Visual Studies, 24*(3), 250–257.

Prosser, J., Clark, A., & Wiles, R. (2008). *Visual Research Ethics at the crossroads* (Vol. 44, pp. 1–35).

Urdapilleta, I., & Lahlou, S. (2012). *Representation of self and body image among obese persons: a new approach*. *lse.ac.uk* (pp. 2009–2010).

Walsh, L., Lemon, B., Black, R., & Collin, P. (2011). *The role of technology in engaging disengaged youth: final report*. Australian Flexible Learning Network. Canberra.

Wiles, R., Coffey, A., Robison, J., & Prosser, J. (2012). Ethical Regulation and Visual Methods: Making Visual Research Impossible or Developing Good Practice? *Sociological Research Online*, *17*(1), 1–19.

Wiles, R., Prosser, J., Bagnoli, A., & Clark, A. (2008). *Visual ethics: Ethical issues in visual research*. National Centre for Research Methods (NCRM).