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Do Advances in Smart City Technology Provide a Plausible Route of Crime Fighting and if so, Which Areas Would Affect the Most Progress Given Concerns in Facial Recognition and Drone Technology?

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Abstract

This research explores the complex interplay of psychological, cultural, and systemic

Keywords:

Introduction

Joh (2019) suggests smart cities provide unprecedented access to crime fighting possibilities. Smart cities can be defined by their intelligent use of multi-agency technology that improves the lives of residents through continuous data gathering (Albino, Berardi, and Dangelico, 2015). This can prevent, combat and effectively reduce different types of crime. Facial Recognition Technology (FRT) for instance has already been utilised in South China to identify minor crimes and automatically issue fines (Tao, 2018).

Such technology provides an opportunity to reduce demand for minor crime and allow renewed focus upon community engagement and fighting organised crime. Policing leaders, however, must accept that use of smart technology provides challenges, and its implementation must come alongside acceptance of both policing and public concerns. These concerns may include infringements on civil liberties such as the right to privacy contrary to the *Human Rights Act (1998)* or the potential for oppressive zero-tolerance policing (Lum, 2009).

Public opinion of FRT paints it as dystopian (Power, 2016) and there remains a need to ensure strict regulation of its use (Kostka, Steinacker and Meckel, 2021). The police Code of Ethics (COE) (College of Policing, 2024) states that whilst police constables should act proportionately, ethically it might be considered an overstep of duty utilising technology that monitors large swaths of the public (Goold, 2004). This

can be attributed to surveillance creep, where the state creates more intricate ways to monitor public activity (Sausdal, 2019). Kostka, Steinacker and Meckel (2021) developed further research which shows that only 35% of the public in England would want such further surveillance.

This figure directly contrasts the significant video surveillance already in place in the UK (Newburn and Hayman, 2002), however it suggests the use of FRT should be considered nationally before widespread implementation.

As criminals develop smart technology, the police must develop their own technological capabilities in response. Whilst FRT and drones can be used both preventatively and proactively to combat crime (Klauser, 2021), they remain niche regarding traffic crime which has seen a significant rise due to the emergence of county-lines and smart vehicles (Robinson, McLean and Densley, 2019). Devon and Cornwall police are one of the first forces to have seen success in drone use, reducing road traffic fatalities and pursuing fleeing vehicles (Whitworth, 2023).

Police vehicles themselves are now equipped with active automatic numberplate recognition (ANPR) and force system technology (Merseyside Police, 2023). With advances in the artificial intelligence (AI) used in FRT, police forces in the United Kingdom (UK) are in a unique environment where trialling future smart technology could be the answer to tackle these new threats.

It is paramount however that this does not simply mean an area becoming a test bed for new technology. This is because this can negatively impact the public opinion of both police and government alike (Halpern et al., 2013). Instead, societal needs should be considered when choosing experimental smart city crime prevention technology (Chapman et al., 2015).

FRT can be fitted to vehicles to provide real time data to officers in their vehicles. This would also improve upon often out-dated current cameras and technology (Keval and Sasse, 2008), although Marvin and Luque-Ayala (2017) underline the need for extensive rationale to increasingly use progressive technology.

Likewise, smart cities are a new and emerging concept (Djenouri, Djenouri and Lin, 2021) and it is important to remember that identified positives, negatives and social influences should be considered with care and context.

Methodology

The research question will be answered through evidence-based research and a systematic literature review. Simple search strategies through the Liverpool John Moores Library Discover website were employed to gather data and information, due to their ethical and replicable nature.

Data was then scrutinised further against its relevance to the research subject and chosen at random from results. The decision was made to exclude search engine use, due to the likelihood of hearsay articles and irrelevant data being found and possibly used. The benefit of a sole library search allows replicability and ensures information sourced is of a reputable nature.

With the absence of outside funding and large timescales, it was therefore the ideal candidate to carry out the necessary data gathering for the research question. Snowball sampling was also utilised due to its simple production of relevant literature (Wohlin, 2014). Moreover, this reduces the likelihood of mistakenly including grey literature, which should be avoided due to a lack of peer review (Haddaway et al., 2015).

Eligibility Criteria

To better quantify the importance of each article the authors have limited the articles to be reviewed to five. Consideration has been given to the risks of limiting the research, such as the possibility of excluding increasingly relevant article or reducing the replicability of results through evidence strength (Kutzner et al., 2017).

Public and Police Support for Increased Use of Facial Recognition Technology in Policing

FRT has steadily improved since the 1960s with the advent of artificial intelligence (AI) (Dauvergne, 2022). Derived from simplistic facial mapping, FRT is combined with AI to match geometric facial disposition to real time imagery (Mann and Smith, 2017). This technology is often depicted as oppressive and futuristically outlandish due to its association with breaches of liberty (Chockia and Nassi, 2021; Couchman, 2019). Technology arising from artificial intelligence has thus been under strict governmental regulation and is subject of concern due to algorithmic artificial bias (Karman, 2019; White and Lidskog, 2022).

Power creep possibilities have been explored by the Chinese government (Dauvergne, 2022) with their use of FRT for law enforcement. It is therefore important to discuss these themes first as such misuse is the basis of much of the opposition to such technology.

Five articles were selected from a systematic search (Bradford et al. 2020; Bromberg, Charbonneau and Smith, 2020; Bragias, Hine and Fleet, 2021; Eneman et al., 2022; Guo and Kennedy, 2023). These articles will be critically analysed in this chapter with respect of two identified sub-themes.

Potential Concerns of FRT on the Private Life of the Public

Despite current digital monitoring by way of closed-circuit television (CCTV) (Fussey, 2008) there is a disparity in the opinion between CCTV and FRT. There is little published research regarding FRT due to its developmental nature (Mann and Smith, 2017), and so examining available data is vital for organisations if they are to retain legitimacy. A lack of transparency of how FRT is used is likely to have the biggest influence upon this (Gates, 2011).

The first article by Bradford et al., (2020) was conducted by way of a survey study in London, with a broad sample size of 1092 respondents over several months. The article aimed to analyse the aspects of trust in police use of FRT, as well as study the public mood in relation to FRT given its existing lack of use (Crawford, 2019). According to Bradford et al., (2020), legitimacy empowers police forces to determine their own uses of new technology. By extension, societies which enjoy more legitimacy may have significantly more leeway in what they can trial and use in daily activity (Lunter, 2020). The results of this article suggest that the opinions of police and FRT use are causally linked, meaning that if the police are trusted and are transparent about FRT then it will likely have positive views.

Bragias, Hine and Fleet (2021) examined public opinion by analysis of 609 comments made on 71 FRT in policing videos on YouTube. They noted a limitation to their method being generalisation and anonymity, due to anonymous users being just as likely to be truthful than they were to lie (Durkee, 2011).

Considering this, Bragias, Hine and Fleet (2021) have found that the implementation of FRT was found to be the biggest cause of public concern, thanks to

failings in its design and the presence of intrinsic biases. It was found that where FRT was developed in Western countries, the technology was superior at correctly identifying Caucasian faces than non-Caucasian faces.

This has led to concerns regarding racism; however, this appears to be an issue regardless ethnicity because of pre-programmed algorithms in the technology, and the authors did not examine how this may be overcome (Bacchini and Lorusso, 2019). A key theme and concern identified in the study relates to the abuse of power encompassing FRT, totalling 32.17% of responses.

Bromberg, Charbonneau and Smith (2019) conducted both a literature review and interview-based survey, whereby they examined articles before analysing 505 surveys. The basis of both was to discover the level of support for FRT use in police body cameras and the factors that pertain to acceptance of such. By extension, Bromberg, Charbonneau and Smith (2019) have also hinted that how surveillance is used can manage concern. In their literature review, Bromberg, Charbonneau and Smith (2019) find that negative public opinion of FRT is inflated, with a larger majority fearing terrorism threats more than infringements on liberty, provided policy is transparent (Murphy and Estcout, 2020).

Their survey study involved separating respondents into groups depending upon their political affiliation and gender. The results were analysed to compare how each factor appeared to influence the opinions of FRT. The survey largely displayed that conservatives are more likely to support police use of FRT and had more positive views of police in general compared to less conservative individuals. Overall, there were positive views towards body camera integration with FRT.

However, younger people in one state were more likely to support FRT regardless of background. Bromberg, Charbonneau and Smith (2019) identify this as being because they have become desensitised towards this type of technology having grown up in a digital age. These results would not be replicable in areas with less digital influence and therefore further studies would be necessary to examine the significance of location and background when discussing FRT use.

How Successful can FRT be

The second sub-theme revolves around the current uses of FRT in law enforcement.

Eneman et al., (2022) carried out a major study using documentation received from three major organisations in Sweden. This included The Swedish Authority for Privacy Protection (IMY), the Police Authority and the Administrative Court in Stockholm, in relation to the police services using a Clearview AI technology to run recognition checks.

The article aims to expand upon regulatory issues that police and relevant authorities face, arising from the Swedish police services illegitimate use of an AI technology to monitor facial recognition. A major concern identified was the outsourcing of data to a third party. This meant that they had no way of knowing what was done with the data that was provided and how this might impact the subjects later. Moreover, there was no way to actively control how police officers utilised the application by Clearview AI and the Police Authority also identified possible misconduct by individual officers (Eneman et al., 2022).

Eneman et al., (2022) employed a qualitative review of empirical data, and the article overall has found that there are legitimacy concerns in data resourcing by the police. These tensions can be overplayed due to both limitations in the technology itself and transparency between all three organisations. Eneman et al., (2022) also did not identify any specific limitations in their own work, despite having not published any specific data about the volume of documents that were screened, and the nature of the contents within.

Guo and Kennedy (2022) discussed why FRT regulation should consider the rule of law and democratisation. This was achieved by way of an extensive literature review including up to 111 articles cited, however no number was given to specify those analysed. One of the key themes explored is the idea of function creep (Guo and Kennedy, 2022). It is argued in the article that FRT can be utilised to monitor genetic disorder and emotion, hinting at ulterior uses of the technology.

A second theme explored is whether FRT is effective enough to warrant its widespread use. The study recognises the positive nature of being able to quickly

identify subjects of law enforcement but makes note of issues with data collection and storage. Widespread general suspicion of surveillance was discussed due to transparency failings as well as mistakes in the identification of ethnicities.

Guo and Kennedy (2022) finally explore the justification of creating watchlists from FRT and why differs from traditional data storage. If there is a necessity and can be explained as proportionate, the study has found there may be leniency with how the technology is utilised, referring to the *Data Protection Act (2018)*.

Concludingly the article suggests policy should be created regarding FRT, with guidance to facilitate changes to policy as the technology grows to prevent explosive function creep.

Perceptions of Smart Roads Policing using Drones

Introduction

Drones are an emerging technology (Alkaabi and Abdel, 2022) and are most often described as unmanned aerial vehicles (UAVs), with a ground pilot actioning the drone through a communication system (ICAO, 2011). Given their multifunctionality, drones are perceived as a breakthrough technology which can assist with domestic and commercial use (Ayamga, Akaba and Nyaaba, 2021), such as delivery and mobile CCTV (Hussain et al., 2022). Public use of drones is increasing despite possible disruptive dangers (Beninger and Robson, 2020), yet what drives public and professional opinion on the use of drones remains debatable (Clothier et al., 2015). Moreover, police forces are now more commonly utilising drones in their practices, although their use is often limited to prevent negative sentiment (Merseyside Police, 2023).

Given the advanced capabilities that drones offer, such as prolonged operational time and thermal imaging (Sakiyama, 2017; Merseyside Police, 2023), there arises a need to discuss uses and concerns. Additionally, the value of drones in roads policing is being explored (Whitworth, 2023) but in doing so there arises a need to develop further codes of practice (Eneman et al., 2022). Subsequently, any future distribution of drone technology should be considered by careful exploration of public perception and police legitimacy.

Five further articles were selected from another systematic search (Heen, Leiberman and Miethe, 2018; Anania et al., 2019; Rosenfeld, 2019; Klauser, 2021; Pedrozo and Klasuer, 2022). These articles will be critically analysed through the exploration of two sub-themes.

Public opinion on drones

Drone use in the last ten years has increased astronomically in the public sector (Beninger and Robson, 2020). The public perception of drone use in general appears to be changing in favour of the development of more advanced drones despite privacy concerns and political factors (Perritt and Sprague, 2015).

The first article by Anania et al., (2019) was an interview-based study that involved 1293 participants in the United States. The aim of this study was to identify links between public support for police drones and political affiliations. Overall, the study shows that there is a disparity between political affiliation and support for drone use, and law enforcement. This has been identified as a potential issue that arises from location, with predominantly democratic states sharing increasingly negative opinions with anonymity. Interestingly, drone use in African American neighbourhoods was supported more regardless of political affiliation, including further policing in general. This is significant as many protestors against such drone technologies state there are ethnically motivated reasons for their employment despite no evidence existing to suggest this (Anania et al., 2019).

Heen, Leiberman and Meithe (2018) on the other hand used survey-based data collection from 481 anonymous respondents. The study focused upon public attitudes of police use of drones nationally in the United States. The authors stated that the reason for this research study was to assess capabilities of drones in activities such as roads policing, whilst monitoring public opinion as these activities are pursued. The study found support for drone use was dependent on application, identifying a limitation in the lack of use of drones in domestic policing. Additionally, the study explains that the public preferred reactive drone uses as opposed to pre-emptive, suggesting surveillance as a factor. With greater reasoning and context behind deployment, the study concludes that police organisations can advertise drone technology transparently and improve community relations. Heen, Leiberman and

Meithe (2018) state this is achievable even with proactive drone use, provided the public are well informed.

Drone Application Affects Public Opinion

The second sub-theme focuses upon how drones are being presently used by police, and the effects their use has on public confidence. The first article by Klauser (2021) is an interview-based survey of 922 persons, including 162 active police officers in Switzerland. The survey studied the differences between public and police use of drones and identified issues with regulation and law. This was because of increasing uses of private drones and commercial police drones Switzerland, despite a lack of research into the public opinion of drones. The study discovers a lack of knowledge by police forces in drone legislation. Of those who are knowledgeable in legislation, they believed it was not sufficient for the prevention of terror attacks. Conversely, prevention of accidents was deemed to be a more appropriate use within current remits, however a larger proportion still believed current legal frameworks were inadequate for the protection of privacy.

The study argued with these factors in mind, that law and policy should be updated to provide better adaptability for police to act as threats emerge. Moreover, the authors suggest that police drone use requires definitions to be drawn as to how they can effectively police the skies before engaging in more than surveillance. There are limitations however, including the lack of clear characterisation of the sky as an enforced area.

Pedrozo and Klauser (2022) conducted a qualitative field study including 10 members of police drone teams in Switzerland. The aim of this study was to analyse the integration of drones into the Neuchatel police force, given the expansion of drone use. The study was carried out over several years between 2015 and 2018 through case study and interviews and found that police drone operators have differing opinions as to the effective uses of their drones.

The study overall concludes that integration of private sector advancements in drone technology by police should be explored. The study implies that police drones, like any equipment, should become an integral part of daily operations. The study is however limited by its small sample size, given that only 10 drone operators are interviewed.

Finally, Rosenfeld (2019) examined the perceptions of drones in traffic enforcement through surveys. 115 participants were chosen from the United States and 125 from Israel. The aim of the study was to examine how drones can reduce dangerous driving whilst balancing the impact of public acceptance. It is important to note that participants were paid a dollar for their interaction in the United States however participants in Israel received no compensation at all.

Overall, the public agree with the idea of traffic policing for a reduction in incidents, although differing opinions of traffic police were noted. A major concern identified was how drones would impact the airway for other aerial vehicles such as passenger planes. Additionally, how the fitment of drones with advanced CCTV and police computer systems to identify stolen vehicles would be effective. As a part of this study, with the deployment of police drones, 31% of participants wanted an outright ban on private drones (Rosenfeld, 2019).

Ultimately, Rosenfeld (2019) concludes that to improve the implementation of drones for traffic policing purposes; they should be used in specific inter-urban locations with less privacy concerns; adopt a specific privacy preservation policy; and ensure the public have a say in the offences that drones can be used to police.

Evaluation

Each article raises the significant issue in establishing public trust in FRT and balancing transparency with effective rollout. Whilst Bradford, Yesberg and Dawson (2020) recognise there is a need to continue technological advancement, the study suggests predicting acceptance of FRT is impossible. Similarly, Bragias, Hine and Fleet (2021) theorise that by combatting misinformation about the use of FRT there will be greater support for its use.

Conversely, Bromberg, Charbonneau and Smith (2020) have found that there appears to be greater support for its use in niche circumstances, such as in body worn cameras. This suggests that public concern for FRT may not be due to police use, but its use in surveillance. This indicates that, as Bradford, Yesberg and Dawson (2020) and Bragias, Hine and Fleet (2021) state, there is possibility for its use during specific incidents; for instance, in identifying wanted offenders. The major theme therefore to acceptance is surveillance.

Unfortunately, the latter two articles focused upon general opinions without researching the factors behind them. Bromberg, Charbonneau and Smith (2020) attempt to identify the political and gender factors that influence a person's trust in FRT, suggesting further research on the topic of political affiliation and police monitoring; however, this is done without suggesting ways to eliminate bias.

The last two articles by Eneman et al., (2022) and Guo and Kennedy (2022) have focused upon reports on real time use of FRT by law enforcement in Sweden and in the UK.

Their studies highlight the bureaucratic processes behind obtaining FRT, which is useful for public relations, however in contrast to Bradford, Yesberg and Dawson (2020) have chosen to review each side with an uneven number of opinions. This creates a negative portrayal of the law enforcement agency, with a key premise being the overreach of the Swedish Police in attempting to use a new technology to apprehend offenders (Eneman et al., 2022).

There are limitations to these studies due to there being little published data about either population despite detailed methodologies. Finally, a major component of Guo and Kennedy's (2022) article was discussing the need to establish regulations that can successfully govern FRT without sacrificing public liberties. If FRT use was clarified and governed by openly discussed regulations, the studies both imply there would be reduced function creep and better understanding of public concern by authorities.

The mentioned articles have all focused in some way upon the acceptance and opinions of the public in the implementation and use of drones by the police. Anania et al., (2019) appear to identify that the support of drones does not change based on the reasoning stated by police. Instead, the level of support fluctuates based on pre-conceived ideas.

The review therefore is highly likely to contain heavily biased views. Moreover, it signifies that even when the public are aware of their own possible ignorance with drone policy, they will continue to align with their original viewpoints despite education. There is therefore a residual decision to not consider the opposing argument.

As Anania et al., (2019) states, it appears even when drones are used to prevent crime it is seen as surveillance. Identifying reasons why surveillance use is so controversial could have been suggested. However, the study does provide significant evidence that these thoughts do vary even across ethnically diverse communities, with richer areas and African American areas predominantly supporting the use of drones.

Whilst Heen, Leiberman and Meithe's (2018) study does not touch on socio-politics as Anania et al. (2019) study does, it focuses upon how opposition to police drone use can change with legitimacy and the perceived effectiveness of a locations police.

When the public trust their police force, they are more likely to trust it's activities (Heen, Leiberman and Meithe, 2018). Strong community relations should therefore be sought prior to the application of drone use, although it fails to identify how acceptance is influenced by drone use. Moreover, any key reasons why the public may have concerns as to how the drones are used is missing, which limits its usefulness in establishing how drones can be properly acclimated to urban policing.

Klauser (2021) on the other hand states that police forces should be mindful of the sky as an area that requires policing. This is a new concept in modern policing (Klauser, 2021) and should therefore be clearly defined. However, the study fails to do this when carrying out its methods and in doing so limits participants to make up their own conclusions.

Each group examined will have their own definitions of the aerial realm (Klauser, 2021) and therefore the results obtained have a large margin of oversight. The study does probe the police usefulness of drones and raises the point that only 12% of police drone operators believed the public would be concerned about their increasing use.

Pedrozo and Klauser (2022) echo this statement with their research surrounding the adoption of drones by the Neuchatel police force. Without ethical consideration of public concern, public opinion will remain unchanged. Police forces need to ensure they are aware of these factors with proper democratic debate, although this study is limited by the participants, of which are all officers serving on the drone team in Neuchatel.

Reducing bias is therefore difficult, although open ended research has been conducted so that most of their findings can be analysed with respect of private companies collaborating with police to further drone research. Unlike Anania et al., (2019), Pedrozo and Klasuer (2022) do not explore the effects of political affiliation or sub-factors of acceptance. This could be a future path of research in niche circumstances.

Rosenfeld (2019) found groups in the United States to be far more supportive of law enforcement drone use compared to Israel and were even in favour of the fitment of FRT and CCTV to drones.

Both groups were in favour of traffic drone policing, and unlike the other articles explored the study found a positive view of police and drones in general. Both groups studied believed that drones in traffic policing could significantly reduce roads crime and the idea of issuing tickets remotely via drones can reduce the burden of traditional roads policing.

The larger sample size, and thus credibility, is affected however by the admission of the group in the United States being paid to take part in the survey. The findings are arguably still significant due to similar results, however the larger proportion of positive responses in the United States cannot be proven to not be an effect of payment.

For the sake of integrity in the future, all parties should be privy to the methodology used by each group involved in the study. This would be more ethically sound, although the basis of using a payment regardless should be explored in of itself to ensure a fair study.

Concludingly, each article raises key themes of privacy and security, and there remains a need to improve transparency and public debate with respect of drones. Moreover, it appears drone use in roads policing is an avenue that should be explored further.

Discussion

The aim of this research was to analyse the implementation of two emerging technologies: FRT and drones. Both technologies are being explored by law enforcement agencies (Gates, 2011; Royo et al., 2022), however, they have become increasingly subject to public scrutiny (Ringel, 2021; Smith, 2015). Mismanagement of

police resources and unethical use can cause distrust and affect legitimacy (Westmarland and Conway, 2020).

Police forces are unlikely to be as effective in delivering a robust service without such technology however (Macqueen and Bradford, 2015). Similarly, it is unlikely policing will be as effective without these technologies as smart cities continue to evolve (Tulumello and Lapaolo, 2021).

The first theme explored the public perception of FRT implementation. The findings from the articles (Bradford et al. 2020; Bragias, Hine and Fleet, 2021; Bromberg, Charbonneau and Smith, 2020; Eneman et al., 2022; Guo and Kennedy, 2023) all suggest that FRT is continually being implemented in unethical ways, without first investigating public opinion.

This can translate into a lack of transparency causing mistrust due to a failure to consider procedural justice (Machura, Jones and Hemmings, 2018). Moreover, current research suggests FRT is not even ready for widespread use, stating it is not accurately portraying and identifying persons in part due to bias (Lunter, 2020). Both factors combine to affect public relations (Bradford et al. 2020; Bragias, Hine and Fleet, 2021; Bromberg, Charbonneau and Smith, 2020; Eneman et al., 2022; Guo and Kennedy, 2023). Interestingly, whilst FRT technology has been proven in concept (Mann and Smith, 2017), its potential misuse doesn't take into consideration how little data there is regarding police adoption of FRT in the UK (Kostka, Steinacker and Meckel, 2023).

The use of FRT operationally, like stopping a person believed to be wanted, is preferred to widespread surveillance (Bromberg, Charbonneau and Smith, 2020). The overarching theme is therefore one of trust, and without a fully functioning product there is unlikely to be any sort of effective implementation (Kate, 2019). Additionally, the concerns regarding the capability of FRT to discern different ethnicities echo past issues in identification before CCTV became mainstream (Bacchini and Ludovica, 2019).

All these factors suggest that FRT is not ethical. Although, there is a need to discern between single use FRT and mass surveillance. Previous legal challenges have ruled FRT to be lawful in South Wales (R v The Chief Constable of South Wales Police,

2020), however, this was basic testbed technology and the public were unaware as to its limitations at the time (Zalnieriute, 2021).

By this extent, FRT should not be adopted in its developmental stage. Proven concepts do not equate ethical adoption of product, especially when FRT can be edited to perform higher functioning tasks such as identifying political affiliation to a high degree of accuracy (Kosinski, 2021). Moreover, there is little to no governmental policy as to how FRT would be realised in daily policing (Ringel and Reid, 2023). Without this, there is an increasing chance of function creep which could overtake the purpose of FRT in law enforcement itself, which is prevent crime (Dauvergne, 2021).

By adopting a transparent approach in the use of FRT, police forces may open themselves to the possibility of misuse of knowledge (Xiaojun and Pei-Luen, 2021), as currently private companies can create AI technology that can be used publicly (Raposo, 2023). This might be addressed with purposeful legislation that limits extensive FRT development for public use (Guo and Kennedy, 2022).

The second theme focused upon how well drone technology can be specialised in different areas of policing, and the public opinion surrounding these areas (Anania et al., 2019; Heen, Leiberman and Miethe, 2018; Klauser, 2021; Pedrozo and Klasuer, 2022; Rosenfeld, 2019). Early adoption of drones has seen great success (Merseyside Police, 2023), however much of drone policing appears to have been reactive (Fish and Richardson, 2021).

The implementation of drones as pre-emptive technology has not been explored ethically yet (Klauser, 2021) which suggests their use must be strictly governed by internal policy due to a lack of analysis by academia (Cavelty and Hagmann, 2021). Due to a lack of current transparency between police and public, factors such as risk aversion, function creep and ethics become a larger issue over time that may affect public opinion (Heen, Lieberman and Miethe, 2018).

It is likely that police drone units are unaware of ethics concerns, likely presenting bias as to their backgrounds. Although, public opinion does not often influence the policy of institutions (Walsh, 2018). Police forces are likely to garner more support from the public if they continue to utilise reactive drone policing due to reducing the effect drones have on liberty (Dwyer-Moss, 2018).

There are also clearly benefits of drone use in roads policing, allowing advanced CCTV technology to reduce the strain on roads policing officers (Mac et al., 2020). Whilst focusing upon improvements in road safety will have a positive effect on public confidence, drones will also improve information sharing and intelligence gathering thus improving response times to traffic incidents (Beg et al., 2020). There is also the possibility of fitting drones with FRT themselves, however this must be monitored with respect of function creep (Guo and Kennedy, 2022).

Future Research Considerations

The adoption of FRT shows promise in improving offender apprehension and improving public safety (Bromberg, Charbonneau and Smith 2020). However, current early iterations of the technology do not possess the means to accurately be used due to failures in recognition or algorithmic error (Karman, 2019), and so further studies should explore the development of the technology. Public opinion should also be vetted, as it appears the specific uses of FRT and where it is being used can vastly change how the public perceives the technology (Murphy and Estcourt, 2020).

Drone technology differs from FRT in that it is a well-tested and effectively used resource (Neocleus, 2013). Research should focus upon how drones are perceived by the public and in what settings, to assess why drone use is a topic of concern despite positive changes in perception (Perritt and Sprague, 2015). As the articles suggested, if public use of drones is the primary concern, future research may focus on how the police can tackle illegal private drone use. Moreover, drones should be tested for long term capabilities in roads policing, to assess and improve their battery life and CCTV quality to effectively tackle roads crime. Linking drones and CCTV systems, as well as FRT to a smart city network (Hussain et al., 2022) could be reviewed.

Implications on Policing Practice

The advent of FRT and drone technology poses complex challenges for police forces. In practice, both technologies require different setups and have vastly different cost benefits (Zharovskikh, 2021; Merseyside Police, 2023). Likewise, both are being actively pursued in the private sector and are therefore garnering attention at the governmental level (Eneman et al., 2022).

Conversely, whilst there has been creation of policy for drone use, FRT is governed by outdated policy (Machura, Jones and Hemmings, 2018). FRT will therefore be difficult to regulate and laws regarding it difficult to enforce. There also remains the public concerns surrounding its use, although given its current state there is time to assess how it might be better adopted (Mann and Smith, 2017).

Additionally, if FRT will have similar functionality to CCTV, there will remain an issue of training into the handling of FRT. If CCTV is to remain in the purview of councils it might then be wise to ensure that large scale FRT use is also monitored by unbiased, government institutions to ensure that it is not abused.

Drones on the other hand have been widely used by public sources in the last decade and there remains legislation to govern their use (Neocleus, 2013). The cost however of building a drone fleet would be high and require adding to the policing budget (Spurrel, 2021). Although, expanding the area of policing to the skies could again bring attention to the *Human Rights Act (1998)*. It would be difficult to account for the potentiality of increased public drone use also should the police seemingly encourage their use, and this brings into question the research completed in the articles as to whether harsher restrictions need to be placed on private drones.

For roads policing however, proof of concept has already been trialled as the articles studied show (Rosenfeld, 2019). Smart technology fitment to drones would provide a highly manoeuvrable platform for police to proactively engage and pursue criminals who also adopt new technologies.

Off road and electric motorcycles or e-scooters provide unique challenges in pursuits (Merseyside Police, 2023), therefore by investing in FRT and drone technology police forces can reduce the danger to the public and offenders by removing the factor of conflict. This could significantly improve apprehension of offenders on electric motor vehicles and deter their use in other types of criminality.

Conclusion

Strategic aims of policing in the UK are to prevent offending through improved communication and accessibility of technology (NPCC, 2021). It is therefore important to evaluate research as it becomes available to ensure police forces are conducting best practice. Moreover, identifying the developing avenues of crime fighting in smart

cities through adoption of new technology will assist in meeting these goals. Specifically, the aim of this research project was to assess the viability of FRT and drones within smart cities.

Literature regarding FRT has identified that its use is controversial and often unethical, with many countries beginning to ban or heavily restrict its development. Function creep and misuse of the technology have been raised as key factors in this, although it is difficult to ascertain the significance of public opinion due to the current lack of full-scale implementation.

There has been mention of a lack of policy and restriction affecting public perception, however it appears societal norms can spread and cause greater change than police use. Regardless, police are providing transparent conversation as to when and where FRT is used. The biggest factor of its future use would be educating the public and maintaining open communication as to how effective FRT is at preventing crime. Improvements in perception often occur when FRT is used situationally and this will be key when debating its use.

Subsequently, drones are being further adopted by police forces to progress regional and national crime prevention goals. Drones possess key advantages over traditional vehicles, being highly manoeuvrable and can be fitted with camera technology. Their benefits in land searches and reconnaissance, including surveillance of public events are undeniable. Unlike FRT, the public finds drone use to be favourable when used reactively. One key issue identified appears again to be how the function of police drones will evolve as their use increases.

Public concern suggests that police use will increase public acceptance of drones and consequently the skies will also need to be policed. Moreover, it appears knowledge of laws surrounding drones is low in police forces and public domains alike. With better education and continued implementation, the use of drones can improve daily policing. Provided the public agree they are not being used to breach liberties they may also be adopted for roads policing or community policing.

This research project finds that drone use is preferable to FRT and should be significantly invested in during development of the strategic aims set out by the NPCC (2022). A key factor especially being the use of drones to deter criminal use of electric

vehicles, that often are used by organised crime gangs to perpetuate a multitude of crime types.

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