# Chapter 23
# Smart CCTV and the Management of Urban Space

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## ABSTRACT

*This chapter briefly describes the proliferation of CCTV over the last few decades with particular reference to Australia and discusses the limits of the technology. It then focuses on new image interpretation and signal processing technologies, and how these advanced technologies are extending the reach, power, and capabilities of CCTV technology. The advent of "Smart" CCTV has the ability to recognize different human behaviours. This chapter proposes a typology to assist the application and study of Smart CCTV in urban spaces. The following four typologies describe different human behaviours in urban space: 1) Human-Space Interaction, 2) Human-Social Interactions, 3) Human-Object Interactions, and 4) Crowd Dynamics and Flows. The chapter concludes with a call for future research on the legal implications of such technology and the need for an evidence base of risk behaviours for different urban situations and cultures.*

## I. INTRODUCTION

Smart Cities aim to make urban areas more livable, efficient and safe through the integration of information and communication technology (ICT). Smart technologies within Smart Cities can either act as new innovative infrastructure in their own right, or more frequently, are implemented to transform the way traditional infrastructure and services are accessed and used. ICT facilitates networking and engagement with the urban system, and can improve the quality of life for people in urban areas (Han & Lee, 2013; Lee, at al. 2014; Neirotti, et al. 2014). A range of these smart technologies have been adapted to transform

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urban infrastructure into "smart" infrastructure. Examples include the city-wide collection of digital data on parking spaces and urban services; security cameras that identify pedestrian risk behaviours; and GPS systems that identify traffic congestion, taxi locations and traffic lights. Such advances give urban residents access to real-time information so they can make better decisions whether it be: selecting the fastest driving route and avoiding congestion, or identifying and visiting nearby services, or avoiding crime or disaster scenes (Yigitcanlar & Han, 2010). Smart technology is changing the way urban residents use traditional cities and urban infrastructure. The range of smart technology is proliferating rapidly with new software and algorithms transforming technology that has been around for many decades.

One such technology, in the process of being transformed, is Closed Circuit Television (CCTV). This chapter briefly discusses the use CCTV technology during the last few decades and outlines the limits of its effectiveness. It then focuses on the transformation of this technology by new innovations. Finally a four category typology to help with the application of this technology in urban space is proposed. The categories that make up the typology are:

1. Human-Space Interaction;
2. Human-Social Interactions;
3. Human-Object Interactions; and
4. Crowd-Dynamics and Flows.

Traditional CCTV technology consists of two parts:

1. The camera or sensor, and
2. The interpretation or signal processing of the image sequence that the video camera takes.

There have been recent advances in both these areas. Image interpretation and signal processing technologies are now employing advanced algorithms to capture changes in the images recorded by the sensors, and the sensors themselves are also becoming more sensitive and so extending the reach, power and capabilities of CCTV technology. These two aspects of CCTV technology are significant for the continued rollout of new CCTV technology and the transformation of existing technology already deployed in cities around the world.

## II. THE PROLIFERATION OF CCTV IN GLOBAL CITIES

The emergence of Closed Circuit Television (CCTV) systems occurred in the 1960s, Its subsequent proliferation in the 1980s and 1990s, has been documented by various authors (Fyfe and Bannister, 1996; Norris, Moran and Armstrong, 1998; Webster, 2004a). Especially since 9/11, CCTV technology has been adopted by urban governments. This reflects growing pressures to guarantee community and public safety in urban spaces, and changing socio-political government agendas. In Australia uses of CCTV technology have been most prevalent in the law and order context (Australian Institute of Criminology, 2004). The attractiveness of CCTV as a tool for the management of urban spaces can be explained by reference to three categories of justification: first, as having a predictive, preventative or deterrent function; second, in assisting on-the-spot responses to emergency situations as they occur; and third,