Virtual Environments as an Experimental Tool for Studies of Surveillance

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Abstract

Space accepts pervasive technologies as an architectural feature inherent to design. As such, architecture is developing various links to video surveillance, crafting a new use and a new user of space. Consequently, a new type and layer of interaction is taking place in architectural space. We extend the experimental nature of 3D Virtual Environments to encompass our surveillance studies, and explore the Closed Circuit Television (CCTV). This paper contributes to the thinking of the architect positioning herself as the user of space while designing, replacing her as an empowered orchestrator of all the technologies attached to buildings.

Keywords: Surveillance, CCTV, 3D Models, Design, Simulation

Introduction

Space is accepting various pervasive technologies as an architectural feature inherent to design. As such, architecture is developing various links to video surveillance, where the latter is introducing to the former, a new use and a new user of space. Consequently, a new type and layer of interaction is taking place in architectural space. As a different mode of space, we extend the experimental nature of 3D Virtual Environments to encompass our surveillance studies. This paper utilizes virtual environments to study and explore the Closed Circuit Television (CCTV) technology's impact on architectural space. CCTV surveillance, or video surveillance is a functionality that has been introduced into space, in the first instance as a method of communicating events in space, but developed into becoming an informative element of space design and function.

Surveillance featured first as a symptom partially appearing in the architectural analysis of space; a peak of this discussion emerges from the analysis of the Panopticon project, however surveillance discussion has moved forward shifting the focus to the growing sophistication of surveillance largely aided by developments in technology, subsequently, leaving the architecture object behind.

Architectural space, however, continues to incorporate surveillance technology without paying much consideration to its deeper implications. CCTV surveillance is practiced in and from buildings, in public and private space, and although many advanced technologies are embedded in old buildings, for new ones, surveillance fails to be considered from the design stage. When considering contemporary practice in architectural firms is conducted with the aid of software and computers, we decided to reflect this use in its variations in our conducted study using a real scenario and a virtual one where the aim is to explore the metaphor of surveillance as a language for space.

Two series of trials are set up, and the researchers sampled designers from different backgrounds to work with two installations, accompanied by 3D Models in order to explore the notions of surveillance and produce qualitative data in order to gain insight into designing for surveillance arrangements. The researchers argue that the debate and studies on surveillance should not revolve only around technology, data gathering, buying, profiling and privacy, but should also be recalled from architecture standpoint.

Contemporary surveillance studies, however, are mostly concerned with issues pertaining to privacy and the safeguarding of data gathering, data processes, mostly for economic and security purposes. The researchers developed a dual system of 3D-model available for interaction in a virtual environment on one hand, and an installation that takes place in real space, on the other. All is done in order to understand the reasons such a crucial and functional topic is barely addressed at the architectural design studio. While

surveillance can be exercised in enormously varied methods, the scope of the research for this paper focuses on use of visual surveillance though cameras—installed in buildings and public spaces—and the processing of information collected from them, whit an emphasis on the way they affect the uses of the space in which the cameras are installed, and the way designers of spaces act on such phenomenon. It is about private cameras, used for everyday activities, this paper is written from an architectural standpoint and does not include any analysis concerning security issues pertaining to terrorism, espionage or policing activities.

We focus on surveillance practices through Closed Circuit Television Systems (CCTV), understanding that CCTV is only a fraction of the much larger phenomenon of surveillance, and highlighting that it is the fraction that can be more directly manipulated by architectural design and integrated into buildings. The aim is to explore the different ways in which CCTV systems affect the users of space—the common people, not criminals—looking at users' perception of space itself, and how this perception can be manipulated by design or the lack of it.

We argue that there are several types of meaning embedded in a surveillance system installation: Most of surveillance systems are designed and produced of the work of a surveillance technician and therefore, deliver a crude message; they take no consideration of functionality, perception and, even less, meaning. Their systems focus on the intrusion and breakage of the space's code of conduct, therefore, the inflection on the meaning is hard and rude most of the time. However, architectural design is the sole responsibility of the architect who should be in charge of integrating and accommodating all technical components and functionalities in the way they are intended to; William Mitchell (2005, p. 19) asserts, it is up to the architect the way architecture "serves as the constructed ground for encountering and extracting meaning from cross-connected flows."

Surveillance and architecture.

In the last decades the continuous advances of technology facilitated the spread of surveillance all over the globe in many forms and media. Widely known breaking points for surveillance practices are the attacks at the beginning of 21 century, however the developing of surveillance afterwards has not diminished, more than a decade after then (Mattelart, 2010; Norris, 2012). For most democratic governments the 'war on terror' has been the perfect excuse to increase surveillance systems of all kinds over their citizens and visitors, but also business and lay people looking for a way to protect their properties also allies with surveillance technologies as they become cheaper, and easier to buy at multiple convenience stores.

David Lyon (1994, p. 4) points how "ordinary people now find themselves 'under surveillance' in the routines of their everyday life," specialized agencies monitor all the activities that run under electronic controls. The collection of information has many sources: phone calls, ATMs use, driving, credit cards, CCTV systems, etc. Every time we use a terminal connected to a computer or pass trough an electronic control, or under a camera, we are subjects of monitoring. Surveillance processes which includes among other activities the "recording and categorization of information about people, processes and institutions"(Ball & Webster, 2003, p. 1).

Information is collected, in most of the cases, with our own approval; it is often exchanged by the de-bureaucratisation of processes: i.e. we allow web sites to record our credit card details in order to save time. The credit card company keeps records of our every commercial activity, and logs them with time and place stamps. Libraries ask for private details in order to grant us the access of their books, and the same process goes for rental shops. Loyalty schemes are promoted by commercial stores, they offer points for every buy, that can be traded as money; through their databases they keep a detailed record of our buying patterns, which serves them to locate us as potential buyers of certain products, and send to us personalized promotions.

Geographical Positioning System (GPS[1]) provides our exact positioning using US' satellites, so we do not get lost, and the only thing needed is a GPS receiver, like a mobile phone. Social networks asks us where are we, what are we doing and even what are we thinking, and most of us happily provide all that information—which is kept on servers for future 'need'—so our 'friends' know what we are doing-thinking-hearing in this very exact moment. One other method of tracking one's location is by RFID tags. RFID is the generic name for Radio Frequency IDentification system. RFIDs provide a way to identify any single mass produced object and link them to their owners.

In the health sector, surveillance is also practiced in various forms. For example, health insurance companies acquire access to health records to offer insurance quotes. They take into consideration hereditary factors that are collected through linking health records. Inside hospitals, patients are tagged for security reasons (eg, to prevent the loss or theft of infants), which keeps them under effective surveillance within limits at all times.

Closed Circuit Television (CCTV) is the accepted terminology for camera-based surveillance systems although these systems are now more net-based open systems than closed. The basic system is a camera connected to a screen and a video-recorder. These systems can be enhanced with facial recognition capabilities to identify individuals and locate them in a specific location at a specific time. The automated analysis of CCTV images is becoming evermore reliable in tracking objects in the camera's field of view, and analysig behavior. Applications of this technology span around many

1 GPS: Geographical Positioning Systems were developed by the US Department of Defence, and its freely available to anyone whit a GPS receiver.

fields from health care to industry to policing.

In academia, surveillance studies gathered unprecedented momentum following Michael Foucault's book Discipline and Punish (1975), which became a basic reference to any surveillance study, and in which Foucault deconstructed surveillance practices. Foucault analyses a prison designed by the Bentham brothers, from a book published by Jeremy Bentham (1791): Panopticon; or the Inspection-House, which consists of an architectural project–never built–of a penitentiary. Jeremy Bentham elaborates not only on the architectural principle, but also the way in which this facility should be run by creating an illusion for prisoners of being under surveillance at all times; hence, proposing it as an ideal mechanism of reformation. Foucault's analysis identifies and highlights this structure and links it to the structure of power:

The Panopticon must not be understood as a dream building: it is the diagram of a mechanism of power reduced to its ideal form; its functioning, abstracted from any obstacle, resistance or friction, must be represented as a pure architectural and optical system: it is in fact a figure of political technology that may and must be detached from any specific use (Foucault, 1975, p. 205).

Here, Foucault deploys the metaphor of building as a structure of power; but he releases himself from the physical structure, and focuses on the metaphorical one because it can be used in almost any end.

Today's thinkers have moved forward: most authors (Doyle, Lippert, & Lyon, 2012; Haggerty, 2006; Jay, 1993) recognize Foucault's influence, but suggest it is better to look beyond the Panopticon and look around on processes and practices of contemporary society highlighting the growth of surveillance aided by developments in technology becoming a tool for manipulation, control and power of institutions and governments, including desperate calls indicating the risks posed to privacy, civil liberties and democratic participation (Diffie & Landau, 2007; Ericson & Haggerty, 2006; Graham & Marvin, 1996; Landau, 2010). According to Adams and Ferryman (2015, p. 272), the potential ethical problems reside on not allowing the enhancing of "the power of the surveillers against the surveilled."

In the architectural field, a paradigm exists that led to a trend of evidence-based designs. CPTED, or the Crime Prevention Through Environmental Design, commenced earlier than Foucault´s studies. Their designs attempt to reduce the possibility and the fear of crime, through manipulating the understanding of architectural implications of security needs. The first wave of this approach (Jeffery, 1971; Newman, 1972) involved passive barrier techniques: locks, fences, gates, clearing pathways, etc. Today's approach (Atlas, 2008; Jones, 2009; Poyner, 2006; Tilley, 2005) includes a more evident access control, surveillance technologies and territorial reinforcement, requiring the architect to determine security requirements, know the technology and understand its applications in architecture. The promise is that "if the design process includes CPTED, it is possible for natural and normal users of the environment to meet the same security goals as physical and technical protection methods" (Atlas, 2008, p. 3). Although CPTED is well formulated, logical, highly applicable and widely based on common sense, most architects are not aware of CPTED, and never addressed the issues during their studies because the topic does not feature in the design studio. Subsequently, architects are exposed to the topic of surveillance when it comes up as a specific requirement of a project (Atlas, 2008, p. vii). The role of architects and designers and their possible contributions to defining the boundaries of surveillance are still in need of development, and studies continue to call for a "better integration of the role and function of crime controllers" (Reynald, 2015, p. 71).

Simulation and surveillance

Simulation of economic, military, mechanical, architectural and other practices is a common activity to study and research behaviour and processes. But simulation also can be used as a medium of entertainment or in the case of surveillances to pretend it is as real as the real. In Baudrillard (1994) words, the importance of simulation against pretending is, "Pretending or dissimulating, leaves the principle of reality intact: the difference is always clear, its simply masked, whereas simulation threatens the difference between the "true" and the "false," the "real" and the "imaginary" (p. 3).

The activity of masking is evident since early forms of surveillance: in the panopticon the simulation started with "the apparent omnipresence of the inspector [...] combined with the extreme facility of his real presence" (Bentham, 1789, p. 25) was the main fiction—or masquerade—on which the facility worked in order to keep a perfect discipline. The inspector should not allow himself to be seen because he would loose his omnipresence at the time of being seen and allowing the inmates to see what he was looking at; but if the inmates did not see him, then they would not know what was the inspector seeing at. Miran Božovič (1995) explains how simulation precludes reality at the panopticon:

...the less the inspector is really present, the more he is apparently omnipresent; or, more precisely, the inspector is apparently omnipresent: precisely insofar as he is not really present, since a momentary exposure to the eyes of the prisoners is sufficient for him to lose his apparent omnipresence (p. 9).

This false belief of the omnipresent inspector procured him a mask of God, so the prisoners at the Panopticon were deterred from transgressing, because the fallacy of an omnipresent and omnipotent God-Inspector: A simulated one.

Over this logic builds multiple surveillance arrangements that while been installed are not functional, but its deterrent of crime effect remains functional and omnipresent on the belief that the possible offender would think is being observed.

Going further on the simulation spectrum to those of digital form of architectural projects we observed that digital models used to present projects could become an interesting

source of data in pretended scenarios of surveillance trying to engage designers to think and consider surveillance from the standpoint of the everyday user of space which beside the possible criminal becomes object of CCTV surveillance and also to look why the implications of surveillance are not considered more deeply from the design studio.

Numerous studies addressed the ways digital media changed the concept of space (Coyne, 1999; Crotch, Mantho, & Horner, 2009; Kalay & Marx, 2003; Liu, 2003; McCullough, 2004; McQuire, 2008; Mitchell, 1999), and, consequently, how these changes modify architecture itself; seeing the evolution of architecture at-hand, with the evolution of digital technology. On the use of digital technology in the process of design, Dave (2003, pp. 181-190) reported an experiment of digital tools used at the design studio looking at the ways artifacts–digital oriented artifacts–affected practice in the studio. His findings were in the sense that large displays produced the sense of being-in-the-world, wireless devices encouraged fluid interactions; though, he was inconclusive on the final effects of integrating digital media at the work process of the design studio. By 2007, Ivanka Iordanova (2007) presented research introducing associative geometry and parametric modeling/design into architectural design education identifying a

…kind of rhythm in the digital exploration process: first, students generate a conceptual idea […]; then, they digitally explore the conceptual idea, when unexpected forms can be created and new 'ideas' generated; an evaluation process determines whether to continue the design process or not. The 'control' of the architecturally meaningful aspect is in the hands of the architect, while the form can be surprising, as generated by computer"(p. 669).

In the above account, Iordanova reports a good level of human-computer symbiosis, and a duality of human creativity and computer conformity. Another experiment using virtual learning environment on an architectural design course is the AVA-AD (Virtual Learning Environment on Architecture and Design) and is developed by the Laboratory of Virtual Learning Environments at the Federal University of Santa Catarina, Brazil. The platform based on Moodle virtual environment, provided 2D and 3D collaborative environment, including chat, email, forum, instant messages, shared white board and VRML navigation, users, groups, schedules etc. It was possible for them to record and track not only the whole design process as it unfolded by the students, but also the teaching process. It eliminated individual corrections, interventions of the lecturer, and other students' work was available to all of them, which enriched the decision making process because "everyone cold befit from a commentary made about one individual design, or from a question answered to one student" (Vecchia, Silva, & Pereira, 2009, p. 265)

Through the improvement of technology the design process is enriched. What used to be considered a black box is becoming evermore accessible for inspection of researchers. The aim of this research project is not to devise a modular solution or a formula for space design that takes surveillance as a factor into consideration. The aim is to focus on individual surveillance arrangements using, at the first stage, cameras. The focus will be on the arrangements that provoke reflective views on the implications of using surveillance, and which also provide some insights into design processes and how the decision-making may or may not change, depending on the media used in the tasks. That is why the tasks were set up one part at the physical space, and the second part in the virtual space, in order to record the main variations of solutions for both realms.

Methodological Procedures

The researchers prepared for the experiment by identifying a physical space, then building up a 3D virtual environment that realistically represents the physical space using MAYA software. The design of the experiment starts with two groups of designers instructed to develop two layouts of cameras and screens in the space. Each group consists of ten designers, and each designer completes the task individually. First each designer is asked to: a) arrange a set of cameras in order to maximise the surveillance of the room; and then b) arrange them to enhance the experience in the room (any experience). The objective of the first step is twofold: firstly, to help designers acquire first-hand experience of space design while taking surveillance needs into consideration, and secondly, to instigate the reflective process of deep reasoning which in turn would aid in critically reviewing design options, and subsequently enriching their experience, and therefore their accounts, which will be explored.

The choice of the physical space for the experiment is based on the potential for design outcome. The space can be described as a multiple use room featuring an interesting wooden roof structure which proved to be inspirational, particularly, in the second phase of the first task, when the designers are tasked with enhancing user experience of the room.

The difference between groups is that the first worked with print-outs of plans and elevations of the room, also with real cameras and cables directly in the physical space–real Elliot Room–, and the second group worked in a virtual scenario, designing through a 3D model of the same space–virtual Elliot Room–built in Maya software, without any of them having been in the actual space while working on the tasks. Another difference between the groups was at the interview, where extra questions are added to the second group, which worked digitally, in order to record the difference detected of working digitally against a more traditional way.

The subjects are chosen from a variety of areas within the design world, and particularly those with design training related to space: Architecture, Music, Sculpture, and Conservation. As well, there was a variety in the professional experience among them –private professional practice from

few years up to 25 years of experience, academics, some with mixed experience, and freelancers. The choice of subjects came to ensure that they are able to provide an insight while being themselves aware of the implications of the use of 3D space and its technology. Each subject is asked to complete individually the task, and is interviewed immediately afterwards, so their thoughts and reflections are still fresh, crisp and vivid (see Figure 1).

Figure 1: Subject on room testing his cameras.

The subjects of the first group are given 3 cameras, 3 monitors, one-projector cables and tools needed to build up each installation in 30 minutes. The guidelines include the recommendation of sketching any extra camera that is deemed necessary, and anything that could not be executed during the task since not all of the roofing structure was accessible – some points are more than 8 meters high.

The second group is served a simulated virtual room, cameras, etc, (see which were constructed up in a Maya modeling software, and are asked to carry out the same tasks as the first group. For this group most of the participants require a small tutorial to use the electronic platform, and are provided with charts and information that facilitate the task.

The questionnaires are designed as a semi-structured interviews (Bryman, 2004, p. 113), they commence with general questions, all of which are open-ended; and further questions are added in response to significant opinions. The questionnaire for the virtual format also include points about the ease of using the 3D medium in comparison with carrying out the task in the real room. Subjects are requested to describe their arrangements, the reasoning of their decisions, and to label the arrangement with a series of adjectives. As well, they are asked to reflect on their previous design work and the way it could have been related to surveillance.

The 3D model of the Elliot Room (see Figure 2.) is built after measurements are taken with a laser scanner in order to reach and get the dimension of the high points that are not easily accessible. Following this, all the volumetric elements of the model are built up with a tolerance of ±0.5cms accuracy. It includes, floor, walls, roof, roof structure, doors, windows, cells for windows view, and a section of the corridor where people access the physical room. Textures in the model are constructed from pictures taken from the actual materials in the room corrected and adjusted in Photoshop software. Special care is paid to the windows to create a microenvironment with images of the actual view of each of the 3 windows of the room that are in eye level. This microenvironment allowed the subject on trial to view from any angle approaching the window the view they would actually have outside the room in the real physical world.

Figure 2: Model.

Among the instructions before starting the arrangements we make known to the designers that they have the freedom to make up the story about what the space is used for, to decide the final use of the room they are working with. This freedom produced a variety of stories, going from the lecture room, to private personal space, banking vault, conservation areas, and exhibition galleries among others. As this decision is the first point of the task, once each subject specifies the function of the space, the cameras would be applied in place to work with the function of the space. They are also requested to think of the reasons to place the cameras at their selected locations, as they will be probed for answers and reasons after they are done.

Results

The outcome of the experiments is 40 different arrangements that varied significantly. When it comes to surveillance, the arrangements can be characterized as logical, efficient and automatic. As for the part of concerning creating an experience, the arrangements are characterized by enjoyable due to their artistic nature and playfulness.

Noted among the major differences between the physical space exercise and the digital one, the following:

At the physical space exercise there subjects used cameras that have rotate and pan capabilities: six out of

ten (60%) designers used mobile cameras against only two designers (20%) in the digital group.

At the digital space exercise subjects placed cameras at inaccessible points of space (without the aid of tools) – outside of windows, or from high points in the roof – four out of ten (40%) used them, against two (20%) of the physical space group.

It seems that having the ability to navigate to any point in the space in the digital medium encouraged installing cameras out of reach, since there is no need for extra tools to experiment. On the other hand, the subjects in the physical space compensated for the above limitation by using cameras that are able to move or rotate.

All the subjects of the virtual model experiment are asked to think about the differences between working in the physical space and by contrast, virtual space as they did. An interesting finding here is that half of the subjects changed their choices between the first arrangement (surveillance) and the second (experience), although most of them are able to identify what would have changed in their own arrangement[2]. The choices refer mostly to adjustments of the cameras and in implementing a kind of trial and error phase in their work. Therefore, we can attribute this modification of their opinion, not to the media used the 3D model, but to the acquired confidence they felt of the idea they are setting up at the exercise, and their desire to perfect their arrangement; which reinforces Iordanova's (2007) findings about the control of meaning in design being in the hands of the architect.

Surveillance as language

'Surveillance as language' is the metaphor we explore, and extend its consideration to Umberto Eco's (1968)[3] definition of architectural language as "an authentic linguistic system obeying the same rules that govern the articulation of natural languages." Subjects are asked if they thought that surveillance could be described as a language for architecture. The surveillance systems structure is clearly recognized by some of the subjects in relation with language:

You have the different morphological elements—cameras, targets for the cameras, vectors of view—and a structure. Because this has a definitive structure to cover everything… It is sort of a language of geometry.

While others did not accept it as language:

Language is for communication and this is not for communication: It is only for one way for somebody who is in charge of the space, there is no mutual relationship, so I don't think there is a language.

Here, however, the influence of the surveillance system on human behavior in the space under surveillance, is acknowledged. Is it not part of the designer's task to visualize the behavior of the users of space being designed? And therefore produce a design that takes into consideration all those technologies that will affect the use of space and behavior of its inhabitants. Notwithstanding the disagreement on the use of language metaphor, there was a clear themes while carrying out the second task of enhancing an experience in the room. (14 of 20: 70%) of the subjects considered an explicit message that would communicate the arrangement of cameras and screens they produced. Table 1 shows the variety of messages that the subjects proposed, and the number of mentions.

Table 1 Messages to be delivered by the installation

Message:	No. of Mentions
Exploration of space.	7
Invitation and interactivity.	5
Fun as in a game environment.	4
Enhancing spatial qualities.	3
Self-awareness/embodiment.	3
Distortion of space.	1
Diversity of experiences and realities.	1
Awareness of CCTV.	1
Functionality.	1

One of the subjects takes the metaphor to the next level and declares:

I believe the camera does speak, if I put the camera in front of the door, it has some meaning, is like you are telling the people "someone is watching you, so you have to behave yourself" something like this. The surveillance system does have a meaning. The system can't say anything but the people recognize the language, is like signs.[4]

This subject is assigning a function to the surveillance camera, while acknowledging the meaning people can extract.

On the surveillance task half of the subjects reported that surveillance systems did not deliver a message, the other half reported it did; the reason this opinion is so divided can be tracked back to the educational background of the individual subjects. Those who's schools focused mainly on educating designers to be the producers of "mass, space, and light" were against the idea that a technical installation with the purpose of collecting information could at the same time deliver a message. Subjects with more open opinions are mainly architects who's educational background include getting formal training on the technical installations. Moreover, getting training on basic and some times elaborated calculations of services and structures. It is this second group who is open to the possibility that a surveillance installation could "talk" to the person under surveillance, even if it was not with words, because they consider the technical installation to be an integral part of architecture, therefore they share its

2 Surveilance: five out of seven (71%). Experience: six out of seven (86%).

3 Cited by (Clarke & Crossley, 2000, p. p. 2).

4 Architect, Phd Candidate.

possibilities of delivering messages.

Surveillance can only be assimilated as a language as long as it forms part of architecture. It requires a context (the built environment), which has a language to itself, and serves to modify the messages that can be read from this context, overlapping its own. A disassembled CCTV system lying in a space does not have this capability; only when assembled that it can produce meaning and communicate it to the people under surveillance. A space with a standard surveillance system delivers a crude message and takes no consideration of meaning, perception, or even functionality. It focuses on intrusion and breakage of the space code of conduct. Therefore, the inflection on the meaning is savage and rude most of the time.

However, integral architecture is not done by technicians, on the contrary, it is the architect who is the one in charge to design spaces, and coordinate the way in which they function integrally with all its technical installations in the way they are intended to. It is up to the architect to determine the way in which architecture "serves as the constructed ground for encountering and extracting meaning from cross-connected flows,"[5] as Mitchell suggests. In that sense, the meaning that a space delivers, and how the surveillance systems will affect those meanings depends on the intervention of an architect, and his thoughtful consideration of the design process.

The use of digital models to getter information proved useful at saving time, results of meditation and insights were no different from the counterpart, which work in the physical space with the physical installation. Digital exercise proved to save time, opened the possibilities for playing with space and installations and subjects saved much more time on producing and perfecting their arrangement.

The researchers advocate an integrative design that considers all the elements in play, traditional and constant evolving technology elements, among them surveillance technology. We recall the role of the architect in relation to society's major ethical concerns, which, in many cases, goes unacknowledged.

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References

Adams, A. A., & Ferryman, J. M. (2015). The future of video analytics for surveillance and its ethical implications. Security Journal, 28(3), 18. doi:10.1057/sj.2012.48

Atlas, R. I. (2008). 21st Century Security and CPTED, Designing for Critical Infraestructure Protection and Crime Prevention. Boca Raton, FL: Taylor & Francis Group.

Ball, K., & Webster, F. (2003). The Intensification of Surveillance: Crime, Terrorism and Warfare in the Information Age. London: Pluto Press.

Baudrillard, J. (1994). Simulacra and simulation (S. F. Glaser, Trans.). Ann Arbor: University of Michigan Press

Bentham, J. (1789). An introduction to the principles of morals and legislation. Printed in the year 1780, and now first published. By Jeremy Bentham Retrieved from http://goo.gl/5PJDng

Bentham, J. (1791). Panopticon; or, the inspection-house: containing the idea of a new principle of construction applicable to any sort of establishment, in which persons of any description are to be kept under inspection: and in particular to penitentiary-houses, prisons ... in a series of letters, written in the year 1787 ... By Jeremy Bentham. [London] ; Dublin printed London, reprinted; and sold by T. Payne ...

Božovič, M. (1995). Introduction The Panopticon writings (pp. 158 p.). London ; New York: Verso.

Bryman, A. (2004). Social Research Methods (2nd ed.). Oxford: Oxford University Press.

Clarke, G., & Crossley, P. (Eds.). (2000). Architecture and language: constructing identity in European architecture, c. 1000-c. 1650. Cambridge: Cambridge University Press.

Coyne, R. (1999). Technoromanticism: digital narrative, holism, and the romance of the real. Cambridge, Mass.: MIT Press.

Crotch, J., Mantho, R., & Horner, M. (2009). Space Making - Between the Virtual and the Physical. International Journal of Architectural Computing, Volume 7(3 - September 2009), 403-414. doi:10.1260/147807709789621202

Dave, B. (2003). Hybrid Spaces of Practice. Paper presented at the Digital Design Research and Practice; Proceedings of the 10th International Conference on Computer Aided Architectural Design Futures, Tainan 2003.

Diffie, W., & Landau, S. E. (2007). Privacy on the Line: The Politics of Wiretapping and Encryption (Updated and expanded ed.). Cambridge, Mass.: MIT Press.

Doyle, A., Lippert, R. K., & Lyon, D. (Eds.). (2012). Eyes everywhere: the global growth of camera surveillance. Abingdon, Oxon ; New York, NY: Routledge.

Eco, U. (1968). Lingaggio archittenico. In P. Portoghesi (Ed.), Dizionario enciclopedico di architettura e urbanistica (Vol. vol. 4, pp. 397-399). [Roma]: Istituto editoriale romano.

Ericson, R. V., & Haggerty, K. D. (Eds.). (2006). The new politics of surveillance and visibility. Toronto ; London: University of Toronto Press.

Foucault, M. (1975). Discipline and Punish: The Birth of The Prison (A. Lane, Trans.). London: Penguin.

Graham, S., & Marvin, S. (1996). Telecommunications and the city : electronic spaces, urban places. London: Routledge.

Haggerty, K. D. (2006). Tear down the walls: on demolishing the Panopticon. In D. Lyon (Ed.), Theorizing surveillance: the panopticon and beyond (pp. xiii, 351 p.). Cullompton, England; Portland, Or.: Willan Publishing.

5 (Mitchell, 2005, p. p. 6).

Iordanova, I. (2007). Teaching Digital Design Exploration: Form Follows…. International Journal of Architectural Computing, Volume 5(4 - December), 685-702. doi:10.1260/147807707783600807
Jay, M. (1993). Downcast Eyes, The Deinigration of Vision in Twentieth-Century French Thought (1st ed.). Berkeley, Los Angeles, London: University of California Press.
Jeffery, C. R. (1971). Crime prevention through environmental design. Beverly Hills, Calif.: Sage Publications.
Jones, R. (2009). Checkpoint security: Gateways, airports and the architecture of security. In K. F. Aas, H. O. Gundhus, & H. M. Lomell (Eds.), Technologies of inSecurity : the surveillance of everyday life (pp. xi, 279 p.). Abingdon England ; New York: Routledge-Cavendish.
Kalay, Y., & Marx, J. (2003). Changing the Metaphor: Cyberspace as a Place. Paper presented at the Digital Design, Research and Practice: Proceedings of the 10th International Conference on Computer Aided Architectural Design Futures, Tainan 2003.
Landau, S. E. (2010). Surveillance or security?: the risks posed by new wiretapping technologies. Cambridge, Mass.: MIT Press.
Liu, Y.-T. (2003). Digital Architecture: Theory, Media and Design. Paper presented at the Digital Design Research and Practice; Proceedings of the 10th International Conference on Computer Aided Architectural Design Futures, Tainan 2003.
Lyon, D. (1994). The electronic eye: the rise of surveillance society. Cambridge: Polity Press.
Mattelart, A. (2010). The globalization of surveillance: the origin of the securitarian order. Cambridge: Polity.
McCullough, M. (2004). Digital ground : architecture, pervasive computing, and environmental knowing. Cambridge, Mass.: MIT Press.
McQuire, S. (2008). The media city: media, architecture and urban space. Los Angeles, Calif.: Sage.
Mitchell, W. J. (1999). E-topia : "Urban life, Jim--but not as we know it". Cambridge, MA: MIT Press.
Mitchell, W. J. (2005). Placing Words: Symbols, Space, and the City. Cambridge, Mass.; London: MIT Press.
Newman, O. (1972). Defensible space : crime prevention through urban design. New York: Macmillan.
Norris, C. (2012). There's no success like failure and failure's no success at all: some critical reflections on the global growth of CCTV surveillance. In A. Doyle, R. K. Lippert, & D. Lyon (Eds.), Eyes everywhere: the global growth of camera surveillance (pp. xiv, 392 p.). Abingdon, Oxon ; New York, NY: Routledge.
Poyner, B. (2006). Crime-free housing in the 21st century. London: Jill Dando Institute of Crime Science, University College London.
Reynald, D. (2015). Environmental Design and Crime Events. JOURNAL OF CONTEMPORARY CRIMINAL JUSTICE 1(02/2015), 19. doi:10.1177/1043986214552618
Tilley, N. (2005). Handbook of crime prevention and community safety Retrieved from https://http://www.dawsonera.com/guard/protected/dawson.jsp?name=https://idp.ed.ac.uk/shibboleth&dest=http://www.dawsonera.com/depp/reader/protected/external/AbstractView/S9781843926146
Vecchia, L. D., Silva, A. d., & Pereira, A. (2009). Teaching/learning Architectural Design based on a Virtual Learning Environment. International Journal of Architectural Computing, Volume 7(2 - June), 255-266. doi:10.1260/147807709788921976