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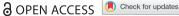ADSS, Northumbria University, Newcastle upon Tyne, UK

ABSTRACT

The body-worn camera (BWC), an audio and video recording device, has been increasingly adopted by law enforcement across the globe. Drawing on a qualitative study, this paper will explore the use of these mobile devices in the UK and examine the challenges that have been faced during its implementation in two British police forces. In particular, we will discuss how these cameras move with the police officer's bodily movements (both intentionally and unintentionally) and are used for policing purposes in different settings (such as urban and rural contexts or different operational units). Based on a set of semi-structured interviews with 26 police officers, this article will explore the contextual, technical and ethical challenges that hinder the use of BWCs in such settings. This study concludes that these practical and techno-social challenges are often interlinked. The context of use of these cameras and how they operate technically are connected, often raising significant ethical issues particularly for data management and storage. Ultimately it is argued that the operational perspective of the frontline officer is invaluable when designing and implementing technologies so they are *policeman-proof*.

Introduction

The body-worn camera (BWC) is an audio and video recording device attached to a police officer's body. BWCs move spatially and physically with the police officer's bodily movements and act as a mediating object that shapes how police and citizens interact (Louis *et al.* 2019). But BWCs are also 'on the move' to becoming a more widely used tool in policing practice. There has been significant investment in BWCs globally, and most British police forces have been implementing this technology, with more than 70% forces already using these cameras (Big Brother Watch 2017). The Metropolitan Police has the largest rollout of BWCs by police in the world (over 22,000). Other police forces in the UK have also been equipped with BWCs and plan to extend their operational use (CoPaCC 2017).[1]

Several studies (primarily randomised controlled trials) have tested BWCs' effectiveness, its impacts on both officer and citizen behaviour, and surrounding attitudes in the UK and globally (Owen *et al.* 2014, Ariel *et al.* 2015, Drover and Ariel 2015, Grossmith *et al.* 2015, Jennings *et al.* 2015, Ariel *et al.* 2016, Koslicki *et al.* 2019). These experimental evaluations tend to assess the effects and different outcomes of the use of BWCs in binary ways, i.e. if participants responded to BWCs as positive/negative, efficient/inefficient, resulting in mixed research findings (Cubitt *et al*. 2017, Gaub and White 2020, White and Malm 2020). There are also studies that explore the perceptions and attitudes of both officers and citizens towards the use of BWCs, mainly through survey

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research (Fouche 2014, Jennings *et al.* 2014, Young and Ready 2014, Gaub *et al.* 2016, Smykla *et al.* 2016, Goetschel and Peha 2017, Sousa *et al.* 2018, Demir 2019).

However, there is a need to conduct more qualitative research, to understand the challenges of using BWCs in practice from the perspective of the user. These challenges are explored by literature focused on factors that influence BWCs adoption, such as its characteristics and environment of use (see Gaub *et al.* 2018, White and Malm 2020). In order to understand how BWCs work in practice, this article will consider different contextual elements (namely the physical, spatial and digital environments of use), their technical capabilities; and ethical issues of data capture and storage. These issues relate to the 'uncertainty principle' and its factors, as discussed by Marx and Guzik (2017) and Marx (2021), namely the *uncertainties of functioning,* context and environment.

White and Malm (2020) highlight how the BWC should be seen as *a tool* and not a 'silver bullet' solution to police misconduct. Indeed, these cameras are often portrayed as allowing increased police transparency and accountability, reduced use of force and violence, and better evidence (Taylor 2016, Dymond and Hickman 2018, Koslicki *et al.* 2019, Louis *et al.* 2019, White and Malm 2020). Nonetheless, literature has also identified considerable privacy threats and impacts on discretion and policing activity (Bud 2016, Mateescu *et al.* 2016, Big Brother Watch 2017, Rowe *et al.* 2018, White and Malm 2020). In particular, significant concerns have been raised in relation to access and storage of recordings, data protection and security (Coudert *et al.* 2015, Big Brother Watch 2017).

The College of Policing (2014) has produced guidance that emphasises the different principles that need to be considered by police forces when adopting and using these devices (such as legal requirements, information management and operational use). In this article we will consider this guidance when analysing how this technology is used in policing and explore some of its challenges from an operational perspective. Contributing to research on officers' perceptions of BWCs (ODS Consulting 2011, Jennings *et al.* 2014, Gaub *et al.* 2016, Smykla *et al.* 2016), this article is concerned with how police officers, as users and operators of this technology, perceive its use in their professional practice. It is particularly relevant to consider their role when recording and managing data, considering they are 'the initial 'owners of BWC footage' (Louis *et al.* 2019, p. 313) and can shape how events are visualised and interpreted.[2] As discussed by White and Coldren (2017), the BWC might not be activated or, if activated, the view can be obstructed, and the footage might even be unwatchable. Indeed 'the BWC goes where the officer goes; however, this can also be a limitation. There is no film crew on the scene to insure a bird's-eye view with perfect lighting' (2017).

By engaging with frontline police officers, this article provides a deeper understanding of how these technologies are used in practice. By focusing at a qualitative level, it brings a necessary and under researched perspective[3] to a topic saturated with randomised controlled trial based experimental studies (Ariel *et al.* 2015, Drover and Ariel 2015, Owens and Finn 2018, White *et al.* 2018, Demir 2019). We provide a richer analysis of the lived experience of frontline officers, similarly to work developed by Guzik *et al.* (2019), Koen *et al.* (2019) and Rowe *et al.* (2018). We contribute to these discussions by offering empirical evidence on the implementation of BWCs and insights into how these technologies are perceived and used by officers in day-to-day policing. In this article we will argue that:

(1). *BWCs are 'on the move'.* They move physically and spatially (Coudert *et al.* 2015) and are adapted by the police officers in order to manage their physical connection with the device. The first section of this article will discuss how BWCs are associated to a notion of *mobility*, by relating its use to the police officer's bodily movements. In particular, we will illustrate how BWCs move intentionally and unintentionally: the device can be deliberately positioned and mounted differently depending on the context of use (such as within different operational units or depending on officers' physical characteristics); but it can also move abruptly during more confrontational interactions with the public, when accidental footage is captured or when accidentally losing the camera.

(2). *BWCs not only are 'on the move' but they operate in different contexts* (operational units or areas of patrol, in particular urban and rural settings). As stated by Gary Marx (2021), these devices are mobile and 'exist within a wide universe of contexts' (p. 1). More generally, in the second section of this article we will address the following question: 'how is the use of BWCs shaped by social contexts?' and, more specifically, 'what are the impacts of environmental conditions on how these cameras operate (physically, spatially and digitally)?'. We will consider not only the impact of environmental or spatial effects (such as lack of light in more remote areas) but also the issues that relate to connectivity (or lack of reliable telecommunications network) when storing footage. Ultimately, we argue these cameras should adapt to different settings but fail to do so due to their technical capabilities and design.

(3). *Context matters but technical capabilities, data ethics and design matter too*. In the last section we highlight how these contextual challenges are interlinked with technical issues and the capabilities of BWCs. We do this by highlighting some of the specific problems faced by the police officers in relation to the software and hardware in use. Such technical challenges also raise significant ethical issues that must be considered, in particular when understanding how sensitive data is managed and stored. Ultimately, we argue that is crucial to consider the operational perspective of the frontline officer when designing and implementing technologies for policing purposes.

Methodology

Methodologically, we explored police officers' engagement with BWCs in their everyday lives. This research was conducted with two British police forces that were in the process of implementing new BWCs to replace older devices that were being used.[4] These police forces were at different stages of BWC implementation, but both were deploying BWCs via 'pooled use'.[5] The selection of these police forces for this study was mainly due to the implementation of a new model of BWC. This was important for two reasons. Firstly, the participants would be able to compare experiences and recall changes from the current to the new model, which provided a focus for our discussions. Secondly, our access was facilitated by key gatekeepers that were interested in evaluating the implementation of the new BWC and understanding this technological transition. These forces are responsible for law enforcement within different geographical areas of the UK (North and South) and cover both rural and urban areas. This is particularly important, as this study explores how the use of these cameras is affected by different environmental factors (physically, spatially or even digitally) and introduces diversity to our sample.

By providing a deeper understanding of police-citizen encounters mediated by these technologies, in this paper we aim to explore police officers' perceptions of BWCs through semi-structured interviews. This was to understand the benefits and challenges posed by the use of these technologies from the perspective of frontline officers. The interview guide included questions such as: *how do you use this BWC? How beneficial are they in policing the local area? Any specific risks specific to this area? What happens with the footage once you finish your shift? What are the impacts of this camera on your job? Would you consider the camera as being part of the uniform? What challenges/ opportunities do you expect in the near future with the use of BWCs?*

As this is a more inductive and exploratory piece of research, 26 semi-structured interviews were conducted with police officers from different backgrounds, patrol areas, officer ranks, age groups and gender, but without any strict quota requirements. Their selection attended to the criteria of diversity and availability to capture different experiences of BWC use. Even when using the same device and following similar operational guidelines and technical guidance (The College of Policing 2014, Home Office 2018a), BWCs can be deployed in multiple ways (Taylor and Lee 2019). Consequently, the different effects that emerge from the use of BWCs can only be analysed if such use is considered from various perspectives. However, considering the size of the sample and this

diversity of experiences in terms of participants background, police force and device used, findings are not easily generalisable. The peculiarities of British policing in terms of strategies and approach (*policing by consent*) should also be considered when extending these reflections to other jurisdictions.

Interviews were conducted between 2018 and 2019, lasting 45 min on average. These individual interviews were all conducted in a private room and there was permission from both police forces to conduct them in police stations and police headquarters. Before signing the informed consent sheet, all participants were briefed (via Information Sheet) on the aims of the study. It was also explained to them that their participation was voluntary and that they could withdraw at any point. All the participants accepted the audio recording of the interviews and these were then transcribed verbatim and anonymised. The participants often shared their professional experience by narrating episodes and stories that illustrated the use of these cameras. Interviewees 'going off at a tangent' was not discouraged by the interviewer as often that 'gives insight into what the interviewee sees as relevant and important' (Bryman 2012, p. 470). It is crucial to build rapport to understand the subjective meanings held by participants and the interviewer's attitude was mainly one that showed empathy and curiosity.

The data collected from both police forces was analysed and coded following a thematic approach (Bachman and Schutt 2014), as these transcripts were subject to multiple readings and dominant themes emerged from the first interviews. The data was then systematically coded following principles of analytic induction (Charmaz 2006) and the initial categories were reviewed into more focused codes throughout the subsequent rounds of analysis. Informed by grounded theory, data was sorted through qualitative coding in order to make comparisons between different segments (Charmaz 2006). Following this approach, the following codes not only emerged from the data but also directed our process of data collection: from (un)intentional movement of BWCs, contextual and technical challenges, environmental effects, design and user experience to footage storage and data security. As mentioned by Charmaz (2006): 'we would compare the events (…) and our codes with the next person we talk with, and the next person, and the next' (p. 3) in order to fill the gaps and constantly interpret our analytic categories. Despite listening to various perspectives from officers in different departments or even police forces, the analysis showed the emergence of similar categories in relation to the challenges faced when using BWCs in practice. We now turn to the findings.

Policing with cameras 'on the move'

BWCs are attached to the police officer's uniform, being connected to their body, physical presence and movement. This section will discuss how BWCs are associated to a notion of *mobility,* as BWCs move physically and spatially (Coudert *et al.* 2015). Considering the mobility and portability of these devices, they are normally perceived as being more intrusive than other visual surveillance systems such as CCTV (Coudert *et al.* 2015, Mateescu *et al.* 2016, ICO 2017). As discussed by Insp Oliver, BWCs capture more detailed and personal interactions with members of the public than other cameras:

> Whereas the body-worn video is very up close and personal. So, it captures a lot more, kind of, personal data, you know? (…) It captures emotions. It captures what people say. You get much more of a feel of an incident from a body-worn video than perhaps you do from a CCTV camera.

Our participants consistently compared the use of BWCs to other visual surveillance technologies (namely CCTV) and raised similar challenges and concerns during the implementation of both CCTV and BWCs (namely in relation to how these systems are administered and data is managed) (McCahill 2002, Louis *et al.* 2019). According to our participants, the comparison of these surveillance systems implied different levels of (in)visibility, distance/proximity, considering that various angles, views and perspectives can be captured with these different cameras. For instance, BWCs allow more personal, detailed and closer contact with the subjects, allowing action to be recorded both in public

and private spaces (Mateescu *et al.* 2016). CCTV only captures visual information from above, providing a wider and more holistic view of events mainly in public spaces. According to our participants, it is possible to obtain audio information and clearer images with BWCs due to proximity to the public, showing events as they are seen by the officer from a first-person perspective. However, with CCTV the image tends to be distorted and lacking in image quality, as these cameras are normally fixed and static, not allowing audio information (Bud 2016). As mentioned by PC Helen (3 years of service) and PC Andrew (5 years of service), respectively:

> CCTV (…) is always from a distance. BWC (…) can be so close up. CCTV is just almost like looking down on a situation, but the BWC is right there and showing what the officer is going through the whole time.

> CCTV is, A it's usually fixed, so it doesn't move with you as you're moving that way. B it usually doesn't have sound or colour, so you're missing the context maybe of what is being said, and C it's usually at a height, it's up there and you can just look like, you know, miniature movements going on bellow. Whereas BWC has sound, colour, it's right there. (…) You're looking through the officer's eyes, kind of, because you can see, hear, from their perspective.

The issue of mobility is crucial when deploying BWCs (Bud 2016, Guzik *et al.* 2019), as they mediate interactions between the police and the public in different spaces (Dymond and Hickman 2018), while acting in coordination with the police officer's body and its movement. We will now illustrate how BWCs can move both intentionally and unintentionally.

Intentionally moving BWCs

The devices used by different police forces differ in terms of size, age, manufacturer and technical capabilities (such as video quality, number of recording hours and storage capacity), despite performing similar functions. Even within these two British police forces, different cameras were being used, as certain departments or roles had more specific and recent devices issued to them. Indeed, different operational units (such as firearms, roads and territory policing) not only used different equipment but their positioning on police officers' uniform also varied. When considering how footage is recorded, the way 'a camera is mounted always depends on the context in which it is used' (CoPaCC 2017, p. 31). For instance, firearms units tend to require devices to be head-mounted, so they fit with the rest of the kit and are not obscured by clothing or other equipment (Home Office 2018a). With such units, the chest-mounted position of BWCs can be described as 'unfit-for-purpose' (CoPaCC 2017) even if that is standard practice for most police officers. As mentioned by Tactical Firearms Unit officers Kevin (12 years of service) and Mark (27 years of service) respectively, the camera must move and adapt to different tasks and demands so it is not cumbersome:

> They [territory policing] have- I think it's just a single box, whereas, ours is all wires. We have, meant to wear it on our caps, but the caps didn't fit properly, so a lot of people have had to sort of bastardise where they put it in. A lot of people have put it on their shoulder. (…)

> It can't be in the same place all the time because otherwise it gets blocked by some of the other kit that we carry. And you can't wear it all the time on your head because it just looks stupid. (… .) A lot of people will wear it on their shoulder. But if we go for a firearms job we have to move it because it has to go on our head. And if you leave it on your shoulder it gets blocked by shields and weapons and stuff. So, the main problem is with the kit we've got now is you have to keep moving it around.

BWCs can be moved and police officers can change its positioning on their bodies. As previously explored, that might relate to how these devices are positioned differently by diverse operational units, but also to how individuals with different physical characteristics (in terms of height, for example) might require an adjustment in terms of where the camera is located. As mentioned by sergeant Patricia (14 years of service): 'when I wore this [BWC] up here [chest] it was too high. It was capturing everybody's foreheads when I was dealing with everything'. This is particularly important when the BWC is used for evidence gathering purposes, as the positioning of the camera can impact how the footage is interpreted (Taylor and Lee 2019). In sum, the BWC can be deliberately

positioned and mounted differently depending on the context of use (illustrated in this section with examples of different operational units or officers' physical characteristics).

Unintentionally moving BWCs

The technical guidance for BWCs published by the Home Office (2018a) Centre for Applied Science and Technology (CAST) was designed to help police forces using these devices. Its first section is precisely focused on positioning and attachment, highlighting how the police officer must ensure that the camera is facing events by pointing the device correctly (Home Office 2018a). However, as we will now consider, these cameras not only move deliberately but they also move unintentionally with police officers' moving bodies, as they interact with members of the public. As discussed by PC Carol (2 years of service), this is particularly the case with older devices that are not held by the clip as tightly and tend to be loose:

> We do have ones that will literally sit down instead of sitting up. I think we have ten in xxx at the moment, and five of them sit down the ways. So, if you turn them on, they're filming your feet rather than filming the actual event. So it's like the race comes on, when you start your shift, to get in and get the best one.

However, our participants explained that even if the device is securely attached, it can still move during *confrontational interactions*. As illustrated by Sergeant Nelson (13 years of service), such abrupt movements might imply that the device will not be positioned correctly: 'I was having a fight once, and it went up to the ceiling (…) It does get knocked and battered, and you end up pointing at the ceiling and recording the roof tiles'. Sergeant Patricia (14 years of service) also exemplified this situation:

> somebody punched me and then I detained that person, during which I think it spun around a bit (…) I would have captured her punching me. I think when I obviously detained her against her will, I think that's when it spun around … .

The camera can either move or the officer might inadvertently switch it off during a more violent interaction. This was illustrated by PC Katie (3 years of service) when describing an incident that 'was quite a fighty situation and the [BWC] turned itself off because I guess my arm must have somehow turned it off. So, it's not the best design, I wouldn't have said'. When discussing the unintentional bodily movement of the officer and the camera, there is the possibility of a false (de)activation. In such cases footage might be either missed or accidental footage might be captured due to how the camera is designed. This resonates with Gary Marx (2021) when he states that 'how the cameras are used is in part determined by how they are designed' (p. 6). Most of our participants narrated situations where they accidently activated the camera by *flipping* the switch down as they moved. In order to adapt the camera to such situations, the officers often use elastic bands around the device to better control the movement of its switches in interaction with their body. As explained by frontline officer Larry (12 years of service) and Sergeant Nelson (13 years of service), respectively:

> When you're driving around in your car, talking to your colleague about random things, a lot of times you look down at your collar [?] and go 'oh, you've got your camera on' (…) Footage of them sat on the toilet, because they'd accidentally put it on, they hadn't realised. Come out of the toilet, you're like 'your camera is on' (…) The way we got round it, being geniuses that we are, we put elastic bands around so that it was harder to flip the switch down, and elastic bands normally come in yellow, don't they? They looked a bit garish. Then somebody on the body-worn camera team thought 'we'll buy some black elastic bands'. We had black elastic bands so it blended in a little bit more.

> There's an elastic band on there, only because otherwise when we put our seatbelts on in the car, it pushes it down, it starts recording – so, we could be in a car, chatting away, we won't know it's recording.

Another element associated with the movement of these cameras is related to the possibility of accidently losing the device and, consequently, its footage. For data security purposes, Home Office (2018a) emphasises non-removable internal media as the best option. However, our participants

voiced concerns with potential accidental loss of both devices and data (removable cards), in particular when recordings are not protected/ encrypted and memory sticks go missing (Jarvis 2017). As explored by Sergeant Nelson (13 years of service):

> If it gets knocked off and ripped off during a fight, there's no back-up of that. So, if you rip that off and chuck it in a bin somewhere, or in the sea, there's no back-up copy, because it's not downloaded anywhere other than on here, until it's uploaded.

This is linked with another aspect that relates to the movement and portability of these cameras: how they are used by police officers in different settings, moving through various contexts and geographical areas. The use of BWCs differs according to their application in diverse roles, operational units, patrol areas or even police stations. Not only BWCs operate in different contexts but their use should adapt to these different settings. However, there are several challenges that limit the ability of BWCs to adapt as necessary: its context of use, its technical capabilities, data ethics and design. The following section illustrates why the context matters and explores, in particular, the challenges faced by police officers when using BWCs in rural settings.

BWCs 'on the move' through cities and the countryside

Urban and rural settings present different challenges for policing (Yarwood 2010, Johnstone 2016, Mawby 2016, Souhami 2019) and the technologies used by the police officers must fit their operational needs in different contexts (Coudert *et al.* 2015, Guzik *et al.* 2019, Taylor and Lee 2019). For instance, while police officers based in cities tend to deal with busier and bigger events involving more people and a higher volume of incidents; rural settings imply interacting with smaller communities in more remote areas. As mentioned by Coudert *et al.* (2015):

> as for any technology, [BWC] introduction should be guided and properly framed to ensure wide and effective use. Systematic evaluations are required to learn about the context or the type of crime they can effectively address, and to adjust their use accordingly. (p. 757)

Our participants mentioned that in urban areas there are usually more violent incidents and events seem to happen not only more often but also more quickly. Offences are more regular and happen at a different speed, as there is always 'a lot happening at once'. BWCs mediate how officers interact with members of the public, by capturing such encounters so 'the police's ability to recollect events is not simply a function of officers' human aptitude to remember what they saw or heard' (Guzik *et al.* 2019, p. 7). By extending their capacity to see and hear, these cameras are particularly useful to record the busy encounters that involve too many people (in particular in the city centre at weekends or to manage crowds when there are big events). In the words of PC Amy (2 years of service): 'in the city center you're dealing with things very quickly. There's quite a quick turnaround and you're coming across more offences on a more regular basis'.

The night-time economy in particular appears to offer additional challenges when patrolling these areas, due to situations that might involve violence and anti-social behaviour. Having at least one camera for each pair of officers seems to be the common practice, as footage will allow them to extend their capacity to see such situations and remember exactly what happened. As stated by Guzik *et al.* (2019): 'the police are able to task to this technology actions that in the past would have been completed by human hands (and eyes)' (p. 12). Sergeant Felicity (18 years of service) illustrated how human actions can be delegated to these technological devices when patrolling such areas:

> As I'm sure it is in many cities and towns in the UK, Fridays but particularly Saturday nights, the town is just busier. And there's more people drinking and that unfortunately can lead to more violence or more high-volume crowds. And when you're a police officer and turn up to that, it's impossible to see everything. Because your job is to get in there, you can't stand back and just watch it.

The participants discussed different challenges when based in rural areas. As these areas tend to be more remote, they normally do not have enough people nearby to serve as witnesses. BWCs provide very important evidence as they will capture the events, even if the officer is single crewed. The camera is almost like having 'someone there' when the officer is alone. As frequently stated by our participants, having BWCs 'it's like someone is there with you when you are by yourself' and 'gives you that extra layer of protection' (officer Simon, 10 years of service). For this reason, when contrasting both urban and rural areas, BWCs are portrayed as particularly useful in more remote areas. As illustrated by Inspector Oliver: 'in urban areas. (…) you've usually got police officers with you relatively quickly. But more so perhaps in rural areas. Because you might well be by yourself. And you might not have other people supporting your evidence'.

Being *alone* here can be interpreted as not having other individuals (police officers or other human witnesses) or technology nearby (such as CCTV). As stated by roads policing officer John (9 years of service): 'if you're out anywhere in the country you're not going to have CCTV cameras, so you can have that [the BWC] and that is going to massively help'. In the words of our participants, it is almost like having a 'friendly witness' with them at all times in settings where no one else (in a human or technological form) would be available to provide support and evidence of what happened:

> I feel sorry for people who work in rural areas, because they're (…) in some of the rural areas they might only have a team of like two or three. (…) So if you're the only person turning up at a domestic or something, then you're on your own and … So you haven't got anyone backing you up, apart from obviously the camera (Sergeant Patricia (14 years of service))

> I think if you were working in a rural area, (…) it would be quite helpful there because obviously, you're going to be in areas where there's no one about to witness things. (…) there might not be any passers-by on the street. The incident I was involved in recently took place on [the High Street], so there were lots of people going past at the time who we got statements from of what they had seen. But if you're in a very rural area, it might just be the police officer speaking to an assault or an aggressive person, so it's your extra, kind of, piece of corroboration. It's very handy in that regard. (PC Amy, 2 years of service)

However, despite being seen as a 'friendly witness', when capturing both image and audio, the BWC presents some additional challenges in rural settings. In order to understand how BWCs operate in such settings, we will now explore the impacts of environmental conditions (physically, spatially and digitally).

Contextual challenges of using BWCs in rural settings

Firstly, we will consider how the physical environment has an impact on the quality of the footage. It is crucial to understand under what conditions BWCs work effectively and environmental effects such as background noise (traffic, crowds, wind) or lack of light (adverse weather conditions that reduce visibility or nighttime) might definitely hinder the capacity to record audio and/or video. Indeed, as we will now explore, the most basic principle of any camera is that light must be captured through the lenses so it is possible to record an image.

The guidance published by the Home Office (2018a) states that the minimum picture resolution is Standard Definition and that under such conditions it is possible to produce an 'acceptable video recording under street lighting and inside buildings' (p. 11). There is certainly an overreliance on street lighting when on foot patrol; however, that can be problematic in more remote and rural areas that tend to be darker, especially during the winter**.** As discussed by frontline officer Larry (12 years of experience), based in a rural area:

> I suppose we spend a lot of our time working antisocial hours which happen to be during the autumn and winter very dark. I'm not policing in an urban area, I'm very much in a rural area. And the downside is it's not very well lit. I've used the camera, and it's very hard to actually view the footage because a camera needs light, doesn't it, for the lens. It tends to … Hopefully, again, this will be solved by whatever cameras they're going to use next when they give us the new hardware. But yes, I've definitely had it where you watch the footage back and you just can't see anything. You can hear it still, you've still got the audible.

The same applies to other environmental conditions (adverse weather) that will impact the quality of the image regardless of resolution. Hence, the footage that is obtained in rural settings is often too blurred or grainy to be useful. As stated by officer Steph (8 years of service): 'the cameras we're using at the moment are great during the day, at night time they're next to useless. They don't cope well in low light at all' in rural roads. In order to deal with poor light conditions, infrared and LED lamps (Home Office 2018a) or devices with High Definition (HD) cameras (Home Office 2018b) can be particularly useful. As mentioned by officer Oscar (13 years of service): 'your torch becomes quite a crucial part of your kit as well as with the BWC. In the winter, 18 h of the day is dark, isn't it? So you're going to be in the dark'. Some participants argue that more recent HD cameras have better quality and adjust to darkness and brightness more easily. Nonetheless, it is important to highlight that these cameras are only available in specific operational units that do not tend to be based in rural areas. Indeed, the city still dominates when considering how embedded the technology is in its infrastructure and how initiatives (not only BWCs but also CCTV, for instance) are imposed centrally with a *metropolitan* focus (Johnstone 2016).

These contextual challenges are interlinked with the BWC technical capabilities. The use of technologies in rural settings pose specific problems that relate not only to its location, physical and spatial environment but also its information infrastructures (Hudson 2011, Davies *et al.* 2013, OECD 2018). When considering the guidance published by the Home Office (2018a), wireless connectivity is one of the optional features that might enhance the deployment of BWCs. This can '[enable] video with audio to be streamed from the BWV device to a mobile display device such as a smartphone, tablet or laptop' (Home Office 2018a, p. 20). Even if this feature could be particularly useful when copying data into such devices, ultimately it would depend on the network available. Due to problems in relation to connectivity in rural settings, it can be particularly challenging in such areas to have access to reliable network bandwidth (Davies *et al.* 2013, OECD 2018). In the words of Davies *et al.* (2013): 'developments in mobile and ubiquitous computing allow people to move beyond the urban fringes and into rural spaces. However, data connectivity and data coverage cannot always be guaranteed' (p. 24).

This was illustrated by officer Simon (10 years of service), based in a rural setting: 'because of the infrastructure, because X small town was so far out down there that the internet doesn't work, you have to have hamsters running to get the computers working and stuff'. It is essential to consider the context of use when designing and deploying such technologies, in particular considering the need for reliable broadband access and connectivity. According to Sergeant Nelson (13 years of service) and Inspector Oliver respectively, even if there is connection available, this can be too slow to transfer the data efficiently:

> If you go more rural, over to the X, you struggle with reception on your radio sometimes. So, if we're having a live feed of a camera, that backs up somewhere else, then I would suggest that you would struggle with the connection sometimes.

> Some of the neighbourhood offices actually just have broadband. So, they have commercial broadband that they are set up through. And the broadband isn't fast enough to transfer the data. So, you know, it needs to be the networks. A high-speed network, really. Because, otherwise, it can take, you know, an hour to upload an hour's footage. And that's just not usable.

As we have explored, BWCs fail to adapt to different settings (namely rural areas) mainly due to their technical capabilities (in particular, image resolution and wireless connectivity). In the following section we will continue to explore these practical challenges, namely how the context of BWC use is interlinked with technical, ethical and design issues in relation to both its software and hardware.

Technical and ethical challenges: faffing *around with cameras*

The key practical and technical challenges discussed by the police officers either relate to the use of BWCs in different contexts (such as rural and urban areas, operational units) or the ethical issues that

emerge in relation to data management. Some of the concerns highlighted by the participants could lead to questions such as: what happens with the footage collected? How to manage the large quantity of data while meeting data protection requirements? Indeed, police forces have been struggling with such requirements and the increasing volumes of personal and sensitive data they must manage (CoPaCC 2017). Our participants explored precisely some of these ethical challenges as, at the end of the shift, each police officer must always transfer the data and upload the footage in the system. This can be done either manually with a USB cable or by putting the cameras in the docking station so they can charge and upload the data to the server while docked (CoPaCC 2017, Home Office 2018a). Officer Oscar (13 years of service) illustrated the procedure of how data is moved from the camera to the cloud:

> when [the officers] come back to the station, they take their camera off and they dock the camera into a docking bay. That footage then leaves the camera and downloads to a local dock server, and then from the computer it uploads to the cloud.

Indeed, there are different options available to access and store the footage: from the use of physical hard drives and local servers to cloud-based storage systems. In relation to cloud services, some police forces already have partnerships with companies and their platforms (such as *Microsoft Azure*). This enables them to outsource the storage of the footage collected by BWCs, in order to attempt to deal with some of the information management challenges (Jarvis 2017, Guzik *et al.* 2019). However, there are concerns with 'the long-term commercial risks of buying evidence storage and management as a service without complete clarity over future financial terms' (CoPaCC 2017, p. 35).

Also, data storage in the cloud might involve some challenges in relation to connectivity with the device. As previously explored, these problems are particularly significant when operating in more rural settings due to their limitations in terms of network bandwidth capacity (CoPaCC 2017). Nonetheless, some officers still mentioned the relevance of having such options available. As discussed by the rural response officer Steph (8 years of service), it would be helpful to have

> a system that as soon as you walk into the police station it will automatically upload [the footage] via the Cloud. You know you don't need to plug it into a computer; you don't need to be *faffing* around with it, just generally smarter technology.

As we will now explore in more detail, this would require a 'robust digital environment' (Guzik *et al.* 2019, p. 9) with capacity to both store and access significant volumes of data.

Inefficient process of data transfer and storage

The participants discussed some of the practical and technical challenges faced in relation to footage storage and the inefficiencies of the process available to transfer data. Sergeant Patricia (14 years of service) discussed such inefficiencies as they usually rely on specific computers and cables that must be available for them to store the footage:

> You've got to download it and that is a bit of a faff with it, because you have to … Only certain computers in the station that I work at work, so I have to wait for that computer to be free. Then I have to go and specifically log onto that computer in order to download. So sometimes there might be three or four incidents to download …

In both police forces, the participants discussed different challenges faced in practice when physically and locally storing the footage: the system either does not work or does not work efficiently considering the volume of data they are dealing with. As mentioned by PC Peter: 'We struggle. Our computer systems, we're retaining all this data, but our computers can't hold all that data'. These challenges either relate to the software or hardware used and how they are often not suitable to their operational needs and user experience. In relation to how the information is processed by the computer system, most police officers do not think the software used is fit for purpose[6] or even reliable. This is often described by our participants as having to faff around the cameras and the software used by the police force. As explored by frontline officers Larry (12 years of experience) and

Steph (8 years of service), both based in rural areas and that wear the BWC 'religiously', the process can be too slow or might not even work at times:

> The software, it struck me that we were using software that you or I could buy from PC World or whatever. It wasn't really meant for mass use, and very often it wouldn't work, you'd plug your camera into it and it wouldn't work. And it could be three o'clock in the morning, you've arrested somebody, you're preparing the hand-on pack for the early team that would deal with the person, and you're tired and you just want to plug your camera in, because that's the last thing, and you plug it in and it doesn't download or the system's full or something.

> We've got so many things we need to worry about with our jobs anyway and to then have to sit there for an hour at the end of your shift purely faffing around trying to upload footage. Some people may choose just not to turn it on because it's less hassle. So yes, usability is a massive thing. If it's not efficient, it's not quick, police officers generally don't want to know (…) The process should be easy but the software is not the best and it turns a five minute job into a 45 min job.

As previously discussed, context matters when discussing these challenges. Different units and devices seem to encompass different practices when storing and accessing the footage. While some police officers only have access to the footage at a local level (held by the central server) in a specific police station, specific units can access it remotely from any physical location. As discussed by PC Daniel (5 years of service):

> we can just access it from a link, so that's quite good. The fact that an officer from across the city could use this, plug it in and I could still be in my office and view it, it makes things a lot easier (…) I don't have to travel to another station to it.

However, not all the participants agree that the software used is particularly reliable when attempting to access and store footage remotely. As argued by Inspector Oliver:

> The software we are using with it isn't designed for Body-worn video. It's a file storage software that was used by, primarily in a commercial setting, for people to be able to access their files remotely. (…) So, and uploading large amounts of data, as you have with video footage, has created a few issues. it hasn't worked enormously well. There has been glitches with it.

Data integrity and security

The use of BWCs by the police pose different challenges that we have been discussing in relation to both its *hardware* and *software*. One of the most significant issues discussed by our participants relate to how the data is gathered and stored. In this section, we will briefly discuss some significant ethical issues in relation to data integrity and security.

We previously presented the scenario of physically losing the camera (and potential evidence) and, as it is highlighted by the Home Office (2018b), there is a need to implement 'adequate measures to mitigate against these potential risks' and prevent data loss (p. 3). According to Inspector Oliver the footage captured by BWC can contain information that is very sensitive in nature, as they record interactions with vulnerable members of the public, namely victims of crime[7]:

> the main risk is that the integrity of the data that's gathered and the potential loss of that data. And, you know, what that could mean for, you know, your victims of crime. And what it could mean for the reputation of the police.

The technical guidance for BWCs published by the Home Office has sections focused on recording, evidential integrity and data security (Home Office 2018a) and the publication *Safeguarding Body Worn Video Data* (Home Office 2018b) provides examples of good practice by providing measures to safeguard BWC footage (such as the physical security of these devices, data protection, management and transfer). Indeed, according to our participants more formal and practical training is needed so they are able to manage and download footage more effectively while considering its potential risks and privacy concerns (Bud 2016, Mateescu *et al*. 2016, White and Malm 2020). Also, as stated by Bud

(2016), there is the need for appropriate governing legislation 'for body-worn cameras to be used appropriately and to minimize potential negative consequences' (p. 120).

Some concerns were raised in relation to an unauthorised third-party having access to BWC footage, as it might not only damage police reputation and compromise their investigative work but also erode public trust. It could also cause harm to victims and other vulnerable members of the public by compromising their privacy and safety (Home Office 2018b). This is particularly relevant depending on the content of the recording and when sensitive information is captured in a private domestic setting (Coudert *et al*. 2015, Mateescu *et al*. 2016, ICO 2017) that might involve the presence and identification of emotionally distressed and/or vulnerable people (i.e. patients or even children), in particular when involving a state of undress (Home Office 2018b). As mentioned by White and Malm (2020), BWCs 'record sensitive information, at a time when citizens – offenders, victims, or even bystanders – are usually at their worst' (p. 51). To avoid unwanted access to these recordings, 'all devices should therefore incorporate mechanisms whether physical or electronic to prevent this from happening' (Home Office 2018b, p. 19), such as encryption.[8] However, as discussed by Insp Oliver, that does not seem to be the case in at least one of devices used by these police forces:

> If one of the cameras falls off the officer's body armour. It gets picked up by someone. You can … These ones are unencrypted cameras (…) They're a camera on a USB stick. (…) So they could be plugged into a computer and the footage could be uploaded to Youtube. It could get into the public domain. (…) If it's footage of a victim of sexual assault, disclosing what has happened in the sexual assault, and they are upset and it's very emotive, then that makes the force look very bad.

The design of the camera: is it user-friendly and policeman-proof?

Lastly, it is important to consider the challenges that relate to the type of hardware and its design, as that has an impact on how the camera is used (or not used) in a daily basis by the police officers. As previously explored, some participants discussed some design issues that relate, in particular, to the size of the camera and its user interface. Described as 'bulky and 'clumpy', as having 'cables everywhere' or, ultimately, as having to add elastic bands to avoid accidental footage (as the camera is operated by a switch that very easily *flips* down, as previously considered in this article when discussing the police officer's bodily movements). In general, the participants agreed that the devices that were implemented in both police forces (that differ in terms of manufacturer) are not the most 'user-friendly'. As suggested by Sergeant Felicity (18 years of service):

> We need to keep a certain level of technology to make it user-friendly, because if we don't upgrade, the police officers just quite simply aren't going to engage with it. We have to make things as user-friendly as we can, and easy to use, so that they can be used in an operational environment.

As illustrated by Guzik *et al*. (2019), the design of technologies such as BWCs and its materiality (bulk, dimensions, weight) have an impact on police operations and practice. Our participants suggested a flatter, smaller device with better user interface so the camera can become 'second nature' to them, as it is attached to their body and must adapt to their movements, professional routine and context of work. As stated by PC Ross (4 years of service), the BWC

> was clearly designed by someone who has never had to wear and use it. It looks lovely, but whoever designed it hasn't had to wear one here, whilst driving a car, chasing someone, rolling around, they haven't thought about it. It's not a practical design.

It was also proposed that new cameras present a 'very definite press' by having to hold a button to turn the camera on, followed by a *beep* to provide reassurance that footage is being captured and avoid false activations. As mentioned by PC Larry (12 years of experience): 'it needs to be simple (…) I often call it policeman-proof'.

Several participants also discussed situations where the cameras were not working for long periods of time and how unreliable these devices can be. According to PC Amy (2 years of service): 'the BWCs, there were often faults with them. As there is with any new technology, but

they were often, like, calling IT to get it fixed, so it can be a bit unreliable at times in that sense'. It is indeed important to not just look at these devices as a 'single variable' but instead '[break] it down into its constituent parts (recording device, storage system, data files, etc.) and considering the variability within each' (Guzik *et al*. 2019, p. 12).

New devices were being implemented in specific operational units of both forces that were perceived as more reliable and with an improved design (lighter, 'sturdier' and more robust with a 'press-on/press-off' rather than a 'flick-on/flick-off button'). However, these new devices (deemed better than the previous ones) still fail to attend to context. As they were being used in specific units such as Tactical Firearms, Kevin (12 years of service) based in this unit, illustrated this by highlighting how the design of the new camera is still not fit for purpose considering the type of incidents he often deals with. This participant even raised concerns in relation to the potential repercussions of having a light flashing in the device that not only are very serious but can even be fatal if interpreted as a 'big flashing target' on their bodies:

> Sometimes this will flash green or this will flash red to allow you to know that you're recording, but I will have it like this, because if we were on … Nine times out of ten we'll be doing firearms jobs, and I don't want to have a big flashing light. If I'm stood in someone's back garden and they've got a gun and it's dark, I don't want to all of a sudden have a big flashing target on me.

Discussion and conclusion

BWCs are portable recording devices that are attached to the police officer's body (Bud 2016, Guzik *et al*. 2019). By looking at how these devices are constantly 'on the move', we emphasised the notion of *mobility* and the relationship of these cameras to bodily and spatial movements. Indeed, as it is illustrated in this article, these cameras can *move (un)intentionally* through different contexts and settings. Firstly, we compared the use of BWCs to other visual surveillance systems (such as CCTV) that tend to be fixed and static. We then illustrated how, depending on the context of use (different operational units or individual physical characteristics), BWCs can be moved *deliberately* as they are positioned on police officers' uniform differently (for instance, on their chest or head). Nevertheless, these cameras can also move *unintentionally* with police officers' moving bodies, as they interact with members of the public (namely during confrontational interactions). In relation to this, we highlighted the possibility of officers accidently losing BWCs or falsely (de)activating them (which might lead to footage being missed or accidentally captured due to the officer's bodily movements).

The movement of these cameras is then discussed in more detail as we consider their use in different contexts by two British police forces. Context matters and urban and rural settings present specific challenges when using BWCs. In both settings, BWCs are seen as an extension to police officers' human capacity to see and record events. This is particularly the case in the countryside and more remote areas where the officer is often single crewed and the BWC is seen as a 'friendly witness'. Nonetheless, the physical, spatial and digital environment can have an impact on the technological capacity to see and record. As we demonstrated, this is also particularly problematic in rural areas due to the *lack of light* and its *unreliable information infrastructure* (namely the difficulties with connectivity and access to reliable network bandwidth). Hence, this article aims to be a contribution in the comprehension of the ramifications of deploying BWCs in such settings. By understanding the effects of these technological devices on policing practice, relevant insights are presented to reflect on the *interconnectedness of urban and rural spaces* and the different challenges faced when using these devices. In particular, this article highlights the importance of attending to context when designing and developing technologies that are particular to policing practice in rural settings.

Focused at a qualitative level, this article demonstrated the importance of an in-depth analysis of the lived experience of police officers to consider the use of BWCs from an operational perspective. This is in contrast to the dominant quantitative or experimental approaches of other studies (Ariel *et al*. 2015, Drover and Ariel 2015, Owens and Finn 2018, White *et al*. 2018, Demir 2019). By

highlighting some of the practical problems, this article considered different contextual, technical and ethical challenges faced by frontline police officers. Findings from this study illustrate that these challenges are often interlinked. The context of use of these technologies differs, as BWC move through different operational units (such as firearms, roads and territory policing) or geographical areas covering urban and rural settings. Not only the context in which BWCs operate matter, but also their technical capabilities (in relation to both hardware and software). Such contextual and technical elements raise significant ethical issues when managing such volumes of data. We have highlighted, in particular, the inefficient footage storage (either physically or in cloud-based systems) or the potential problems with data integrity and security inherent to using these cameras *on the move* (such as data loss or unauthorised access).

This article also showed how important it is to consider the perspectives of frontline police officers when designing these technological devices. Engaging with frontline police officers and understanding how these cameras impact their practice is crucial to develop and implement BWCs with a *user-friendly* design (Mateescu *et al.* 2016). The challenges explored during this study demonstrate that often these cameras are not suitable to our participants' operational needs and user experience on the frontline of policing (Guzik *et al.* 2019). This applies to both the camera as a material device (its dimensions and user interface) but also to the virtual systems used to manage and store the footage captured. Indeed, technological design is fundamental to ensure that, as stated by our participants, BWCs are 'policeman-proof'. These findings are particularly relevant when considering different contexts of use (different operational units or areas of patrol) so these cameras are designed in order to be fit for purpose in different operational situations.

This not only contributes to criminological and policing research but also to science and technology studies, by addressing the relationship and dynamics established between human actors and technological artefacts (Guzik *et al.* 2019). It can also be an important opportunity and call for criminologists and policing scholars to engage more with other areas and multidisciplinary fields of study that consider the value of the user (namely human–computer interaction). This would allow us to better explore how technologies applied in policing and criminal justice settings are designed and used by humans when interacting with computers (Davies *et al.* 2013).

In conclusion, we argue that it is crucial to depart from the perspective of frontline police officers to better understand not only how technologies are used but also adapted to fit with their professional practice and diversity of roles. Even if most participants acknowledged the BWC as already being incorporated in their uniform and routine, they also highlighted how this varies enormously depending on their unit, operational environment and context of work. Further research is needed to address such contextual elements and, by creating evidence on the use of these technologies, provide insight on how BWCs are perceived and work (or not) in practice. There is a need for more in-depth knowledge and understanding of police-citizen encounters mediated by BWCs (Dymond and Hickman 2018), so it is possible to develop recommendations on the use of these technologies and translate research knowledge into practice (namely of what is necessary in terms of design). This applies at the level of policymaking but also engagement with policing practitioners: when departing from the perspective of the user (ie. frontline police officer), such studies can inform how technologies are then deployed and justified by senior management.

More generally, this can also involve discussing how BWCs engage with other technologies (such as police vehicles and dash cameras, CCTV, drones, tasers, computers and IT systems more generally). Due to their increased data collection capabilities (namely in relation to biometric data), it is also particularly important to consider other challenges and risks that might emerge with the development of new video camera technologies and their potential integration with BWCs: from face matching or recognition to behavioural pattern or even automated emotion recognition (Coudert *et al.* 2015, White and Malm 2020). This will allow us to better understand how these cameras are being adopted and integrated with other technologies in the present but also contemplate the future challenges we will face as their use expands in policing (and other) settings.

Notes

1. Several pilot programmes were significant in the development and implementation of this technology by British police forces. From 2006 until 2007, BWCs were trialled in Scotland (ODS Consulting 2011) and also in Devon & Cornwall. From 2013 until 2014 they were used by the Isle of Wight and Hampshire Constabulary (Ellis *et al.* 2015). Finally, in 2014, they were adopted by The Metropolitan Police (Grossmith *et al.* 2015) and Essex Police, where their use was evaluated by The College of Policing (Owens *et al.* 2014).
2. See, for instance, Boivin *et al.* 2017 considering the potential for BWC 'perspective bias' or Phillips (2016) questioning the assumption that BWCs capture an objective reality of the events and the potential for perceptual distortions.
3. With the exception of studies that conducted semi-structured interviews and focus groups analysing the impact of BWCs (such as Gaub *et al.* 2018; Guzik *et al.* 2019, Koen *et al.* 2019, Sandhu 2017, Taylor and Lee 2019) and the ethnographic research developed by Rowe *et al.* (2018) that explores how police officers 'use and talk about the use' of these cameras.
4. In order to maintain the anonymity of these police forces and our research participants, it is not possible to reveal what devices were being used and for how long. However, there was variance in the technology used even within the same police force (either because different departments/ units had different BWCs or because the 'older' model was still in use during the implementation of more recent cameras).
5. This meant that officers would obtain a camera when starting their shift, but it would not, necessarily, be assigned to them permanently.
6. The practical challenges faced in relation to IT infrastructure do not just relate to how video footage is stored but also how it is managed and shared with CJS partners, in particular when transferring a substantial volume of data through the network.
7. Primary information that can be captured might involve *first accounts from victims, suspects or witnesses, identification of a person, direct conversations with members of the public, actions of people, physical and mental state of people* or even provide a *record of criminal activity* (Home Office 2018b). But there is also secondary information that can unintentionally capture other elements that relate to *operational policing* (such as tactics, information related to other cases) or police/ emergency staff and members of the public (namely personal information and visual and verbal identification through their face, voice, name, clothing, *etc*) (Home Office 2018b).
8. As mentioned in the code published by the ICO (2017):

   because of the volume of personal data and potentially sensitive personal data that BWV cameras will process and the portability of them, it is important that you have appropriately robust technical and physical security in place to protect this information. For example, make sure devices can be encrypted, or where this is not appropriate have other ways of preventing unauthorised access to informatio. (p. 29)

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