VIDEO SURVEILLANCE: THE UNITED STATES AND THE UNITED KINGDOM

THESIS

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CHAPTER I

INTRODUCTION

Around the world, the problem of crime is ever present. Governments and police agencies are constantly trying to find new ways to prevent and solve crimes, and make their cities safer for law-abiding citizens. Administrators look into technology of all kinds to reduce crime levels and lessen the fear of crime. Reducing crime levels without reducing the fear of crime will do nothing to calm the population and make people happy, but reducing the fear of crime without reducing crime levels will do nothing to abate the social and economic costs of criminal activity. At the same time, crime prevention measures must not violate privacy or other human rights, and the population must approve of its use.

One of the most popular technologies for reducing crime is Closed Circuit Television (CCTV). Camera technology has grown exponentially over the past decades, and is being used by law enforcement agencies around the world at increasing rates. There are two ways in which this technology can be used. If a police department uses closed circuit television systems proactively, the cameras allow one human being to see many different areas at the same time; witnessing crime or other emergencies and immediately reacting. When a camera operator witnesses a crime in progress, they can

dispatch police, if they witness a person clutch their chest and fall over, they can dispatch an ambulance, or if they witness a fire, they can dispatch the fire department.

Proactive methods cost more than reactive methods, however. A person must be paid to sit in front of a camera and watch for very rare occurrences. When cameras are used reactively, they are used as recording devices. If police are told that a crime has occurred at a certain place at a certain time, they can use the recordings from the camera to identify suspects and gather evidence. At trial, video evidence is very useful in order to identify and convict perpetrators. This method is cheaper than proactive methods, but cannot be used to prevent crimes, merely to solve crimes and punish those responsible.

In either case, cameras also serve as a deterrent to potential criminals. If a person knows that someone is watching through a camera or that their actions are being recorded, they are less likely to commit crimes. In this way, even cameras that don't have someone monitoring them and are not even recording can reduce crime in the area where the camera is located, as long as people believe that they are being watched.

The question remains, however, how effective cameras are at accomplishing these goals. Governments and police agencies are spending millions of dollars on surveillance systems of all kinds, and much research has been done as to their effectiveness at accomplishing all the different goals that they are designed for.

CCTV appears to be a promising direction for law enforcement in the United States and other countries, but questions remain about cost effectiveness and human rights. This study will assess the true potential that video surveillance has for the future of

law enforcement in the United States, and whether or not it can play a role in the reduction of the crime problems that America faces.

CHAPTER II

MODEL NATIONS

Many nations already have established surveillance systems. Some of these systems have been operating for decades, some for only a few years. Each nation has its own laws and regulations regarding the use of CCTV systems, so each nation's experiences and successes do not necessarily translate from one nation to another.

In South Africa, the Western Cape government decided to use CCTV to boost security at Table Mountain after 18 recorded attacks in the national park there from January to August of 2007. The money allocated by the South African Government for the CCTV system will be used to create a new command and control center for park police and for more cameras to cover the entrances of the park ("South Africa", 2007).

In 2006, Sydney, Australia installed new cameras in five areas of the city in response to the London bombings earlier that year. The 50 cameras already operating around the city and the more than 6,000 cameras operating in Sydney's trains and train stations were also upgraded with advanced zoom capabilities and additional upgrades that improved their reliability. One of the five areas that received additional cameras was targeted by the authorities because a survey of city residents found that the area in

question was routinely avoided by citizens due to "drugs, sleaze, and crime" (Connoly, 2006).

In 2007, Brisbane, Australia upgraded the security system in their airport. They pioneered a system where cameras are used in conjunction with facial recognition technology to verify the identity of passengers boarding planes. The program is called Smartgate, and it involves passengers having information digitally printed on their ePassport, which is then scanned at a kiosk before they board their flight. When they board the plane, they pass in front of a Smartgate reader, which takes their picture and compares their face with the face on file from their ePassport. If the facial features of the person boarding the plane do not match the biometric data for that person, they are not allowed to board ("Facial Recognition", 2007).

Canada implemented its first open-street CCTV system in 1991. Sudbury, Ontario received CCTV in 1996, and London, Ontario in 2001. Cities like Vancouver, Edmonton, Toronto, Hamilton, and Kelowna also have government run camera systems. Even small cities like Yellowknife, Northwest Territories have received CCTV systems. Vancouver, Calgary, and Saskatoon are planning on following their lead and putting CCTV on their streets (Walby, 2005).

The most recent country to implement a large scale public CCTV system is China. In 2006, Beijing had an estimated 263,000 cameras, of which 15,000 were run by the government. Only those 15,000 are legally allowed to be pointed at streets, squares, and other public places. Private cameras are only legally allowed to be pointed within the property limits of the owner ("Surveillance Cameras", 2006).

The city with the most cameras is Shenzhen, a large coastal city located right next to Hong Kong, the city it was modeled after. In 2006, they installed cameras with two way communications systems, so victims of crimes can push a button and immediately be connected with the police officer looking through the camera. In addition to these cameras, more than 200,000 cameras without the speaker system were installed in 2006 ("New Device", 2006).

In 2007, the Chinese government started implementing a system in Shenzhen that will add a number of new technologies to the existing camera system. They will integrate sensors that employ both facial recognition technology and Radio Frequency Identification (RFID). The camera, the facial recognition software, and the RFID reader will combine into one system, which will track people using their faces and citizens' residence permits, which will have embedded RFID chips encoded with a large amount of personal information. This information includes the permit bearer's name, address, police record, employment history, landlord's telephone number, educational record, medical insurance information, ethnicity, and even reproductive history (in order to help enforce China's "One Baby" law). The project, named "Golden Shield," is being developed by a company called China Public Security Technology, a company run by Chinese entrepreneurs, but based in Florida (Spencer, 2007).

Using CCTV on this scale is not entirely unprecedented. While the technology rivals anything currently employed anywhere in the world, the number of cameras is comparable to both the United Kingdom and the United States, the two countries most widely known around the world for their public camera systems. Therefore, most of the research into the effectiveness of CCTV has focused on these two areas. While they both

use CCTV, they use them in different ways, and the reactions by each country's populace are different as well.

The first nation to make public video surveillance a major national policy with the associated costs in time, technology, and manpower was the United Kingdom. The video surveillance of Britons started in 1961, when public officials installed black and white cameras in the Holborn train station in London. As the number of cameras in train stations rose over the subsequent decades, officials started installing cameras in and around sports stadiums in the 70's and 80's to keep a public eye on "soccer hooligans." Cameras were installed in London's financial district in response to a bombing by the Irish Republican Army in 1993. In addition, private companies and organizations have given control of their camera systems to police, giving the government even more surveillance capability (Patrick, Singer, & Stecklow, 2006). This trend has spread across the country, leading many to nickname the United Kingdom a "surveillance society." This nationwide focus on CCTV has made the UK the worldwide leader in public surveillance.

Today, London has more public security cameras than any other city on the planet, with about a half million cameras in the city. A typical Londoner can expect to be filmed at least 300 times in an average day. The United Kingdom as a whole has as many as seven million cameras (Patrick, Singer, & Stecklow, 2006). These cameras are receiving constant maintenance and upgrades, constantly making the system more complex, and better able to perform the job the British government intends for them to do.

One of the latest improvements is the addition of a speaker system built into the camera so the camera operator can communicate with citizens that the operator is viewing. A pilot program testing the effectiveness of the new cameras was run in the English town of Middlesbrough. According to the British Home Office, the camera and speaker system resulted in "a noticeable drop in anti-social behavior," but they provided no data to back up this claim. They did report that the camera operators focused on small scale public order offenses such as littering, using the speaker to order offenders to pick up the trash they dropped and put it in nearby receptacles. Without complete data, the actual effectiveness of this system cannot be measured, but 20 more towns around the country have applied for the permits to install these camera and speaker systems (British Home Office, 2007).

The system as it stands has many flaws, however. A pub owner in the West Midlands was recently given a ticket by an automated camera for going 40kph in a 30kph zone. The problem that the citizen had with this was that at the time the camera caught his vehicle speeding, he was in his pub playing darts with a large group of people, with his car parked outside. The ticket was eventually dropped, but he still received a fine and had points taken off his license due to the fact that he failed to name the driver of the vehicle on the forms he filled out for the court. As the owner put it, "I couldn't name the driver on that car because, as far as I'm concerned, no-one was driving the car" ("Motorists Disprove", 2007). This instance highlights the fact that cameras are not always right. The images still have to be interpreted by humans, and that human interference in the system can cause incorrect results. In this case, an innocent man received a speeding ticket he didn't deserve. In the case of a camera catching a murder or

assault in progress, the human viewing the camera footage of the incident could misidentify a suspect, resulting in an innocent person going to jail based on the video evidence.

The problem of citizens receiving undeserved tickets by speed cameras has caused such a public outcry that companies are beginning to find ways to profit off the situation. Dr. Phillip Tann runs a company called "Autopoietic Systems" that is developing a speed monitoring system using GPS and a client's cell phone. This system can track a user's phone to within a meter, and accurately judge at what speed the phone, and by extension the car it is in, is traveling. Clients can use this system to prove in traffic court that they were not speeding when law enforcement or traffic cameras claim they were. This system and systems like it will help keep track of the accuracy of law enforcement technological devices ("Motorists Disprove", 2007).

Another problem that may lead to suspects being acquitted is the fact that up to 90 percent of all cameras in the country may be in violation of the Data Protection Act. Most of the cameras in violation are due to cameras not being visible with clear signs marking their location, or due to camera tapes not being properly secured, raising concerns about the privacy and security of the recordings. Gordon Ferrie, a former police officer, chairs an organization known as Camerawatch. This organization fights to make sure that cameras run by the government are run properly, according to the laws and regulations of the United Kingdom. They are not opposed to the operation and use of cameras, and believe that they are an overall benefit to British society, but only when they are used correctly. It is Camerawatch that is monitoring and reporting on the illegally placed cameras and the lack of security in video storage areas around the country (Hall, 2007).

The cost of the British system has been a significant portion of all Home Office crime prevention money being spent over the last few decades. Between 1996 and 1998, CCTV spending accounted for more than three quarters of all crime prevention spending. Between 1999 and 2003, the Home Office spent 170 million pounds on cameras and related equipment and services. This has grown from the 38 million pounds spent on the system between 1994 and 1997. All of this money is matched pound for pound with the local community that will be receiving the actual cameras. In addition to the costs of the actual equipment, there are costs from installing, running, and maintaining the system as well. The city of Westminster estimates that each camera costs 20,000 pounds, but requires an additional 12,000 pounds per year per camera for running and maintaining the system (Armitage, 2002).

This is not a new phenomenon in America, either. As early as 1971, Robert Gray suggested using cameras to help control assaults on bus drivers (Gray, 1971). It is a rapidly growing trend in American cities. The first government run CCTV camera on a public street was installed in New York's Time Square in 1973. The New York Police Department installed it due to the failure of their other crime prevention policies during the previous decade, and in response to some of the highest crime rates the city had ever seen. Unfortunately, this measure also failed, and the cameras were removed after only two years. It didn't take long before New York City had more cameras, adding them to subway stations in the 1980's and schools and housing projects in the 1990's (Yesil, 2006).

In areas around the United States, more and more police installed cameras to monitor and prevent crime activity. Cameras popped up in Virginia Beach in 1994, then

in Tampa Bay in 1997. In fact, camera use grew so fast during the 1990's that a survey conducted by the International Association of Police Chiefs found that by 2001 (before September 11th) 80 percent of all police agencies that responded to the survey had some sort of public video surveillance program, and another 10 percent were planning on establishing one. A RAND survey also in 2001 found that 41 percent of local departments and 66 percent of state departments had public video systems (Yesil, 2006).

The terrorist attacks of September 11th increased the already rapid pace of camera security system installation. One of the first cities to start a large scale surveillance system after 9/11 was Washington DC. The Metropolitan Police Department teamed up with the National Park Service to conglomerate control of cameras previously run by many groups by assuming control of cameras previously under the control of the FBI, Department of Transportation, DC school system, and private businesses. Now, combined with newly installed cameras, thousands of cameras are controlled by one central agency in one central command center with floor to ceiling video monitors. The monitors give real time surveillance of such national icons as the Washington, Jefferson, and Lincoln monuments, Union Station, and the Korean and Vietnam War Memorials. They also provide coverage of subways, shopping malls, and apartment buildings (Yesil, 2006).

In 2006, Washington DC police set up new cameras in residential areas. While the prime purpose of the previous cameras had been terrorism prevention followed by crime prevention, the new residential area cameras will focus exclusively on crime prevention and detection. As of March, 2007, the police department had 48 cameras up and running and an undisclosed number planned. The police determined which areas to install the

cameras based on the number of calls for service, number of reported crimes, and the recommendation of civic and citizens organizations. These were passive cameras, meaning a police officer was not watching the screens at all times, but authorities were able to review recordings from the cameras after crimes were reported in the area. This made it more of a forensic tool than a crime prevention measure (Metropolitan Police Department, 2007).

This passive camera system was upgraded to a more active monitoring system in 2008. Police Chief Cathy Lanier decided to put officers in charge of monitoring these cameras, of which there are now 73, with that number still rising and expected to reach 125 within two years. There are not enough officers to watch all the cameras, but a small group can pick and choose cameras to watch based on the most recent crime trends, and can switch cameras when calls for assistance are received by 911 operators. The chief decided to use live monitoring instead of passive monitoring after a man was shot and killed within view of a camera, but numerous passers-by neglected to call 911 for over 10 minutes. Authorities hope that situations like this will be prevented with a more pro-active approach to using the camera system (Klein, 2008).

New York's systems have been constantly upgraded since September 11th as well. In 2007, New York Police announced plans to put cameras on hundreds of Manhattan busses, and put 3,000 motion sensors on subway and commuter rail facilities. This will tie into their new 90 million dollar system, which will have up to 3,000 cameras around the city operating by 2010, all transmitting to a central surveillance center in Manhattan (Marks, 2007).

One camera is already set up and monitoring the license plates of cars that are traveling into, out of, and around the city. When cars pass by the camera, it automatically scans the license plate and checks it against a database of license plate numbers kept current by the New York Police Department (NYPD). This is a pilot program that the city plans to expand in the future. The system will eventually cover the entire New York financial district, and will cost an estimated 81.5 million dollars. The current plan calls for more than 100 license plate readers, thousands of surveillance cameras, and numerous automatic road blocks that can block traffic in the case of an emergency. The system, called "Ring of Steel," is modeled after a similar system in London's financial district (Lisberg, 2007).

Many people have complained about the new system, citing privacy and civil liberty concerns. The Mayor of New York, Michael Bloomberg, called these people "very naïve" if they think they aren't being watched at all times already. "We are under surveillance all the time" by private companies, whose tapes are made available to the police if there is an incident. "It's just ridiculous people who object to using technology." He also stated he hadn't talked to anyone in London that wasn't "thrilled" about the CCTV system operating there (Tumposky, 2007).

In 2004, Chicago Police announced plans to install 250 high tech cameras to complement the 2,000 cameras already in place around the city. Mayor Daley and officials from the Chicago Police Department (CPD) claim that the cameras are for anti-terrorism and to reduce crime, and they will be placed around potential terrorist targets. The new system will also start to incorporate cameras from differing agencies around the city such as the police, transit, housing and aviation authorities, and private businesses.

Like Washington D.C., the city will have one central control room where all camera feeds will be monitored (Yesil, 2006).

In 2006, Mayor Daley put forth legislation that would require bars and businesses open more than 12 hours at a time to install security cameras to help identify who comes and goes at all hours. The cameras would be paid for and operated by the business owners, but some people claim that it is only a matter of time before the city co-opts these cameras for police purposes. "There is no reason to mandate all of those cameras unless you one day see them being linked up to the city's 911 system" said Ed Yohnka of the Illinois American Civil Liberties Union (ACLU) (Keen, 2006).

In 2007, Chicago was one of the first cities to put behavior recognition software into their surveillance system. The system, designed by IBM, is being used as a selling point for Chicago's bid to host the 2016 Olympics. The system already has technology that can recognize the sound of gunshots and automatically turn cameras towards the scene. There is some resistance to the upgrades and to the system itself. The ACLU has claimed that it infringes upon freedom, and a professor from Northwestern University has claimed that the idea of these cameras preventing a future terrorist attack (another major selling point of the system) is "absurd" (Babwin, 2007).

The Democratic National Convention was held in Boston in 2004, and that city upgraded its CCTV system for the event. The Boston Police Department installed 30 new cameras, and the Department of Homeland Security linked these 30, along with 1,000 other government-owned cameras and an equal number of civilian-owned cameras into one large network covering the financial district, city hall, traffic intersections, and transportation areas. It was the first time that local, state, and federal systems had all been

combined to make one large surveillance system. Although the conglomeration lasted only as long as the convention, the 30 new cameras were integrated into old systems, and plans are in place to combine the separate systems again should the need arise (Yesil, 2006).

Even more cameras are being added to Boston's public areas. The Massachusetts Bay Transport Authority has 79 cameras covering about a quarter of their 60 train stations in Boston. More than a hundred more are planned, mostly due to enforcement concerns revolving around the new automated payment system. They reason that passengers will be less likely to cheat on paying their fares if they know a camera is watching (McElhenny, 2004).

Other cities are also installing extensive CCTV networks. Dallas installed a 40 camera wireless system in 2007 to cover its business district (Smith, 2007). The University of Pennsylvania has over 400 cameras operated by campus police (Young, 2003). Seattle is considering conglomerating many private security cameras into a government run system (Sullivan, 2007). Newark city officials purchased 1,145 new buses, all with CCTV cameras in them (Hackett, 2007). Clovis, California, home to a company that manufactures video cameras, has over 100 government run CCTV cameras for a city of around 90,000 people (Bulwa, 2006). Baltimore, Madison, St. Paul, Pittsburgh, and even smaller cities like Liberty, Kansas and Scottsbluff, Nebraska are investing their money and resources in CCTV systems (Savage, 2007).

Despite objections by the ACLU, civil liberties groups, and many citizens, cameras are here to stay, and the number of cameras in the country is only going to

increase. One thing that researchers have striven to find out is whether these cameras are actually causing a reduction in crime or the fear of crime.

CHAPTER III

RESEARCH

The question that must be asked is whether these cameras have any actual tangible effect on the crime rate of the cities and towns where they are installed. Governments can put billions of dollars into the system, but if there is not a measurable drop in the crime rate, they haven't seen a return on their investment. There are many ways to measure the amount of crime that has been prevented or solved through the use of public video surveillance, and most of them have been used by at least one researcher or team of researchers to discover what effect, if any, the cameras have.

One of the first basic reports on CCTV's effectiveness at reducing crime was in 1996. This report showed that the cameras had caused a significant impact, and that they had succeeded in lowering the crime rates in the areas they were installed. The report acknowledges that it was difficult to gauge the effectiveness of the cameras, because many crime prevention measures were put in place at the same time as cameras, and no true control group could be used. Even so, the report shows that crime in Birmingham, England was reduced by 14 percent in the first year after cameras were introduced, and overall sales in Wolverhampton's town center went from the national average to 1.25 percent above the national average after four cameras were installed in the shopping districts of the city in 1988 (Poole & Williams, 1996).

Even more striking was the reduction in vandalism along the seaside promenade of Bournemouth, on the South Coast of England. City officials installed 51 cameras there in 1985, after paying a half million dollars to repair the vandalism that was done to the area's buildings. Twelve months later, the city spent only 60,000 dollars on vandalism repair. They used the money saved to put an additional eight cameras in another area of the city, and reduced the vandalism costs there from 120,000 dollars to "virtually nothing" (Poole & Williams, 1996). This study, if it could be generalized to the entire country, would mean that the cameras, including hardware, maintenance, and operating costs were a great bargain. The amount of money saved by the taxpayers would far outweigh the millions of pounds spent on the system. More recent studies, however, have shown a much different result.

In 2002, Welsh and Farrington wrote a report for the British Home Office detailing their scientific findings after performing a meta-analysis on all prior research done on the effectiveness of CCTV systems in the United Kingdom. They included only studies that focused on CCTV as the independent variable, had crime as the dependant variable, had sound methodology, had at least one experimental area and one comparable control area, and had at least 20 crimes reported in the area before the intervention. They reviewed all relevant journals and contacted all available researchers in the area and found 22 relevant studies meeting their criteria. Of these, 11 found that the cameras caused a reduction in the amount of crime committed, five found that the cameras actually increased the amount of crime, five found no effect either way, and one found an uncertain effect, where no conclusions could be made. Only 18 of these studies included

enough data in the publication to be included in the final meta-analysis (Farrington & Welsh, 2002).

The statistic chosen to measure the effectiveness of each system was the Odds Ratio (OR). This statistic is used to show the proportional change in crime in the control area over the experimental area. An OR greater than 1 indicates a positive effect, an OR less than 1 indicates a negative effect. An OR of 1.3 would indicate that crime increased 30 percent in the control area as compared to the experimental area. Or, conversely, crime in the experimental area was reduced by 33 percent (the inverse of the OR, or 1/1.3) (Farrington & Welsh, 2004).

From the 18 studies identified, the researchers concluded that the overall effect on crime of the different CCTV systems was a statistically significant, but small drop in crime of around four percent. Of the 18, nine showed a positive effect on crime with odds ratios of 1.27 or higher, and nine showed no positive effect on crime with odds ratios of 1.02 or less. The nine that showed a positive effect were enough to combine to make the small net effect (OR = 1.04) statistically significant (p=.003) (Farrington & Welsh, 2002).

These studies were further divided up into different types of crimes and different types of areas. CCTV was found to be most useful when targeted at vehicle crimes, but not at all useful at reducing violent crimes. This would imply that cameras set up in places like car parks with large numbers of vehicle thefts would be more useful and show more of a return on investment than cameras targeted at violent crime (Farrington & Welsh, 2002).

The authors divided the geographic areas that were studied into three categories. These three categories were city center and public housing, transportation systems, and car parks. In the nine studies dealing with city center and public housing areas, five showed a small significant reduction in crime rates, while four showed no reduction. The combination of all nine showed a small, but statistically significant drop in crime of two percent (OR = 1.02) (Farrington & Welsh 2002).

In the four transportation studies, two found a desirable effect on crime rates, one found no effect, and one found an undesirable effect on crime. Of the two studies showing a positive effect on crime, there were other interventions that may have caused the reduction, leading to questions as to whether the cameras were the actual cause of the reduction in crime. When the data from all four studies was combined, the data showed a statistically insignificant drop in crime rates (OR = 1.06) (Farrington & Welsh, 2002).

The largest decrease in crime rates was reported when cameras were used in car parks, as the data on types of crime lowered by camera use would suggest. There was a statistically significant drop in crime with an odds ratio of 1.70. However, there were also other types of crime deterrents being used in these areas at the same time, so the precise amount of crime reduction due to CCTV systems is difficult to measure (Farrington & Welsh, 2002).

In 2004, Welsh and Farrington found that the British government may have been able to get the same effects for a much cheaper price. They followed up their report on CCTV by researching the comparative merits of CCTV, an active surveillance system, compared to improved street lighting, a passive surveillance system. They used the same methods for this study as they used for their previous study on CCTV. They used only

research where the independent variable was CCTV or street lighting, the dependant variable was crime, the total number of crimes in each area was at least 20, and the research was of sound methodological design (Farrington & Welsh, 2004).

They found 19 CCTV studies and 13 street lighting studies that met their criteria. Performing a meta-analysis on these studies revealed that both programs were equally effective at reducing crime. The OR for CCTV was 1.27 (p=.0004), which means crime decreased in the CCTV areas by 21 percent. At the same time, they found that the OR for the street lighting programs was 1.28 (p=.0008). This means that crime in experimental areas was reduced by 22 percent. These similar outcomes reveal that surveillance can work, whether it is cameras or merely increased illumination providing fewer areas for criminals to hide (Farrington & Welsh, 2004).

The authors also separated the studies into type of area. They divided the areas studied into city centers, residential or public housing, car parks, and public transportation. The only area that didn't show a decrease in crime during the studies was city centers with CCTV cameras. All other areas showed a statistically significant decrease in crime with both CCTV cameras and improved public lighting. The largest effect was seen in car parks with CCTV systems (OR of 1.77, p<.0001). Improved lighting (OR = 1.47, p = .022) was significantly more effective in city center areas than CCTV systems (OR = 1.15, p = ns) (Farrington & Welsh, 2004).

Like their first study, this study found that both CCTV and improved street lighting were much more effective against property crimes like vehicle theft and vandalism than violent crime like robbery and assault. The odds ratio for CCTV's effect on property crime was 1.54 (p <.001) compared to the lower but still significant OR of

street lighting, which was 1.27 (p = .019). For violent crime, both CCTV (OR = 1.05, ns) and street lighting (OR = 1.15, ns) had no significant effect (Farrington & Welsh, 2004)

In this study, the authors also examined the effects of displacement and diffusion. Displacement is the effect of one crime control measure pushing crime into the surrounding areas, effectively reducing crime in the area with the new crime control technique, but raising the crime rate in the surrounding areas. This would result in the same amount of crime over the entirety of both the experimental areas and the surrounding areas. Diffusion is the opposite outcome, where a crime control measure lowers the crime rate in not just the experimental area, but the surrounding areas as well. In order to test for these effects, researchers should use an experimental area, an adjacent control area, and a non-adjacent control area. If the crime rate in the experimental area goes down, and the crime rate in the non-adjacent control area stays constant, the effects of diffusion or displacement should be seen in the adjacent control area. Unfortunately, not many researchers use this design when studying CCTV or street lighting (Farrington & Welsh, 2004).

In this particular study, 11 of the 19 CCTV studies and 12 of the 13 street lighting studies attempted to measure displacement or diffusion. Many mixed results were found, making a conclusion impossible as to whether either method caused either result. Of the seven city center CCTV studies, four found evidence of displacement and three found evidence of diffusion. Of the street lighting studies, three found evidence for displacement, nine found no evidence of displacement, and two found evidence of diffusion (Farrington & Welsh, 2004).

The conclusions to be drawn from this study suggest that cities should perform a cost benefit analysis between CCTV and improved street lighting. If street lighting is found to be as useful or nearly as useful for reducing crime as CCTV, many governments may want to consider it as an alternative to the more expensive CCTV systems. The fact that lighting systems have minimal upkeep costs when compared to the extremely high upkeep costs of CCCTV means that municipalities and governments looking for a cheaper alternative to CCTV may want to purchase lighting systems that will provide similar crime prevention effects.

In 2005, a large study was conducted for the British Home Office regarding the effect of CCTV in 14 different areas around the country. The researchers came to many of the same conclusions as Welsh and Farrington as to the overall ability of CCTV cameras to reduce crime. Each of the 14 areas studied had separate goals and strategies, which makes using one research methodology for all 14 slightly problematic, but the researchers focused on the cameras' effects on crime and the fear of crime. Overall, only two of the 14 areas studied had statistically significant drops in crime during the study period. Unfortunately, both these areas had confounding factors that may have been responsible for some or all of the reduction in crime that was recorded (Allen, et al., 2005).

The first area, that the researchers named "City Outskirts," had a statistically significant drop in crime of 28 percent during the study period. This area was a zone on the outskirts of the city that had 47 cameras installed in and around it, and it included residential areas, an arboretum, a hospital, and a light industrial area. The researchers studied the target area, a control area, and a buffer zone around the experimental area.

The inclusion of the buffer zone was to test for the appearance of a diffusion or displacement effect, but none appeared (Allen, et al., 2005).

While the drop in crime of 28 percent was significant compared to the control area's drop in crime of 1 percent, there were many confounding variables that may have played a part in this change. In the year before the cameras were installed, there was a large surge in crime in the experimental area for unspecified reasons, and the drop in crime rates brought the area back to its pre-surge levels. This may imply that there was something else influencing the high crime rate for the period of time the area was under scrutiny, and that the CCTV was not the impetus for the reduction in crime. In addition, there was an anti-burglary project in effect in the area, the area received an improved lighting design during the study, and the arboretum in the experimental area received a large renovation. Any one of these many intervening variables could account for a large part of the drop in measured crime rates during the experimental period. (Allen, et al., 2005).

The second area that showed a significant drop in crime was named "Hawkeye." It consisted of 60 public transport car parks with 646 cameras that were installed over a period of 17 months in and around London. Only 58 car parks with a total of 556 cameras were evaluated. All of the car parks in the study showed a significant drop in crime. The overall effect was a 73 percent drop in vehicle crime, contributing to a 45 percent reduction in vehicle crimes in car parks over the whole city. Since an appropriate control area was impossible to establish, the researchers compared this drop in crime to car parks in the rest of the country, excluding London. The comparison group showed only a 10

percent decrease in vehicle crimes during the same period, leading to a statistically significant result for the experimental area (Allen, et al., 2005).

In a group as large as 58 car parks there was naturally a large discrepancy in the amount of crime in each particular car park both before and after the camera systems were installed. The researchers grouped the 58 car parks into high, medium, and low risk categories, and then compared the reduction in crime across all three categories. They found that the higher risk car parks showed a much larger improvement than the lower risk car parks. The high risk areas showed a drop in vehicle crime of 80 percent, compared to the medium risk group's drop of 62 percent and the low risk group's statistically insignificant drop of 37 percent. The crime that showed the largest decrease was damage to vehicles (82 percent decrease), followed by theft from vehicles (72 percent) and theft of vehicles (67 percent) (Allen, et al., 2005).

As with the "City Outskirts" area, there were other confounding variables that may explain some or all of the drop in recorded crime. In this case, it was mainly a case of improved infrastructure in many of the car parks under study. Many of these received upgrades, including resurfacing, new fencing, and new lighting during the experimental period, which may have had an effect on the crime rate that would account for some or all of the recorded change (Allen, et al., 2005).

Of the other 12 research areas, none found a statistically significant drop in overall crime. Three studies found evidence for crime displacement, and none found evidence for diffusion. Of the ten studies that researched whether the camera systems reduced the fear of crime, five found that fear of crime actually decreased. Almost all of

the areas had some sort of confounding variable, making a true estimation of the benefits of CCTV difficult to obtain (Allen, et al., 2005).

A problem with these and most other pieces of research involving the effectiveness of CCTV is the fact that it is difficult if not impossible to perfect a design that will accurately assess the effect of CCTV on crime. Due to laws, procedural issues, and monetary concerns, researchers cannot implement a sufficient research design to gain an accurate statistical picture. Some of the problems in the research designs that are implemented include inadequate data gathering either pre or post installation of CCTV systems, researchers not accounting for seasonal variations in crime, lack of adequate control areas, no attempt to measure displacement or diffusion, inadequate reporting of data, and lack of independent evaluation (Armitage, 2002).

One of the claims that has been leveled against CCTV systems is that it reduces the reporting of crimes to the police. The theory states that if citizens know that the crime was probably caught on tape, then they are less apt to report it to police themselves. People rationalize that if the action and the suspect were caught on tape, there is no need for them to become involved. A researcher decided to test if this phenomenon was taking place, and decided to use both surveys and official records to find out (Surette, 2006).

In the first phase of the study, surveys were given to random people in a certain city intersection. They were asked whether they knew if CCTV cameras were installed in the intersection, and then asked how likely they would be to help a citizen in trouble in the area. There was no statistical correlation between knowledge of the cameras and reported willingness to help others in distress. This would imply that there is no guardianship reduction taking place in areas with CCTV systems (Surette, 2006).

In the second phase of the study, the number and type of calls for service in the areas with CCTV, a proximity area, and a control area were recorded and analyzed. The results showed that people were just as likely to report suspicious activity in camera areas and non-camera areas. It also showed that reports of suspicious activity were highly correlated with calls of other types within the different areas, showing that the rate of people calling the police for suspicious activity stayed constant with the rate they were calling the police for everything else. The results of both this analysis and the surveys show that there is little to no guardianship suppression effect at work in areas with CCTV (Surette, 2006).

So whether CCTV works to reduce crime or not is subject to interpretation and the research is fairly inconclusive. Some research shows a large effect, some shows a small effect, some shows no effect or even a negative effect. The majority, however, seem to think that in the UK at least, CCTV systems have a small, but statistically significant impact on crime. Policy makers will have to decide whether this small impact is enough to justify the millions of pounds spent on the system over the decades, and whether or not they should continue to invest in CCTV technology. Another factor that policy makers might consider is whether or not CCTV systems provide a reduction in the fear of crime among the populace. Do the cameras make people feel safer? Do people like CCTV systems? Do they want to be videotaped at all times when they are in public? A reduced fear of crime is another benefit that may justify the amount of money that has been spent and will be spent on CCTV.

As early as 1992, the British Home Office conducted a study to ascertain the public's opinion of CCTV cameras. They started by finding out what percentage of

people expressed worry about the installation of CCTV cameras in three different areas. The three areas researched were city streets, a shopping center, and a car park. The city street sample was split into night and day, for a total of four categories (Charman & Honess, 1992).

The city street night time category had the highest percentage of people who were worried about CCTV systems (16.6 percent) followed by the city street day category (8.7 percent), the shopping center category (4.3 percent) and the car park category (1.8 percent). The exact worry about the system varied from person to person, but the researcher grouped these worries into one of six categories. These categories were: controllers may look for and act on incidents that didn't really require their attention to justify the cost of the system, controllers may abuse the system for their own gain, the system might be used for "covert" purposes, there was a sense of unease at being watched, the video evidence may be misleading, and there may be a gradual erosion of civil liberties (Charman & Honess, 1992).

Males were much more likely to be represented in the "worried" category with 12 percent of all males being worried, compared to only 5 percent of all females. 17 percent of all people 20-29 years old were in the worried category, compared to 6 percent for all other ages combined. Females were much more likely to agree to the statements "only criminals need to fear CCTV," "The more cameras we have the better," and "people who control the CCTV systems can be trusted." There were no significant differences in these or any other responses when comparing people interviewed in areas with CCTV and those without CCTV (Charman & Honess, 1992).

Another question asked during this research was whether people believed that CCTV systems worked to reduce crime. 74 percent reported that they believed CCTV was either very effective or quite effective at increasing crime detection, 62 percent believed CCTV increased crime prevention, and 53 percent believed CCTV made people feel safer. Respondents were then asked to rank order what crimes they felt would be most reduced by the increased detection effect of CCTV, then they were asked the same question about the deterrence effect of CCTV. For detection, the respondents put violent attacks first, followed by theft from persons, vandalism, sexual assaults, shop break-ins, and finally drunk and disorderliness. For deterrence, the top crime thought to be deterred was shop break-ins, followed by sexual assault, violent attack, vandalism, theft from persons, and drunk and disorderliness (Charman & Honess, 1992).

Another of the early methodologically sound studies as to the effect of CCTV on the fear levels of a populace was undertaken in Glasgow between 1994 and 1996. The researchers used a city center area and two comparable control locations to conduct interviews, and performed interviews six months before the cameras were installed, three months after the cameras were installed, and 15 months after they were installed at all three locations. The sample size was 3,074, with roughly even numbers in all three interview periods (Ditton, 2000).

The results showed that before the installation of CCTV, people were more likely to avoid the city center area at certain times because of crime fears (50 percent) than the control areas (43 percent). Instead of improving this, the CCTV systems seemed to make it worse. Three months after CCTV was installed, the number of people claiming they would avoid the city center area because of crime fears rose to 59 percent and dropped to

39 percent in the control areas. 15 months after CCTV was installed, the numbers had moved even farther apart, with 65 percent saying they would avoid the city center area at certain times and only 37 percent claiming the same thing about control areas (Ditton, 2000).

The researcher also asked survey respondents how much they noticed or "minded" the CCTV cameras being there. One third of all survey respondents (1,011) claimed they "minded" being watched by CCTV on public streets, which was much higher than the number that "minded" being watched in shops or banks (634) or car parks (418). Age and gender were statistically significant variables when it came to opinions about the acceptability of public street CCTV. Younger people and males were much more likely to disapprove than older people and females (Ditton, 2000).

The results of this research depended on whether or not the survey respondents even knew if there were CCTV cameras active in the area. Three months after installation, only 33 percent of people surveyed knew there were active cameras in the area. At 15 months after installation, this number had only risen to 41 percent. At the three month mark, 44 percent of men knew about the cameras, while only 32 percent of women knew. The increase in overall knowledge of CCTV coverage between three months and 15 months was almost entirely due to females raising their awareness. The female ratio went from the three month level of 32 percent to a 15 month level of 38 percent while the male knowledge rate stayed steady at 44 percent (Ditton, 2000).

This small number of people who knew about the presence of CCTV in the city center area may mean that the results from the fear of crime statistics may be skewed based on some other variable increasing fears in the city center area. If so few people

were aware of the cameras in place, any effect that the cameras may have had on fear levels of those who knew of their presence may have been too small to overcome the rise in fear levels overall. In other words, if more people knew the cameras were there, fear levels may have risen less or even dropped over the experimental period.

These studies all focused on city centers and other busy commercial or industrial areas. Allen, Bryan, and Gill (2007) conducted a study that focused on the public's perceptions of CCTV systems in residential areas. They performed public attitude surveys both before and after CCTV was installed in eight residential areas. The researchers used a survey designed to be completed by homeowners in their home, and used a random sampling technique to choose the homes to sample. The researchers got response rates of 59 to 75 percent (Allen, et al., 2007).

Their results show that people are significantly less likely to be happy with CCTV after installation of the cameras in residential areas. The overall population went from 81 percent approval to 74 percent approval after installation of the cameras, a statistically significant drop of 7.4 percent. Males went from 79 percent to 74 percent females went from 83 percent to 76 percent and whites went from 81 percent to 72 percent. Those who did not feel safe in the area had their approval rating drop from 88 percent to 65 percent a drop of 22.8 percent. People who had been victims of crime within the previous 12 months went from an 86 percent approval rating to a 67 percent approval rating, a drop of 18.7 percent. All of these drops in approval were statistically significant, and none of the groups measured showed any increase in approval, whether statistically significant or not (Allen, et al., 2007).

The surveys also asked whether people agreed or disagreed with certain statements. Those agreeing to the statement "People would report more incidents" went from 69 percent to 51 percent "Police would respond more quickly" went from 56 percent to 36 percent "There'd be less young people hanging around" went from 63 percent to 40 percent "The level of crime will get lower" went from 80 percent to 48 percent All of these results were statistically significant (Allen, et al., 2007).

These decreases show a steady decline in people's attitudes about CCTV. Of note, however, is the fact that even after the decline post-installation, there is still a very large degree of approval for the system. One side can argue that the decline in approval shows that citizens don't like CCTV, but the other side can show, using the same statistics, many people (in most cases still a majority) still approve of CCTV systems after they have experienced living in a CCTV area. This ability to use the same statistics to prove two different things is part of the problem in trying to implement new systems. People on both sides of the argument have legitimate reasons for either encouraging or discouraging the spread of government run camera systems.

The overall consensus, if there is one at all, seems to be that video surveillance has had a small but significant effect on crime in the UK. It is more useful when targeting property crimes, specifically vehicle crimes and vandalism. It is less useful when targeting violent crime. People seem to be very receptive to the installation of cameras and approve their use, but this approval seems to lower after the implementation of the actual system. There is some research to show that overall, factoring in crime reduction and reduction of fear levels, CCTV is a great bargain for the British government. There is

other research that shows that CCTV is a waste of money for the UK, when cheaper more effective means of reducing crime and fear levels is available.

In the end, it will be police and government administrators who make the final decision as to whether or not CCTV is worth the price in the United Kingdom. Residents may assume that all police are behind this program, but Mick Neville, the head of New Scotland Yard's Visual Images, Identifications and Detections Office recently said "Billions of pounds have been spent on it, but no thought has gone into how the police are going to use the images and how they will be used in court. It's been an utter fiasco: only three percent of crimes have been solved by CCTV" (Oates, 2008).

One of the problems with evaluating cameras in this way in the United States is that very few agencies have conducted any research on how effective their camera systems are. In 2007, researchers from the ACLU surveyed 131 jurisdictions across California and found 37 communities that had some sort of surveillance camera program. Not a single one had done any sort of research as to the effectiveness of the cameras. In San Francisco, the only records the city could provide showed that crime increased in more than half of all the areas with surveillance cameras (McDonald, 2007).

The Chicago Police Department claims their cameras have resulted in over 1,200 arrests since 1996, and Chicago's Commander of Information Services says "Our preliminary research shows that they are effective, especially left in places over 180 days." But Jim Harper, Director of Information Policy Studies at the Cato Institute disagrees that these cameras can prevent crime. "They are good forensic tools. After something happens, they'll tell you what happened." He went on to say "We are not safer from terrorism with security cameras in our cities, particularly terrorists that are willing

to die, security cameras do not control their behavior. They would not stop them from planning to pull off an attack." Security Consultant Bruce Schneier believes that cameras only displace crime, and do nothing to actually prevent it. "If you're the owner of a 7-11 with a surveillance camera and someone robs the store next to you, then that's a win for you but not for the police" (Baram, 2007).

The cameras that were installed in Washington D.C.'s residential areas were not received well by the community. After two men were shot within range of the cameras, community members complained that the system was not a deterrent to violence. "You know, I think people are really ignoring the cameras. They just act like they don't care. They just don't care" claimed one resident. In some areas, the cameras are even blocked by trees (Handlesman, 2006).

A national survey of Americans shows similar results to those in the UK concerning people's attitudes towards surveillance cameras. A recent poll by ABC and the Washington Post shows that overall, 71 percent of Americans support increased use of Surveillance cameras. The young support cameras less, with only 61 percent of those 18-29 supporting increased surveillance, compared to 80 percent of those over the age of 65. Women (75 percent) support cameras more than men (66 percent) and Republicans (81 percent) more than Democrats (66 percent). People with college degrees (74 percent) also showed higher rates of approval than those with high school diplomas or less (64 percent). Whites (73 percent) also supported cameras more than blacks (63 percent) (Lirtzman, 2007).

There seems to be very little research into the effectiveness of public video surveillance in the United States. What research and data have been collected is mostly

anecdotal, and no true experiments could be found for any public camera systems in the United States. One study showed that criminals might not be as afraid of cameras as police departments would like to think, however. In 1985, the Athena Research Corporation found that armed robbers listed video surveillance in the bottom three on a list of potential deterrents. They claimed that other factors including the number of clerks, the number of customers, and the number of police patrols would be much more likely to deter them from committing a robbery. According to the authors of the study "One of the reasons they give is that is that they know no one is watching at the time, and also they're not worried about being recognized because they can just wear a disguise or get away anyways" (Ozer & Schlosberg, 2007).

One area that has been researched in the United States is the area of video surveillance for use in traffic enforcement. The practice of using cameras to automatically give tickets for speeding or running red lights is on the rise in the United States, just like the other forms of government video surveillance. The legality of these cameras differs depending on the state and even the city or county in question.

In Louisiana, state lawmakers have repeatedly failed to pass legislation making these types of traffic enforcement cameras legal. But there is no law saying they are illegal either, so many municipalities have begun to use them, even without the clear legal authority to do so. In one of these cities, Lafayette, a local anti-camera activist has filed an official complaint with the police department. He alleges that the private company that operates these cameras is violating a state law that requires anyone who gathers evidence for use at a court proceeding to be licensed by the state ("Louisiana", 2007).

This law is meant for private investigators, but the activist and his group claim that the private company running the camera fits the definition for purposes of licensing requirements. According to the statute, "'Private Investigator' or 'private detective' means any person who... accepts employment to furnish information... or for the purpose of obtaining information with reference to... crimes or wrongs committed." Any employee who violates this law is subject to a year in jail and/or a $5,000 fine ("Louisiana", 2007).

In California, the legislature recently passed a law saying that paying the companies that install and run traffic cameras a percentage of the revenue they generate is illegal. They felt that paying as a percentage would encourage companies to use unethical practices to artificially inflate ticket numbers. However, dozens of cities across the state are still paying these companies on a percentage basis. The law was changed in 2004, but cities like Laguna Woods and Costa Mesa still have contracts that are in violation of the law. The city of Los Alamitos changed its contract after a judge struck down all tickets received by citizens under the old contract. "If the sincere intent is about safety, (money) should not be a factor" said State Senator Jenny Oropeza (D-Long Beach) (Muir, 2007).

Whether they are legal or not in the specific jurisdiction where they are found, cameras are rapidly becoming more and more common on streets and in intersections around the country. The City of Houston, Texas, installed 20 new traffic cameras in 2007, after it had already installed 50 in 2006. Houston Police Department's Executive Assistant Chief Martha Montalvo supervises the program, and says that "This is not about revenue. This is about changing the behavior and public safety." A new state law in

Texas requires that a portion of all revenues from these cameras goes to a regional trauma center (Stiles, 2007).

Austin, Texas, installed cameras on Interstate 35 in order to provide updated information for traffic planning. The city hired a company called Alliance Transportation Group, Inc. to set up 21 cameras along the interstate and photograph license plates. These license plates were compared with Department of Transportation records, and surveys were sent to 150,000 homes. The surveys ask such things as where the person was going, why they were going there, how many people were in the car at the time, and how many people live in the person's house (Fikac, 2007).

While the purpose of the cameras wasn't to ticket anyone, many people objected to being photographed. One female resident said "It almost feels sneaky." She is concerned about her personal information being protected. Another citizen stated "This is Big Brother-ish. It is an invasion of privacy." Jim Harrington, director of the Texas Civil Rights Project, said "It's one thing to study traffic patterns, but to ask all this personal information of people makes you wonder why they are doing it. And if anyone ever believes that the government is going to throw (the information) away, I have a bridge to sell them" (Fikac, 2007).

Traffic cameras are also becoming more technologically advanced. Washington DC is considering upgrading its traffic camera system to scan for people abusing the High Occupancy lanes. This new technology would scan every car that passes by in the HOT lane, and based on the reflectivity of human skin, would be able to tell how many occupants are in the car. The system would not be fooled by mannequins or any other sort

of cheating device used by motorists, because human skin has unique reflective properties (Laris, 2007).

There have been a few research projects looking into the effectiveness of these traffic cameras. A 2007 Virginia Department of Transportation study shows that red light cameras actually increase accidents. Five cities were studied, with all five showing an increase in rear end collisions after cameras were installed, two showing an increase in angle collisions, and four showing an increase in injuries. The overall effect of adding red light cameras in these cities was a 42 percent increase in rear end collisions, a 20 percent increase in right angle collisions, and an 18 percent increase in injuries. The camera industry claims that there would be a spike in accidents after the cameras were installed, but this number would lower over time. This study found that this was not the case, and crash numbers did not go down over time (Virginia Transportation Research Council, 2007).

The Washington Post did a study as to the effectiveness of red light cameras in Washington D.C. and found the same results as those found in Virginia. The program started in 1999, and officials claimed the goal was to reduce accidents. The city has cameras at 45 different intersections, which are controlled and maintained by a private company. The number of crashes at those intersections increased from 365 in 1998 to 755 in 2004, a rise of 106 percent. Injuries and fatalities rose from 144 to 262, or 81 percent, in the same time period. Broadside or T-bone crashes went from 81 to 106, a rise of 30 percent. Intersections with lights but without cameras saw increases of 64 percent, 54 percent, and 17 percent in those categories (Wilber & Willis, 2005).

A Federal Department of Transportation study found different results, however. They studied seven different areas around the country with red light cameras installed. They found that overall, while rear end collisions rose by 14.9 percent, right angle collisions dropped by 24.6 percent. Injuries from rear end collisions went up 24 percent, but injuries in right angle collisions dropped by 15.7 percent. An economic analysis also performed in the same study found that right angle crashes were significantly more costly than rear end collisions, so the drop in right angle crashes was a vast economic improvement even when accounting for the costs from the increased rate of rear end collisions (Council, Eccles, Griffith, Lyon, & Persuad, 2007).

If the intention of authorities is to reduce crashes, they may want to merely increase the amount of time traffic lights stay yellow, according to research done by the Texas Transportation Institute. One extra second onto the standard yellow light time reduced red light violations by 53 percent and crashes by 40 percent, while one less second than the minimum recommended yellow time increased crashes by 110 percent. The study also found that the vast majority of tickets issued for red light violations happen within the first second that lights are red. In fact, the average time a light is red before a person gets a ticket for running it is under half a second. The average time a light is red before someone runs it and causes a right angle collision is five seconds or more. This means that people are being issued tickets for violations that have a very low probability of causing crashes in the first place (Texas Transportation Institute, 2005).

The results seem to show that red light cameras may increase crashes due to people over reacting to yellow lights and slamming on their breaks when they shouldn't. The cameras themselves are not always ethically or legally administrated, and may cause

more problems than they solve. If the intention of the authorities is really to increase safety rather than raise revenue, increasing the amount of time a light is yellow in order to give drivers a better chance to react seems to be a much cheaper and much more effective solution.

CHAPTER IV

EMERGING TECHNOLOGY

The legal responsibility of police to obtain a warrant before using a new piece of technology will be a constant legal question in the future. New technologies are constantly being introduced or upgraded. Some have very little to do with privacy concerns, like the Australian CCTV camera with a built in flame detection system. This camera can identify flame much more accurately than conventional fire detection systems, saving time and money usually wasted on false alarms (Prodetec, inc., 2004).

One of the most interesting and far-reaching new technologies for cameras is facial recognition software. This software can take an image from a camera and search a database of pictures for matches, identifying with a very high degree of accuracy everyone it takes a picture of. In fact, this technology has gone so far, it can even identify emotions. Dutch researchers have created software that can read faces and translate small facial feature movements into an accurate analysis of emotion. The immediate reason for developing this technology is marketing, but it can conceivably be used in the future for security reasons. A nervous or unhappy person walking into a government building may be something for security to focus on, for instance (Martinelli, 2007).

An extension of this facial recognition technology is behavior recognition software. This technology may have the largest impact of any other emerging technology on criminal justice camera systems. One of the largest drawbacks to CCTV is the fact that someone needs to be watching the feed to catch a crime in progress. With some cities having tens of thousands of cameras, this can become a difficult proposition. Behavior recognition technology allows the camera to automatically interpret what someone in the camera's field of view is doing, and alert police personnel so they can take a closer look (McKay, 2007).

The way these systems work is that they can detect which objects in the camera's field of view are stationary, like buildings, mountains, utility poles, etc., and which objects are variable, like people and cars. Once the software identifies what something is based on shape or how it moves, it can then assume some things about how that object is supposed to act. It can deduce that when a person goes from upright to horizontal very quickly, that person has probably fallen down and may need help. If a small piece of the video image from a person or a car suddenly separates from the larger image, the person or car has dropped or thrown an object to the ground, which may need to be investigated. Any suspicious behavioral patterns like these can signal an alert for police personnel to take a closer look, which would change cameras from a deterrent forensic tool to an actual crime stopping tool (McKay, 2007).

Johns Hopkins University was one of the first areas to install cameras with this feature in 2005. 89 cameras are run by 14 university personnel. Since its deployment, the software has alerted on numerous thefts, acts of vandalism, traffic infractions, and even helped to catch an armed robber. Bicycle thefts dropped from 25 to three after one year.

The total number of crimes on campus was 536 in 2003, 703 in 2004, and 279 in 2005, showing a marked decrease after the installation of the cameras (McKay, 2007).

Another emerging technology that will have an impact on the way cameras are used in the future is camera miniaturization and mobilization. The United States Army is on the forefront of experimenting with this technology. It already has a prototype backpack sized camera that can be deployed in hostile areas and can hover or land and transmit video images back to the controller. It can fly as high as 10,500 feet, and can take off and land vertically, like a helicopter (Crane, 2005). If this technology is developed further, governments can replace their existing statically placed cameras with moving cameras, allowing even greater coverage, real time tracking of suspects, and the ability to change camera angles.

CHAPTER V

CONSTITUTIONAL ISSUES AND COURT CASES

The legality of CCTV cameras of different types and in different areas around the United States revolves around whether it is constitutional for the government to videotape its citizens without a warrant. The relevant amendment in cases of intrusion of privacy is the Fourth Amendment, which states:

> The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

This raises many legal questions, including whether videotaping a person in public counts as a search, and whether or not it is reasonable or unreasonable if it is a search.

Many Supreme Court cases have been decided about the government using technology to observe the public, and whether or not those acts violated the fourth amendment. The first major case to be decided was the case of Katz v. United States (389 U.S. 347 (1967)). Katz was a man under suspicion of violating gambling statutes by passing betting information over the phone. The police put a recording device on the outside of a public phone booth known to be used by Katz, and used the recordings obtained in court to convict him. He appealed, and the case went before the Supreme Court.

The court had to decide if the wiretapping method used by the police violated his fourth amendment rights. The police contended that since they didn't intrude into the phone booth, merely listened outside it (using a microphone), that they did not need a warrant. Everything was done in a public place, so there was no expectation of privacy. Katz contended that he had a reasonable expectation of privacy in a closed phone booth, and that the police should have had a warrant to be able to intrude into that privacy.

The Supreme Court sided with Katz. In an opinion written by Justice Stewart, the court said that a physical intrusion into the phone booth was not necessary, and that the fourth amendment protected "people, not places." They ruled that a person can still expect privacy in a public place if they take steps to make something private. In this case, being in a closed phone booth was reason enough for Katz to expect privacy. In a written concurrence, Justice Harlan set out a two-point test as to whether the fourth amendment should be viewed as relevant. First, something is a search, and hence constrained by the fourth amendment, when the person has "exhibited an actual (subjective) expectation of privacy." Second, society must be prepared to recognize that this expectation is (objectively) reasonable.

This case has become the basis for many more Supreme Court cases dealing with surveillance and the fourth amendment. Some cases tend to support the conclusion that open street CCTV cameras would be constitutionally allowable, and some seem to support the other side of the argument.

One of those supporting the side that CCTV is constitutional is United States v. Knotts (468 U.S. 276, 281-82 (1983)). In this case, a man was tracked electronically in

his car. He claimed that he had a reasonable expectation of privacy in his automobile, but the court ruled:

> A person traveling in an automobile on public thoroughfares has no reasonable expectation of privacy in his movements from one place to another. When [an individual] traveled over the public streets he voluntarily conveyed to anyone who wanted to look the fact that he was traveling over particular roads in a particular direction, the fact of whatever stops he made, and the fact of his final destination when he exited from public roads onto private property.

In addition, the court stated "[n]othing in the Fourth Amendment prohibited the police from augmenting the sensory faculties bestowed upon them at birth with such enhancement as science and technology afforded to them." In other words, the police can use electronic surveillance on any transaction or movement that is performed in plain view of the public on public streets.

In addition, the case of United States v. Sherman (990 F.2d 1265 (9th Cir. 1993)) seems to imply public video surveillance is constitutional. In this case, the defendant claimed that the government using videotape against him at trial violated his fourth amendment rights. The court ruled that:

> The transaction took place in plain view in a public place along a highway. Everything that was captured by the camera could just as easily have been seen by a person hiding in the trees where the camera was located. Videotaping of suspects in public places . . . does not violate the fourth amendment; the police may record what they normally may view with the naked eye.

People who disagree with this stance claim that the case of Ybarra v. Illinois (444 U.S. 85 (1979)) shows that indiscriminate surveillance of everyone on the street is a violation of their fourth amendment rights. In this case, police searched everyone inside

an establishment when they only had reason to believe that one of them was involved in illegal activity. The court ruled that police must have an "individualized suspicion" in order to search someone without a warrant. This would mean that if public video surveillance is ruled a "search" by a court, that this case sets the precedent that the indiscriminate videotaping of people in public would make it an "unreasonable" search, and thus it would be unconstitutional. The Supreme Court has never ruled that video surveillance of public places constitutes a search under the Fourth Amendment, however.

There is also debate as to whether cameras, if allowed, are still allowed if they are pointed or rotate in such a manner as to view private property, rather than exclusively public property. In the cases of Florida v. Reilly (488 U.S. 445 (1989)) and California v. Ciraolo (476 U.S. 207 (1986)) the court created a two part test to determine if surveillance of a private place without a warrant is constitutional. The first part of the test is whether the surveillance occurred from a public place, and the second part of the test is whether the search was conducted in a physically non-intrusive manner. If it was from a public place and was physically non-intrusive, then it did not violate any reasonable expectation of privacy. This test, while originally made for video surveillance from a government operated airplane, should translate to a government operated public surveillance camera.

While the constitutionality of using advanced technology such as video cameras to observe private property, such as houses, has never been established by the Supreme Court, many lower courts have ruled on similar incidents. For instance, in the case of Fullbright v. United States (392 F.2d 432, 434 (10th Cir. 1968)) the 10th Circuit Court of Appeals ruled that a police officer could legally observe private property using binoculars

as long as he was doing so from a public place and did not physically intrude on the property. Since public surveillance cameras would only be installed in public places, and since they would not be able to physically intrude into private areas, they would not be in violation of this legal precedent.

While most other courts have ruled along the same lines as the Fullbright case, some have disagreed. In the case of United States v. Taborda (635 F.2d 131 (2d Cir. 1980)) a Second Circuit court ruled that the Drug Enforcement Agency did not have the right to observe an individual's home with binoculars, citing the increased expectation of privacy in a person's home. Most courts use the precedent set by Fullbright rather than the precedent set in Taborda, making it constitutional to observe a private residence using binoculars or other commonly available technology.

A question has also arisen concerning the additional technologies employed in some modern video cameras. While the previously cited cases have dealt with the additional technology of magnification and the ability to record images (both things that human police officers do not have), there are many other technologies out there that cameras can employ. In the case of United States v. Karo (468 U.S. 705 (1984)), a camera that could detect infrared light was used to track materials being moved from house to house. The Supreme Court ruled that using this technology violated the defendants fourth amendment rights, and that "[i]ndiscriminate monitoring of property that has been withdrawn from public view would present far too serious a threat to privacy interests in the home to escape entirely some sort of Fourth Amendment oversight."

In the case of Kyllo v. United States (533 U.S. 27 (2001)), the infrared technology that the police used to identify a heated pot farm inside a home without a warrant was deemed to violate the defendant's fourth amendment rights, even though the camera only viewed the heat radiating from the walls of the home. Justice Scalia, in his majority opinion, stated:

> We think that obtaining by sense-enhancing technology any information regarding the interior of the home that could not otherwise have been obtained without physical "intrusion into a constitutionally protected area",(Silverman, 365 U.S., at 512), constitutes a search-at least where (as here) the technology in question is not in general public use.

Cameras set in public areas and only observing public areas have been deemed to be constitutional by the courts in many separate cases. Cameras have even been deemed constitutional when pointed at private homes. The one small set of circumstances where public CCTV cameras may run into questionable legal status is when a camera has private property within its field of view, and the camera also utilizes technology not in general public use.

CHAPTER VI

CONCLUSION

Surveillance cameras are increasing in numbers around the world. Governments and police agencies from Australia to China to Europe are turning to increased camera technology to help control crime and terrorism. In the United States and the United Kingdom especially, more cameras are installed on a seemingly daily basis. Whether or not these cameras accomplish their stated goals or not has been the subject of much debate.

Cameras in the United Kingdom seemed to have a small but significant effectiveness, but other, cheaper means of reducing crime seem to have similar reduction effects. In the United States, very little research has been done as to the effect of camera surveillance on crime, but what research there is supports the same conclusions as those in the UK. When it comes to how people perceive cameras, in both the UK and the US, people seem to be in favor of cameras before they are installed, but afterwards this approval drops.

In the United States, the legality of camera surveillance depends on a large number of factors, including the public's right to privacy and their expectation of privacy. Different states and different cities have different laws about surveillance, and many of

these are confusing and vague. There is research to suggest that criminals don't fear cameras, in which case cameras would not serve as a valuable crime deterrent. But there is also research to show that cameras can be an effective way of reducing crime levels and the fear of crime in certain circumstances.

The use of traffic cameras is also on the rise in both the UK and the US. The legality surrounding these are also in question in many jurisdictions, as well as whether or not they actually work to reduce vehicle accidents. There is much research to suggest they actually increase accidents by making drivers more worried about getting a ticket than they are about safety. Increasing the length of time a light stays yellow would possibly provide a much greater benefit to safety than using cameras and video enforcement of traffic laws.

More research needs to be conducted as to the effectiveness of camera systems worldwide. With all the time and resources devoted to these systems, there needs to be statistical support for their effectiveness, or the taxpayers of numerous countries will have been taken advantage of. Cameras have the potential to be abused, and to be tools of an oppressive government. Police agencies and other government officials must make sure that these systems are doing only what they have proven to be effective at doing, and not used to violate the rights of citizens.

Police agencies and governments in the United States should feel justified in installing and utilizing public surveillance cameras as long as they are specifically targeted at crimes that have been shown to be affected by surveillance (such as littering, vehicle crimes, and vandalism), there are no better or cheaper methods available to reduce these crimes, and steps are taken to assure the public that their privacy and other

rights will not be infringed upon. As long as constant research is performed to study how effective these cameras are at their assigned tasks, they can be an effective tool for specific circumstances, but they should not be used for any uses for which they have been shown to be ineffective.

This should not prevent law enforcement from experimenting with new ways to use video technology, however. If law enforcement and other government agencies can find new uses for CCTV, they should implement these ideas and test to see if they are beneficial. For instance, police agencies in cities with CCTV systems should give police dispatchers access to the cameras, so that when police officers are dispatched to a disturbance, the dispatcher can inform the officers of relevant information given to them by the cameras. If an officer is on his way to a fight outside of a bar, the dispatcher can give him information as to the number of people involved, descriptions of suspects, what direction suspects have fled in, and other relevant information that will help the officer know the situation before he arrives.

With increasing technology, this information might even be able to be accessed by the officer himself from his patrol car. As data transmission systems become more advanced, it might be technologically feasible to put camera monitors in police cruisers, so police can see the scene for themselves. If recordings are also able to be transmitted directly to the officer, they can be used by officers to verify the story of witnesses, clear up confusion, and track suspects.

In addition, this system would benefit medical services and fire services. If dispatchers for both fire departments and emergency medical services departments had access to surveillance camera feeds, information could be given to ambulances and

firefighters en route to medical and other emergencies. This information could help them know what equipment they should have ready, and allow personnel to discuss exactly what needs to be done when they arrive on scene. This could reduce the time it takes to start life saving operations, ultimately saving more lives.

Other uses for surveillance cameras must also be investigated and experimented with. Other agencies besides the police must investigate whether cameras in public areas can help them perform their jobs. Traffic cameras could be useful for government bodies in charge of traffic, city maintenance, city planning, and others. Experimentation and research must be performed to determine all the possible benefits that surveillance cameras can provide.

This research must be done correctly, as well. We cannot allow police agencies to claim that crime went down by a certain amount without making sure that this amount was statistically significant compared to a legitimate control area. Numbers and statistics are meaningless without the proper context, so those evaluating the system should not be members of the agency running the program. This will ensure that accurate data is reported, and will increase the odds of the data being accepted by the public.

For instance, if a city was to ask a researcher to gauge the effectiveness of a camera system, the first thing that should be done is to collect data before the cameras are put in place, if possible. These data should be gathered for at least one year before the installation of the cameras if at all possible, to give the researcher an accurate picture of the situation before the cameras are installed. If these are red light cameras, the researcher should use the number of tickets given for red light running, the number of crashes in each intersection, and even the number of complaints by citizens as the dependant

measures. If the cameras are public surveillance cameras, the researcher should use the number of crimes in the area, type of crime, citizen fear levels, and public perception of surveillance technology as the dependant measures.

After collecting baseline data for at least a year, the researcher should then observe the effects upon the various dependant measures while the cameras are being installed. The researcher may find that any effects shown in the results started when the cameras were not even operational, which would mean people stopped breaking laws even before the deterrent devices went into effect.

Data should continue to be gathered for at least one year after the cameras are operational. This will help to smooth out seasonal effects that may cause variations in the data. In addition, data should be collected not just from the experimental area, but from an adjacent control area and from a non-adjacent control area. Control areas should preferably be in the same city, but if this is not possible, a similar city or rural area should be used. The use of these control areas will factor out many threats to internal and external validity, as well as testing for displacement and diffusion effects.

Researchers should use as many dependant measures as they can, to try and get a more accurate idea of the true effect of camera systems. In addition to recording the previously mentioned data, researchers should also perform citizen satisfaction and fear level surveys to record the public's reaction to the cameras. They should make sure that they use this information, combined with the multiple dependant measures they have observed regarding crime trends or traffic infractions, to get a more accurate view of the true impacts of camera systems.

It would seem that the most beneficial solution to solving many of the problems with citizen satisfaction is for government agencies to have an open and honest policy with the public. If city agencies are using cameras, they should make all data, excepting the actual videos, available to the public. The number of crimes detected by CCTV, the number of times CCTV footage is used in court, the number of cameras there are in a city, the location of those cameras, the amount of time personnel spent watching CCTV monitors, the number of times personnel reviewed recordings, and all other relevant information should be made public record so that accurate research can be done into the overall effectiveness of camera systems. Government agencies should be free to install and maintain cameras in public places, as long as the public is allowed to fully monitor the government's use of these cameras, and use the government's own reported numbers to make an accurate assessment as to the cost effectiveness and overall performance of surveillance systems. Problems will only arise when the government is allowed to monitor the public without the government being monitored by the public.

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