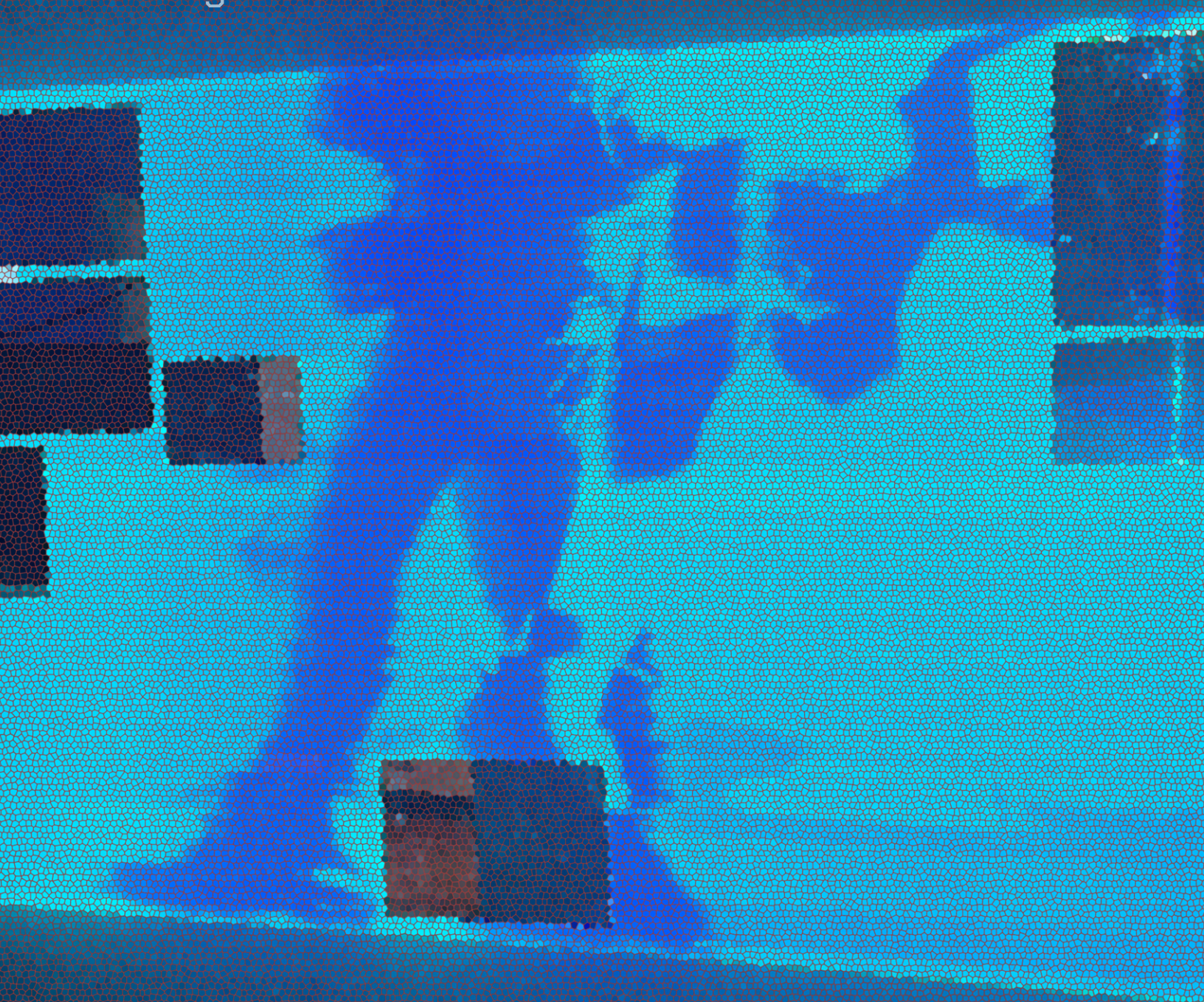
REFLECTIONS UNVEILED:
Publicness vs Privateness Through the Lens of Surveillance



By Zaheen Sandhu

A thesis exhibition presented to OCAD University in partial fulfillment of the requirements for the degree of Master of Design in Digital Futures
Gallery, OCADU Waterfront Campus, April 4-6, 2024
Toronto, Ontario, Canada, 2024

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Abstract

The pervasive nature of surveillance in urban spaces raises important questions about the boundaries between public spaces and an individual's privacy. At the same time, defining private, public, or semi-public spaces has also become difficult. Many of these surveillance systems are embedded into the urban spaces extremely well and have become a part of an individual's everyday life, as in the case of CCTV cameras and RFID machines. This thesis project explores the ways in which an immersive experience along with data physicalization techniques can be employed to convey the scale and impact of surveillance in urban spaces. The research was conducted through a literature review that explored surveillance from a historical and contemporary perspective, the relationship between bodies and screens and the role of data physicalization. Research-Creation was employed as a key research methodology for conducting data walks and iterative development of prototypes. This research resulted in exploring analogue materials and digital techniques within a physical immersive experience. *Reflections Unveiled* invites visitors to engage with aspects of visible and invisible forms of surveillance, through elements such as distortion and layering depicted by using mirrors in the immersive space while uncovering how they are viewed through those surveillance systems.

Keywords: surveillance, data privacy, immersive installation, experience design, data physicalization, projection mapping

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Lastly, I want to extend my heartfelt appreciation to all those who have played a part in shaping this thesis and my academic career. Thank you for being a part of this incredible experience.

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Chapter 1: Introduction

During the fourth year of my undergraduate degree in 2020, my final project “Keeping A Track” revolved around highlighting Facebook’s (Meta) invisible form of surveillance, the Off-Facebook Activity Tool, and translated it into visible forms of Data Visualization. I did this by taking my personal data gathered through Facebook Pixel and used it to create an interactive web-experience. I highlighted key factors such as how Facebook gathers vast amounts of data while you are browsing on the internet, even if you are not logged into the application, (for example, it tracked what I added and removed from my basket on Amazon or other shopping websites) to generate personalized targeted advertisements. During this process, my interest in Data Visualization grew and I was able to understand how it could be a valuable tool to lay out information but in an interactive and informative way. I graduated during the pandemic and due to that, I was not able to conduct a physical exhibition, hence the project resulted in a website. The ideal project I was keen on presenting was in the form of an interactive installation as it provides an opportunity for a rich experience, for people to understand the relevance of the theme, while interacting with different artifacts in space.

Since then, my interest in topics related to privacy, ethics, and surveillance has grown as well as along with a curiosity towards creating physical immersive experiences. In the context of this thesis project, this research has intended to foster conversations among people about the invisible form of surveillance prevalent in surveillance systems located in urban spaces. Despite the physical presence of these surveillance systems such as CCTV cameras and RFID machines that operate as forms of visible surveillance, the underlying concept of observation and scrutiny is inherent within these systems. How frequently do we pause to acknowledge these surveillance systems directed at us while crossing them on the streets? The interest in surveillance arises from a desire to pause and contemplate how these systems have become ever-present in urban spaces.

The following section delves into the motivation for choosing to focus on surveillance within urban spaces specifically.

1.1. Why Surveillance in Urban Spaces

Moving away from the theme of surveillance in the digital realm, I found an interest in surveillance in urban spaces. The approach towards privacy concerns in the digital realm tends to differ from those in urban spaces. In digital spaces, consent is typically requested (through prompts such as “I accept” buttons) whereas privacy in urban spaces is often encroached upon without explicit consent. As we step out of this digital space and enter urban spaces, we can see surveillance having a significant impact there as well, long before the digital era. When stepping out of our homes to commute to places, we are surrounded by several types of surveillance systems that have now become a part of everyday life. Imagine this, you wake up in the morning, get ready for work and head out as you do every day. As you step out into the street, you are crossing multiple buildings, workplaces, residential areas, and restaurants. All happen to have (not so tiny) cameras pointing out on the streets, they go unnoticed as you cross them. You decide to take public transport to commute to work, hop on and scan your card on the machine. You reach your stop and start walking towards your workplace, crossing yet another set of black and white domes and rectangular structures on the exterior of the buildings placed high up. They probably go unnoticed this time as well. To enter your workplace, you swipe your identification card outside of the building and go inside. Throughout the journey, surveillance systems such as CCTV (closed circuit television) cameras, and RFID (radio frequency identification) machines are surrounding us and have woven themselves seamlessly into the everyday environment. These are forms of visible surveillance where their physical form is present in space, but there is an underlying notion. The

invisible form of surveillance is present behind those systems providing a sense of constant monitoring that leads to automatic behavior regulation[1] amongst individuals being surveilled.

1.1.1. Project Goals and Expected Outcome

To integrate the different aspects of surveillance in urban spaces such as the visible and invisible forms of surveillance, the aim was to develop a physical immersive experience wherein visitors are invited to actively engage and interact with materials dispersed throughout the space. By doing so, the objective is to foster a deeper sense of involvement wherein visitors are not merely passive observers but are immersed within the space. Some of the objectives for this thesis project include:

1. To facilitate a critical understanding of visible and invisible aspects of surveillance in urban spaces.
2. To encourage introspection among visitors by engaging them with the physical immersive space and its different components.
3. To invoke the notion of being observed through the design of an immersive space by incorporating analogue materials and digital techniques.

"Reflections Unveiled" manifested as a physical immersive experience inviting visitors to explore aspects of visible and invisible forms of surveillance that surround them in the urban space. By using analog materials and image projectors, the focus is to depict the different elements of surveillance such as reflections, layers, and distortion. Further, by utilizing space, materials, digital aspects, and data physicalization, visitors will encounter data that is no longer invisible, providing a sense of visibility and creating a moment of realization within the visitor.

[1]The notion of people regulating their behaviour due to an awareness of being monitored has been examined in detail by Foucault (1995) in *Discipline and Punish*. I discuss this further in Chapter 2: Critical Literature.

1.2. Research Questions

1.1.1. Primary Research Question

In what ways can an immersive experience along with data physicalization techniques be employed to convey the scale and impact of surveillance in urban spaces?

1.1.2. Secondary Research Question

By using new forms of immersive technology, how can we raise awareness surrounding the topic of surveillance and privacy?

1.3. Scope and Limitations

This thesis project explores the theme of surveillance specifically in urban spaces and has not been extended into private or digital spaces. By conducting a data walk within a set radius in downtown Toronto, Canada, the primary focus has been on collecting the number of surveillance systems such as CCTV cameras and RFID machines and has been limited to these two categories. Qualitative data gathered through a set of data walks was utilized in different forms within the physical space of the installation and quantitative data has been used to create data physicalization forms to translate the data. In this thesis project, instead of using open public data, such as the data collected by the city of Toronto on the number of CCTV's installed, I exclusively used data I gathered through using the method of data walk.

1.4. Chapter Overview

In this chapter I introduced the motivation, the main topics of research, and the goals of this thesis project.

Chapter 2 is an in-depth critical literature review that delves into aspects of surveillance in urban spaces from a historical and contemporary perspective while also discussing these concepts in the Canadian context. This is followed by an analysis of themes within interactive

media such as subjectivity and control, and the relationship between bodies and screen specifically in the context of responsive environments. Lastly, I examine the importance of effective communication of information through visual representations and physicalization of data.

Chapter 3 discusses a range of different artists while making correlations between selected artworks in the context of this thesis project. The artists examined are Bruce Nauman, Stanza, Rafael Lozano-Hemmer, and SOFTlab

Chapter 4 examines the research methods and methodologies employed in this thesis project. It specifically looks into *Research-Creation* as the key methodology and further discusses the methods used such as data walk and iterative prototyping.

Chapter 5 discusses the development of various iterative prototypes that were created during this thesis project. It also mentions the evolution of these prototypes into the final exhibition installation.

Chapter 6 concludes this thesis project and discusses the evolution of the project in the future.

Chapter 2: Critical Literature

This chapter focuses on various aspects of surveillance such as the integration of surveillance cameras in urban areas and the collection of digital information through RFID Tags. It discusses the evolving dynamics of surveillance in the digital age by focusing on different literature texts and addressing the challenges whilst defining them. Focusing on the embedding of surveillance in public space, it investigates the aspect by reflecting on the Canadian context. The literature then moves onto topics of interactive media through responsive environments, subjectivity and control, the relationship between bodies and screens, and closed-circuit video works. Lastly, there is a focus on the evolving role of data visualization, specifically in the realm of visual representation and the importance it has on the communication of information in an artistic and humanistic manner.

2.1. Why Surveillance in Urban Spaces

Surveillance, from both a historical and contemporary perspective, remains a critical aspect of influencing notions of privacy, power, social behavior, and individual autonomy. Central to this has been Jeremy Bentham's eighteenth-century disciplinary concept of the *panopticon*[2] which was extensively examined by French philosopher and historian, Michel Foucault (1995) in his work *Discipline and Punish*. Foucault critiques the concepts of visible and invisible power, surveillance, power dynamics and disciplinary mechanisms through an in-depth analysis of the architectural apparatus. He emphasizes that surveillance goes beyond mere observation and control; it creates a regime of invisible power, internalizing disciplinary norms within those being surveilled. "He is seen, but he does not see; he is the object of information, never a subject in

[2] A tower in the center of a circular structure with cells around it, allowing a watchman to observe all prisoners without them knowing if they're being watched. The basis of the architectural design principle was to create a sense of constant surveillance by an unseen observer, leading prisoners to regulate their behavior and impose control among inmates due to the uncertainty of being observed at any moment.

communication." (Foucault, 1995, p. 200). The constant threat of being watched leads individuals to regulate their behavior even if no one is actively observing them highlighting both invisible and visible forms of power. Foucault further elaborates on Bentham's principle of visible but unverifiable power by saying:

> Bentham laid down the principle that power should be visible and unverifiable. Visible: the inmate will constantly have before his eyes the tall outline of the central tower from which he is spied upon. Unverifiable: the inmate must never know whether he is being looked at any one moment; but he must be sure that he may always be so. (1995, p. 201)

This highlights the intricate power dynamics inherent in surveillance enabling those in positions of authority to exert control over individuals and populations. By looking at Foucault's analysis of the *panopticon*, there are correlations seen beyond the prison walls. He emphasizes a broader societal model where individuals are subjected to various forms of surveillance and disciplinary norms. Foucault explains, "The panoptic schema, without disappearing as such or losing any of its properties, was destined to spread throughout the social body; its vocation was to become a generalized function." (1995, p.207). Individuals are subjected to surveillance in schools, workplaces, hospitals, and even public spaces through constant monitoring, regulating their behaviors implied through certain norms and expectations. In the contemporary society, physical forms of surveillance such as cameras, digital identification cards including credit or debit cards, transportation cards, RFID machines etc. function like the physical structure of the 'tower'; wherein an individual is not aware of whether they are being watched but the threat is very well present. Metaphorically there is an evident extension of this in society such as the feeling of constantly being monitored and self-regulation of behaviors. At the same time, it is crucial to define *panopticon* in today's technological age wherein the role of advanced electronic systems has changed the mechanism of surveillance and the meaning of "being watched". Haggerty (2006) in *Tear down the walls: on demolishing the panopticon,* brings attention to this matter by providing a historical overview of the panopticon and highlighting new 'opticon' definitions

coined by various authors and how these terms have not been able to fit in perfectly within "the contemporary global, technological or political dynamics of surveillance." (2006, p.26). Surveillance today has shifted from the concept of a 'centralized observer' onto an amalgamation of multiple technologies and decentralized observational techniques. As discussed before, the physical forms of surveillance provide a sense of constant surveillance by routine recording and analysis of aggregated trends that result in documented traces and data doubles surrounding the individuals as they go about their daily affairs. (Haggerty, 2006, p. 29). This further influences individuals' actions and perpetuates a culture of self-surveillance. This thesis acts as an extension into the formulation of invisible and visible forms of surveillance by looking at the physical attributes of mirrors, they act as means of reflection allowing the subject to view themselves while being aware of being watched. The revelation of the subject in this scenario ends up acting as a crucial and essential element when talking about making surveillance visible.

Examining recent works by authors such as Bennet et al. *(2014)* in *Transparent Lives: Surveillance in Canada*[3]*,* there is an understanding of how the term *surveillance* has been modified, defined, and used in different contexts for centuries. From agents in trench coats to cabinets with confidential files and now databases having abundant information on its citizens; the way *surveillance* is defined relies heavily on the context. (Bennet et al., 2014, p.5). Taking the example of the panopticon, being surveilled in that context would have different implications as compared to surveillance in today's digital age. They define *surveillance* "as any systematic focus on personal information in order to influence, manage, entitle, or control those whose information is collected." (Bennet et al., 2014, p.6). Initially, closed-circuit television (CCTV) systems were invented for people's safety and security purposes with little to almost no personal data collected from the public. In a relatively brief span, the systems have become extremely common and enhanced in various aspects such as the scale, appearance, type of technology used

[3] Written by multiple authors, this book employs several key elements that guide its exploration of surveillance in Canada such as emphasizing on trends and case studies.

to create them, methods for storing information and type of personal data collected. (Bennett et al., 2014). The presence of multiple cameras in urban spaces extends far beyond mere observation, influencing those who control and have access to surveillance technologies wielding significant influence over the interpretation and use of surveillance data. This control can be leveraged for various purposes, including social control, political manipulation, and economic exploitation, reinforcing existing power structures and inequalities.

2.1.1. Embedding of Surveillance: Canada

The integration of surveillance cameras installed in public streets often evade public awareness despite their "visibility". Their strategic placements into high walls enable them to be easily overlooked by passersby. These black dome shaped devices on walls and small rectangular boxes outside of buildings are integrated into urban space and are not seen as isolated objects and, as such, they have "become taken-for-granted parts of daily life". (Iveson & Maalsen, 2019, p. 333). The chapter *Transparent Lives: Surveillance in Canada - Trend 7: Embedding Surveillance in Everyday Environments from the Surveillance of People to the Surveillance of Things* by Bennett et al. (2014) sheds light on the increasing integration of surveillance technologies, particularly CCTV cameras, into everyday environments in Canada. Despite the United Kingdom historically leading in the adoption of such surveillance measures, Canada is swiftly following suit, incorporating surveillance technology into contemporary urban life. (Bennet et al., 2014, p.133). Discussing the legal requirement for businesses to visibly display signage and/or posters alongside the surveillance camera indicating the presence of video surveillance, there is a gap seen in this as most businesses have failed to comply with this law and the signs are often unnoticeable and inconspicuously designed. This lack of compliance with the law has resulted in a lack of awareness among the public regarding the extent of surveillance systems surrounding them in public spaces. This specific issue became visible to me when I surveyed the area surrounding

Richmond St West, Toronto through a data walk[4], an example shown in (Image 1) below. It became evident when I looked at the data collected and saw the discrepancy between the number of surveillance cameras and signages.

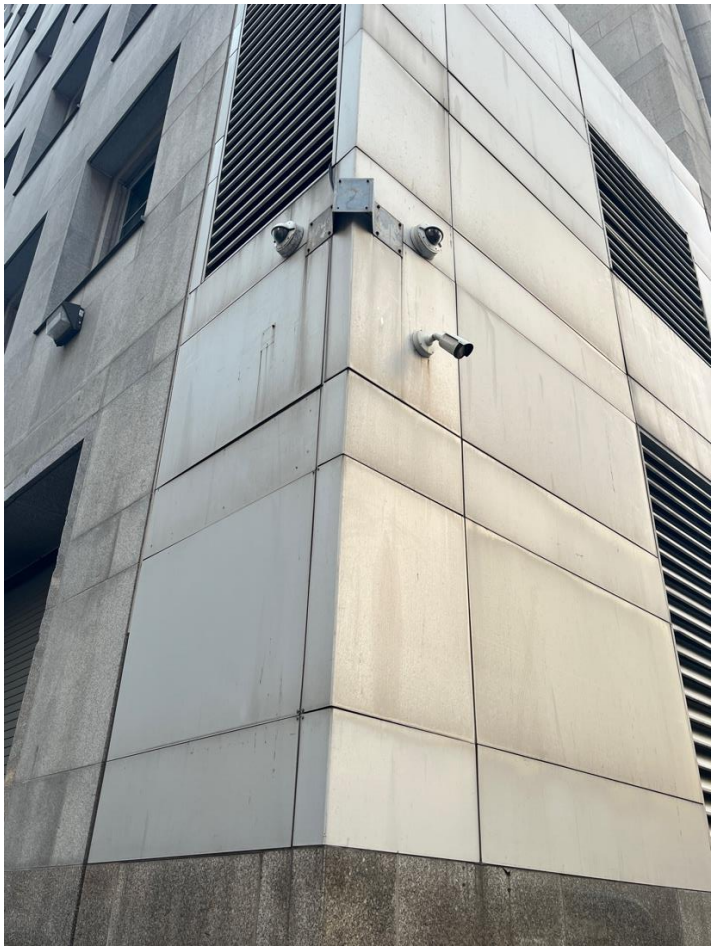

Image 1: Surveillance cameras photographed at Richmond St West and Simcoe St. Photo by author.

By providing a critical examination of the growing presence of surveillance technology in Canadian society and its implications for individual privacy, *Transparent Lives: Surveillance in Canada - Trend 7* served as an important foundational touchpoint to understand the importance of transparency and accountability in surveillance practices. When examining embedded

[4] Focuses on an individual/group of people stepping out into the urban space and physically engaging with the data and documenting the same in real-time. *Data Walking – A process for reflecting on the production and significance of data*. https://www.datawalking.uk/

surveillance in other common everyday items, an example of this can be discussed through digital identification documents (ID). Digital biometrics and radio frequency identification (RFID) chips are present in routine ID cards such as driver's licenses, health cards, and passports. (Bennet et al., 2014, p. 135). These 'cards' are used by people to enter their workplace, residential or college campuses almost daily along with purchases made through credit, debit or shopper cards, the constant use of these results in a form of record-keeping of an individual's personal digital information. This data "enable both governments and private corporations to collect, analyze and shape their behavior as ideal citizens and consumers." (Iveson & Maalsen, 2019, p. 333). By interacting with digital devices and infrastructure it results in urban inhabitants leaving a digital trace of themselves and their activities. Nissenbaum argues, "Spaces have become points of information capture and passage; commercial transactions and travel are newly enriched with information." (2009, pp. 39-40). *Video Surveillance and Public Space: Surveillance Society Vs. Security State*, Lysova (2022), focuses on the importance of citizens having the right to their privacy when out in public spaces, but as the surveillance tools are evolving, there are thus significant threats to the urban fabric. (Lysova, 2022). By drawing inspiration from these frameworks, this thesis project focuses on two specific modes of surveillance: CCTV Cameras, and RFID Tags situated within an immersive space to employ information to visitors about the 'invisible' form of surveillance surrounding them.

2.2. Responsive Environments: Video and Installations

Moving forward from the theme of surveillance, this section focuses on key literatures that played an important role in materializing concepts that looked at themes focusing on the relationship between the viewer and the space, the correlation between the role of subjectivity and control, and closed-circuit and screen-based installations.

2.2.1. Subjectivity and Control

Mirrors serve as effective metaphors for reflection and distortion, both visually and conceptually. Utilizing mirrors in a space disrupts traditional modes of perception, inviting viewers to reconsider their relationship with the self and the world around them. In the context of surveillance, mirrors can evoke notions of transparency and opacity, revealing the complexities of visibility and concealment inherent in surveillance practices. On the other hand, interactivity within an immersive space with the use of mirrors provides a much richer exploration process for the visitors. In David Rokeby's (1996), essay *Transforming Mirrors: Subjectivity and Control in Interactive Media,* his central discussion revolves around the notion of artworks made with interactive technologies as transformative mirrors, fundamentally altering how we perceive ourselves and interact with the world. He highlights the unique capacity of interactive media to amplify subjectivity by allowing individuals to actively shape their experiences within the artwork. As he mentions, "While all interactive works reflect interactors back to themselves, in many works the idea of the mirror is explicitly invoked. The clearest examples are interactive video installations where the spectator's image or silhouette becomes an active force in a computer-generated context." (Rokeby, 1996, p.7). The concept of "interaction" within the scope of this thesis relates to the engagement of visitors with the spatial environment and the elements such as mirrors and camera placed within it. The utilization of mirrors plays a pivotal role by involving the visitors in navigating the space and engaging with the cameras and mirrors. By employing projections that reflect off these mirrors, the visuals become distorted, blurred, and fragmented. The mirrors serve a dual function: firstly, they enable visitors to observe their own reflections prompting contemplation of their spatial orientation; secondly, they introduce distortion and blurring, offering an alternative perspective that obscures the clarity of the video feed. For me, the mirrors depict both the invisible and visible aspects of surveillance.

Rokeby emphasizes the notion of "control" in immersive spaces and the placement of elements within the space as it influences the visitor's exploration journey. He explains, "The

spectator sees some representation of themselves on a video projection screen. This representation follows the movements of the interactor like a mirror-image or shadow, transformed by the potentials with which the artist has endowed the space." (Rokeby, 1996, p.7). By letting visitors explore the space and engage with the elements, their experience can spark areas of self-discovery, prompting questions of pre-established perceptions and further exploring alternative aspects of themselves within the immersive space. The artist and visitor play a critical role in developing the artwork's meaning, and this is achieved by balancing the interaction and the interactor in the given space. The result of the experience matters on the interactor's sense of control and in turn their behavior has an impact on the richness of the experience. Rokeby argues, "Interaction is about encounter rather than control." (1996, p.8). An extension of this is deployed in the thesis project wherein the visitors upon entering the space take a moment to engage with the space prompting them to question their established perceptions and further explore alternative aspects within the immersive space. By providing an immediate response as they discover the camera through the projected visuals, a connection gets established between the visitors and the elements - a reflection-based analogy to depict surveillance and highlight that through the metaphor of mirrors.

2.2.2. Relationship between bodies and screen

In *Body and Screen: The Architecture of Screen Spectatorship - Screens: Viewing Media Installation Art*, Mondloch *(2010)* touches upon some interesting and resonating viewpoints. By looking at other artist's work, she discusses in detail the relationship between the bodies and screens and closed-circuit video works within the context of screen-based viewing. Emphasizing how different techniques are used to situate the person viewing the space can influence how they experience the space and the work; there is a strong relationship that can be created between the viewer and the work because of the foundation of the different forms and techniques of screen-based control. When examining artwork from the 60s-70s, Mondloch explains that:

> "through an assortment of techniques, such as varying the arrangement of cameras and monitors, combining live and prerecorded feedback, inverting viewers' images divorcing cameras from their monitors, and introducing time delays, these artworks demonstrate how the viewing regimes associated with technological apparatuses assert precise kinesthetic and psychic effects upon their audiences." (2010, p. 24).

This thesis project is driven by creating a space wherein the different techniques used such as projections on mirrors, and numerous mirrors dispersed around the space, to create a moment of realization within the visitors. They see themselves but from the eyes of another viewer, the viewer in this scenario being the cameras. Certain expectations are formed by the visitor upon entering the experience, and the way the space has been utilized with materials further layered upon those expectations.

On examining spectatorship, Mondloch (2010) says: "Our cultural habit of immediately looking at media screens and our propensity to view them as windows onto other representational or informational spaces—concentrating on the spaces depicted 'on' or 'inside' the screen—has special consequences for the complex spatial dynamics of screen - reliant installation art spectatorship." (p. 60). A viewer upon entering a space, such as a room filled with media screens in various forms, sparks a need to make a relationship of what is happening in the present time. In *Be Here (and There) Now The Spatial Dynamics of Spectatorship*, Margot Lovejoy's (2004) book *Digital Currents: Art in the Electronic Age* reflects on Bruce Nauman's *Performance Corridor* (1969–70). Lovejoy talks about how the invention of the video camera acted as a new medium for artists to experiment with within the gallery settings. She explains, "Combined with sound, music or spoken dialogue and text, the medium opened up new aesthetic ground for exploring time, motion, sound, and image relationships in a broad range of contexts." (Lovejoy, 2004, p. 95). Depending on the location of an installation, the use of video as a medium in the space can make the spectator become a part of an interactive dialogue resulting in a reflection of the artist's intentions. She further goes on to say, "– a unique way of exploring fresh relationships

in the triangle which exists between artist, object, and viewer." (Lovejoy, 2004, p. 97). The different texts discussed in this section provided a framework for this thesis project by incorporating notions of engagement with elements, and the relationship formed between space and visitors.

2.3. Representations of Data

This section of the literature review aims to explore the significance of data visualization in creative fields focusing on novel approaches such as data physicalization. It provides insights into the role of data physicalization in shaping narratives, engaging audiences, and fostering reflection.

The significance of data visualization in the creative field has evolved over time and now plays an important role in contributing to the construction and communication of knowledge. In *Data Visualization in Society, Introduction: The relationships between graphs, charts, maps and meanings, feelings, engagements* Helen Kennedy and Martin Engebretsen (2020) delve into the meaning, relationship, and representation of information by emphasizing the importance of understanding data visualizations as not just objective depictions of information but the role it plays in shaping the narratives. (2020, p.21). An opportunity is presented within the field of data visualization for depicting the same dataset in various ways and thus can evoke diverse meanings and emotions based on the context and the audience. Context plays an essential role in formulating the way the data is interpreted and acts as a powerful tool for conveying information. The authors discuss the connection between people's emotional engagement with data visualization and their aesthetic aspects. Kennedy & Engebretsen explain, "The forms, colours, and arrangements of data visualizations trigger our senses in particular ways. In turn, the interplay between the semiotic, meaning-making aspects of data visualizations, and the emotions they evoke is closely related to their ability to elicit social engagement." (2020, p. 24). This thesis explores the above-mentioned dimensions and extends the narrative into physical artifacts to

showcase data. Using data collected within a selected radius in Toronto was an essential factor in deciding how to use that data within the immersive space.

Even though 2D data visualization has been the most significant way to showcase information on various subjects, we now see new ways to represent the same set of data. As discussed in the book "Making with Data"[5] there has been a substantial focus on terms such as Autographic, Data Materialization, Data Manifestation, Data Sonification, Data Edibilization, Information Olfactation, Data Tactility, Data Objects, Data Sculpture and Data Physicalization. All these terms refer to diverse ways of representing data using different senses. For the development of this thesis project, there has been utmost focus on understanding different properties of Data Physicalization and further utilizing them by translating the data collected into physical form.

2.3.1. Role of Data Physicalization

Unlike conventional visualization, data physicalization can provide a more holistic experience by employing various sensory modalities and focusing on an immersive and interactive experience. Due to the ever-evolving landscape of data, physicalization has emerged as a powerful tool by offering new means for conveying information. Dragicevic et al. (2021), in *Data Physicalization,* refer to the term as "a physical artifact whose geometry or material properties encode data" (p. 4). By including physicality, interaction, and other elements such as touch, sight, and sound, this has enabled engagement with data as a fun experience. Taking this forward, the authors go on to discuss the same:

> Some consensus seems to be emerging that more abstract representations benefit task performance and reflection, whereas more aesthetic, playful and pleasurable data

[5] Huron, S., Nagel, T., Oehlberg, L., & Willett, W. (Eds.). (2023). *Making with data: Physical design and craft in a data- driven world* (First edition). AK Peters: CRC Press.

> representations are more able to "engage" people, an effect that can be further augmented by the triggering of emotional commitments (Dragicevic et al., 2021, pp. 20-21)

The three-dimensional and tangible nature of physicalized data not only has the power to engage visitors, but also creates a unique space for artists and designers to communicate ideas and data. Jansen et al. discuss that "In comparison to screen-based visualizations, physicalization can similarly offer to bring data to many more places and aspects of our social lives." (2015, p. 3229). A beneficial aspect of data physicalization is the ability to include other elements of interactivity in the experience by placing it as a part of an immersive installation. This enables the physical data to not be just stand-alone pieces but act as a supporting element to the entire experience. They explain:

> In particular, since physicalizations can be anywhere and are always "on", they can be used as ambient data displays and support casual visualization. Furthermore, data is increasingly present in museums and art galleries in the form of data sculptures, that is, physicalizations created by designers and artists whose purpose is to communicate meaning and elicit reflection on data. (Jansen et al., 2015, p. 3230).

Data physicalization played a significant role in the process of developing this thesis project. The utilization of physical materials to depict data collected through a set of data walks transformed the annotations in a printed map into physical artifacts. The next chapter will examine different artists' works through a critical review.

Chapter 3: Contextual Review

This chapter focuses on themes of surveillance, viewer engagement and participation, and the use of analogue materials and digital technology demonstrated through the works of Bruce Nauman, Stanza, Rafael Lozano-Hemmer, and SOFTlab. Nauman's *Live Taped Video Corridor (1970)* challenges traditional perceptions by immersing participants in a claustrophobic corridor, utilizing real-time video feeds to distort self-perception. Stanza's *Visitors To A Gallery (2004)* blurs the lines between observer and observed, transforming gallery visitors into active contributors to the evolving artwork through surveillance technologies. Rafael Lozano-Hemmer's *Under Scan, Relational Architecture 11 (2005)* engages viewers as both observers and subjects, prompting interaction through shadow-activated video-portraits. Similarly, SOFTlab's *Mirror Mirror (2019)* integrates a set of panoramic mirrors and light fixtures to create an immersive environment, inviting visitors to participate in the artwork's transformation using their voices and movements.

3.1. Bruce Nauman: Live Taped Video Corridor (1970)

Bruce Nauman is an American artist who works with sculptures, films, photographs, videotapes, and performances. One of his major works *Live Taped Video Corridor (1970)*, which is an evolution of his prior work *Performance Corridor (1969)*[6], influenced the formulation of this exhibit installation. *Live Taped Video Corridor* (Image 2) comprises of a looped video installation designed to immerse participants in a vertically elongated make-shift corridor. This well-defined space consists of two stacked floor-mounted monitors positioned at the end of the corridor, with a ceiling-mounted camera above the entrance. The bottom monitor displays a pre-recorded loop of the empty corridor with nobody inside while the other exhibits real-time footage capturing the

[6] *Bruce Nauman | Performance Corridor*. (1969). The Guggenheim Museums and Foundation. https://www.guggenheim.org/artwork/3148

movements of participants within the space. Due to the architectural constraints of the corridor, the work evokes a sense of claustrophobia as the participant is restricted to only linear movement with no other movement permitted. Upon the participant entering the corridor, the images on the video monitors accentuate the perceptual dynamics, adding to the claustrophobic ambience. As the participant progresses deeper into the corridor, their figure on the monitor diminishes in size distancing them away from their own actions. The camera's position hinders the participant from seeing their faces on the monitor and by only being able to view their back, fosters a dissociative experience wherein self-perception becomes fragmented.

Image 2: Bruce Nauman, Live Taped Video Corridor, Solomon R. Guggenheim Museum, New York Panza Collection, Gift, 1992. https://www.guggenheim.org/artwork/3153

Nauman's work challenges conventional notions of technology as a reflective medium, as discussed earlier through David Rokeby's essay *Transforming Mirrors (1996)* wherein interactive technologies foster the viewer's engagement through reflection. While Nauman's work on one hand prompts audience engagement, the installation destabilizes the conventional mirror function. This further force the participants to find themselves being surveilled as their movements are monitored and distorted due to the installation's spatial configurations. M Leonard *(n.d.)* in *Live-Taped Video Corridor – Art & Electronic Media* mentions the use of a "control group" by saying:

> This monitor, which displays an endless videotape loop of the empty corridor (though it could be a still photograph and the difference would be indiscernable), acts as a sort of "negative control group" for the installation. It displays what the artwork is without the introduction of the human element: an empty hallway with two monitors on the floor. The inclusion of this "control group" by Nauman is his acknowledgment of his reliance on an active audience for this particular work. (para. 4).

Inspired by Nauman's work, this thesis project explores the theme of surveillance and viewer participation by employing mirrors to depict notions of observation and visibility. There is a sudden shift between the role of watching yourself in the mirrors vs being monitored at the same time and being shown that in the very same space. By prompting the participants to engage with the space with heightened awareness as they see their own reflections in the mirrors and the projected live feed off the mirrors, I aim to evoke a sense of invisible and visible surveillance wherein the viewers are aware of being observed yet unable to figure out the full extent of their visibility.

3.2. Stanza: Visitors To A Gallery (2004)

Dr. Stanza, an independent artist based in London (UK), has been exhibiting his work since 1982. His work revolves around surveillance systems, responsive environments, observation, invisible

agency, and the use of an enclosed gallery space. In one of his series of installation exhibits, *Visitors To A Gallery (2004)*, he employs a digital artwork surveillance system that captures visitors entering the gallery, incorporating them directly into the artwork itself. Situated within a gallery setting, the artwork blurs the lines between observer and observed as individuals upon entering the gallery become a part of the space and the private body is made public and shared. By utilizing proximity sensors and live video feeds (Image 3) there is a real-time exploration of human interaction with surveillance systems transforming the gallery into a dynamic and interactive environment. He goes on to relate the artwork with creating a parallel universe which he refers to as a *parallel reality*.

Image 3: Stanza: Visitors To A Gallery. https://stanza.co.uk/cctv_web/index.html

Using the gallery as a database and the visitors as the data, the movements, patterns, and interactions of visitors are recorded and interpreted as data points, making the visitors not merely passive spectators but active contributors to the evolving artwork. Stanza also goes on to utilize the gallery space as a panopticon, a space of constant surveillance and observation; intended to confront viewers with the implications of surveillance technologies on notions of privacy and personal agency. His pioneering efforts in the early 2000s through this work have inspired many elements within this thesis project, which includes exhibiting within a gallery setting and utilizing

that space to incorporate the visitors as the artwork has been the main integration. In the context of Stanza's installation exhibit, there is constant capturing of the visitors, which gets reflected back to them through a mix of analogue and digital aspects. The visitors get embedded into the installation, highlighting the notion of being part of a surveillance video feed. This case study helped me understand the evolving relationship between art, technology, and surveillance as well as articulating the use of cameras to invite the visitors to stumble upon their reflections in the space.

3.3. Rafael Lozano-Hemmer: Under Scan, *Relational Architecture 11 (2005)*

Mexican-Canadian media artist, Rafael Lozano-Hemmer has been known for his innovative works that merge architecture and performance art by utilizing various technologies such as robotic lights, digital fountains, computerized surveillance, media walls and telematic networks to facilitate public engagement. *Under Scan* (2005), an interactive video art installation, a part of his series called "Relational Architecture" embodies Lozano-Hemmer's innovative blend of technology, public engagement, and interaction between video portraits and passers-by. Situated in a public space over many years in different locations. The art installation utilizes a computerized tracking system to detect passers-by and trigger the activation of video-portraits projected within their shadows. These video-portraits were previously recorded by a team of local filmmakers.[7] In the installation when a shadow casts upon these video-portraits that have been dispersed at random spots, they "awaken" and engage in eye contact with the viewer (Images 4-5). Till the time the viewer's (passers-by) shadow is casting upon the video-portrait, it keeps on playing, after which, if there is no shadow casted upon the video-portraits, the portraits look away from the viewer and slowly disappear. The installation re-sets after every 7 minutes.

[7] "Over one thousand video-portraits of volunteers were taken in Derby, Leicester, Lincoln, Northampton and Nottingham by a team of local filmmakers. For its London presentation in Trafalgar Square, Tate Modern filmed over 250 additional recordings. As people were free to portray themselves in whatever way they desired, a wide range of performances were captured." https://www.lozano-hemmer.com/under_scan.php

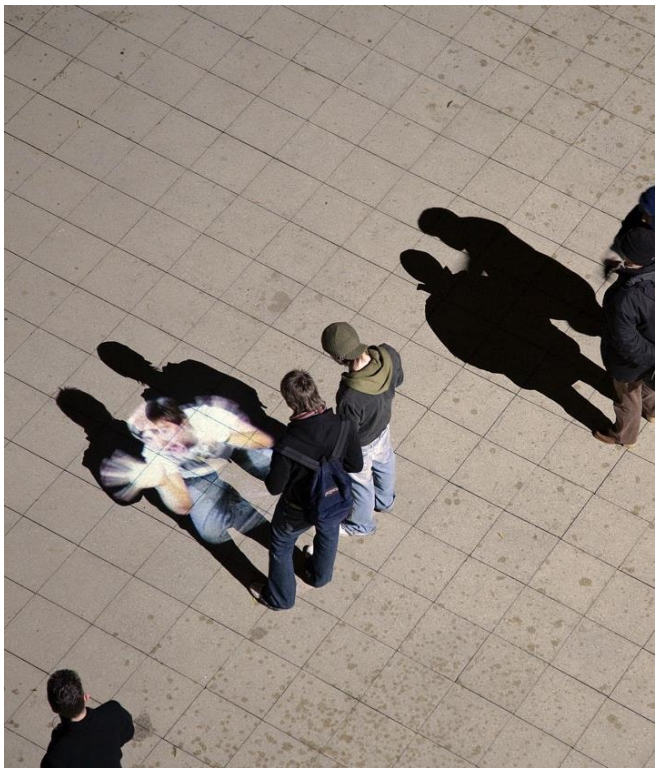

Image 4: Rafael Lozano-Hemmer, "Under Scan, Relational Architecture 11", 2005.
Shown here: Brayford University Campus, Lincoln, United Kingdom
Photo by: Antimodular Research. https://www.lozano-hemmer.com/under_scan.php

Image 5: Rafael Lozano-Hemmer, "Under Scan, Relational Architecture 11", 2005.
Shown here: Brayford University Campus, Lincoln, United Kingdom.
Photo by: Antimodular Research. https://www.lozano-hemmer.com/under_scan.php

Under Scan stands as a significant contribution to the realm of interactive video art installations. The focus lies on the dynamics of observation and the observer, where individuals depicted in the video-portraits serve as subjects of observation, while the viewer assumes the role of the observer. This installation offers a thought-provoking exploration of presence and engagement between the viewer and the video-portraits within the evolving dynamics of public spaces. The video-portraits encourage the notion of interaction among viewers as the second their shadow casts upon it, viewers automatically get engaged with the art installation. As viewers adjust their body movements and orientations, a natural inclination arises to ascertain the cause and effect behind the activation of the video-portraits. This feature, which encourages viewers to actively participate and interact with the installation, is mirrored in this thesis project. The immersive installation invites visitors to engage with the physical space and elements dispersed around, such as a camera and projections on mirrors until they discover the camera and discern its workings.

3.4. Softlab: Mirror Mirror (2019)

Based in New York City, SOFTlab is a design studio led by Michael Szivos. Their approach integrates a research-based design practice to explore the interplay between technology, art, architecture, and engagement with the public. *Mirror Mirror (2019)*[8]*,* commissioned by the city of Alexandria's Office of the Arts (VA), is an opened circle structure measuring 25 feet in diameter and 8 feet high, that resembles a lighthouse made of Fresnel lenses incorporating elements of reflection and refraction. Situated in an urban environment, the installation encompasses the surroundings while grabbing the pedestrian's attention and invites them to engage with the structure in ways both familiar and unexpected. The monochromatic mirrors on the exterior

[8] To understand the context of this installation, I have referred to its documentation through their website. This further helped me in making correlations with my work and the installation.
https://soft-lab.com/project/mirror-mirror/

reflect the urban environment, the waterfront, and visitors, meanwhile, the inner structure displays a full-color spectrum (Images 6-7). Furthermore, the installation reacts to sound stimuli, enabling visitors to engage with it actively. Each vertical component of the installation contains LED fixtures that are triggered by sound, generating luminous responses. This dynamic interaction transforms the outward-facing panels from mirrored to transparent, while the inner panels retain their reflective quality, resulting in an endless, multicolored interplay of reflections. The interplay of light, sound, and the materials used creates a dynamic and immersive environment, inviting visitors to participate in the installation's transformation using their voices and movements. In the context of this thesis project, the incorporation of mirrors, projections and inviting visitors to engage with the elements aims to foster a similar physical immersive environment that is reflected in *Mirror Mirror*.

Image 6: Mirror Mirror Alexandria, VA 2019. Photo by Alan Tansey.
https://soft-lab.com/project/mirror-mirror/

Image 7: Mirror Mirror Alexandria, VA 2019. Photo by Alan Tansey.
https://soft-lab.com/project/mirror-mirror/

In conclusion, by reviewing all the mentioned works, there were insightful correlations that could be made in relation to this thesis project that were further cultivated into the prototype development. In the next chapter, key research methods and methodologies shall be discussed.

Chapter 4: Research Methods and Methodologies

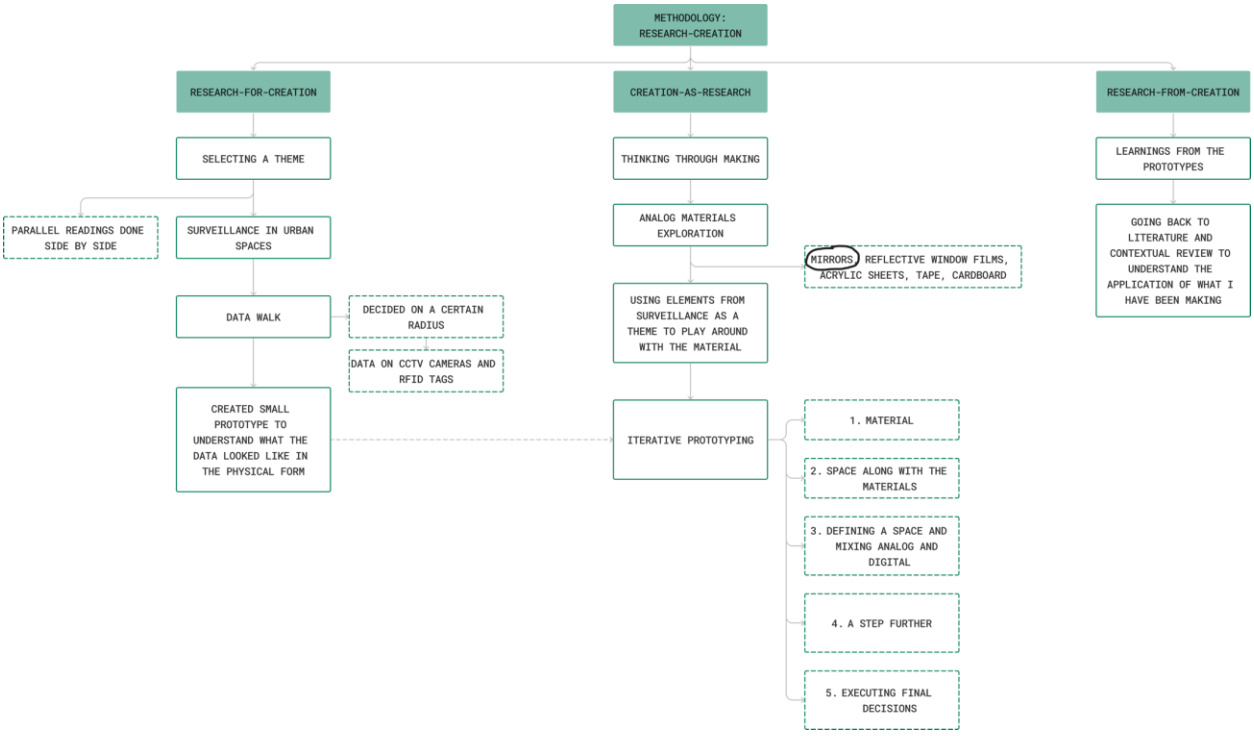

Diagram 1: Breakdown of Research-Creation Methodology

This chapter emphasizes the development of this thesis, specifically the studio project section. A mixed-methods research involved literature and contextual review, research-creation methodology, quantitative and qualitative collection of data and iterative prototyping. One of the main components that has had a huge impact on this thesis has been the integration of parallel *making* that reflected in (and as) the *research*. Research-Creation as talked about in Chapman and Sawchuk's (2012) *Research-Creation: Intervention, Analysis and "Family Resemblances"* mention "Research-creation 'theses' or projects typically integrate a creative process, experimental aesthetic component, or an artistic work as an integral part of the study." (2012, p. 6). This methodology provides an opportunity for the researcher to go along with their intuition and "feeling", which makes it possible to work through the research from a theoretical, creative, and artistic point of view. Incorporating a mix of creating artifacts or prototypes, this methodology

focuses on providing a hands-on experimentation process offering a deeper understanding of the subject matter. This resonated with me while I was moving along with the project as the process involved parallel iterative prototyping and conducting literature research. As highlighted by the authors in the article:

> Generating situated forms of knowledge, combined with new ways of developing and disseminating that knowledge, research-creation helps reveal different contexts and methods for cultural analysis (e.g., dance or dramatic performances in theatres or other spaces, a series of studio-based audio compositions, collaborative prototyping of new media applications, et cetera). (Chapman and Sawchuk, 2012, pp. 11-12).

This framework provided an opportunity for me to emphasize my artistic expression while simultaneously focusing on new ways of generating knowledge and insights. In the journal article, the four sub-categories under the method are stated as follows: *research-for-creation, research-from-creation, creative presentations of research, and creation-as-research*. For the making part of this thesis, a combination of them have been used as illustrated in (Diagram 1) above. The research-for-creation method focuses on the different ways of "gathering together of material, ideas, concepts, collaborators, technologies, et cetera, in order to begin." (Chapman, 2012, p. 15). This method of gathering information together eventually leads to a future creation element that holds an important place in the outcome. In research-from-creation "there is a form of iterative design or testing that involves the participation of individuals or groups who may be an intended audience." (Chapman, 2012, p. 16). In creation-as-research, "'Creation-as-research' involves the elaboration of projects where creation is required in order for research to emerge. It is about investigating the relationship between technology, gathering, and revealing through creation." (Chapman, 2012, p. 19).

Along with this, certain artists' work such as Nauman, Stanza, David Rokeby, Rafael Lozano-Hemmer, and others provided contextual importance for me to understand the theme I was working with. Looking at the artist's works made me think that these works were produced

decades ago when technological tools were being discovered. Yet they had a successful impact on the outcome. *How could I use technology to enhance the experience yet not make it the front and center element?* The decision to use mirrors (as the main element) and incorporate the digital aspect to it made this project move further. Qualitative and quantitative data was collected around a certain radius of 205 Richmond St West (OCADU Graduate Building). For this, a process called as Data Walk[9] was conducted. Lastly, one of the primary methods that had a huge impact on the formulation of this project was iterative prototyping. This was conducted from start to finish and involved multiple prototype installs, and material exploration which eventually helped me in understanding the research.

The sections below will briefly elaborate on the methods used and in chapter 5: prototype development, I shall be providing a detailed explanation of the different stages and what they led to.

4.1. Data Walk

Unlike traditional methods for collecting data such as using public resources, interviews etc. the primary approach employed was a process known as "Data Walk". It mainly focuses on an individual/group of people stepping out into urban space physically engaging with the data and documenting the same in real-time. As this thesis is based on showcasing surveillance systems that surround us in our immediate public environment, engaging with the urban space served as an important method. Through this method, the walk entailed documenting observations meanwhile taking photographs and collecting the data needed. A mix of qualitative and quantitative data was collected. Qualitative data entailed observing the positioning, structural and spatial dynamics of the surveillance systems on the streets. The placement of the cameras was usually up high in the corner embedding into the walls whereas the RFID Tags were situated at

[9] *Data Walking – A process for reflecting on the production and significance of data.* https://www.datawalking.uk/

the waist level at the entrance of the building. Some additional observations regarding the surveillance systems were whether these cameras and RFID Tags were in working conditions or not. Similar observations have been discussed in *Ethnography for a Data-Saturated World, Chapter 9: The data walkshop and radical bottom-up data knowledge* by Alison Powell (2018). Through a discussion on situating and reflecting on surveillance in one of the sections, she discusses through an experience of a data walk that was conducted:

> One common element of critique was the experience of observing traces of data-based surveillance. In every walk, some participants photographed the banal architecture of surveillance: blank-surfaced round surveillance cameras hanging from above in university campuses and privatised shopping areas, passcode protected gates and doors that close spaces off to those without the data, and railway station turnstiles with RFID readers that collect data on who passes. But many of these installations are inscrutable on their own. It is impossible to know whether the camera is functioning, or how the RFID transport data is packaged up and sold – much less to whom. (2018, p.223).

Through a mix of all these observations, they significantly influenced the design aesthetics for this project such as the characteristic grid-like layout of downtown Toronto, and the structural look of the surveillance systems, which was further incorporated into the making, using analogue materials such as the mirrors. Discussed in detail in section 5.1.1, Quantitative data was collected on the number of CCTV and RFID Tags that were present on the streets. This method revealed an understanding of the comparison between the two surveillance systems. It was evident areas that were heavily populated with these systems were workplaces and residential buildings.

This method provided valuable insights for further development of the research project. Multiple data walks enabled me to note down the points that I might have missed before and made the observations clearer. Data walking has emerged as a powerful strategy for research creation as it involves critical observations while navigating through space.

4.2. Iterative Prototyping

Constant making came about to be the core method of the research-creation process. This method helped in integrating the research into the project and vice-versa. There was a focus on specific elements such as the use of analogue materials in a space along with digital layering to it. This process involved connecting the materials with insights from the data walk and other research done as discussed in the literature and contextual review and then used further in material exploration. Rather than following strict prototyping cycles, there was an emphasis on relying on intuition and observations made when the elements were placed in each space. Continuous exploration, observations and implementation of these into the next prototypes helped in creating a framework to blend the materials, technologies, and space together. The next chapter will discuss this method in detail explaining the role each prototype played in moving this project forward.

Chapter 5: Prototype Development

This chapter focuses on the iterative prototyping conducted throughout the duration of this thesis. As discussed in the previous chapter, *creation* has been integral to this project, leading to a deeper understanding of my project. With every iteration of the prototype, no matter how rough or small, I gained a better understanding of how the materials, research and space interact with each other. A major part of this process involved creating prototypes while simultaneously conducting literature reviews. This helped connect the dots between *what* I was making and *why* I was making it. Four different prototypes were created, each developed through a different method and directed towards a different outcome. In developing these prototypes, I gathered and understood data, explored different materials and technologies, articulated the effects of those materials within a space and ultimately pieced everything together.

I thoroughly enjoyed this part; it has truly been a joy working with various materials, digital technologies, and gaining a deeper understanding of what I enjoy doing.

5.1. Prototype One: Discovery Through Exploration

Formulating my initial ideas into the creation stage began with articulating the kind of information I wanted to convey to visitors through the experience. Relying on a digital journal to track my ideas and employing the brainstorming process, I actively recorded my ideas in the form of mind maps. As illustrated below in (Diagram 2), early ideation involved selecting a theme centered around “digital and data privacy” and branching out ideas from there. The branches explored categories focusing on themes I wanted to explore, elements I could draw from them, installation ideas, and my thoughts. From the outset, the primary goal was to provide knowledge and educate visitors through an immersive experience. However, the question arose of how to create a well-navigated space with the desired information.

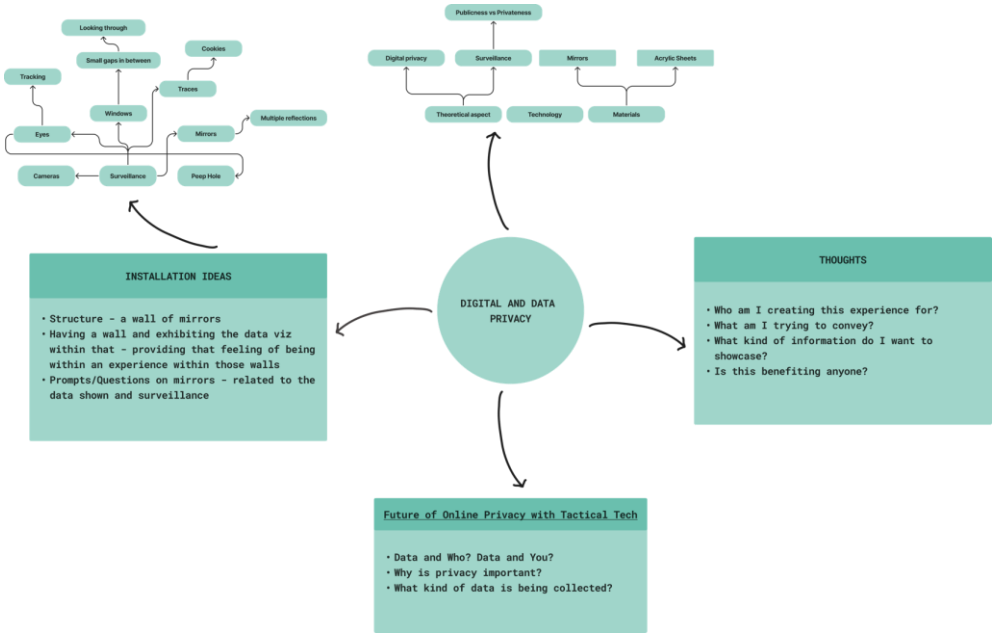

Diagram 2: Initial ideation of theme.

To work with the timeframe and constraints for this thesis project, I decided to focus on a sub-theme within digital privacy thereby choosing surveillance as the main theme, specifically targeting surveillance in urban spaces (Diagram 3).

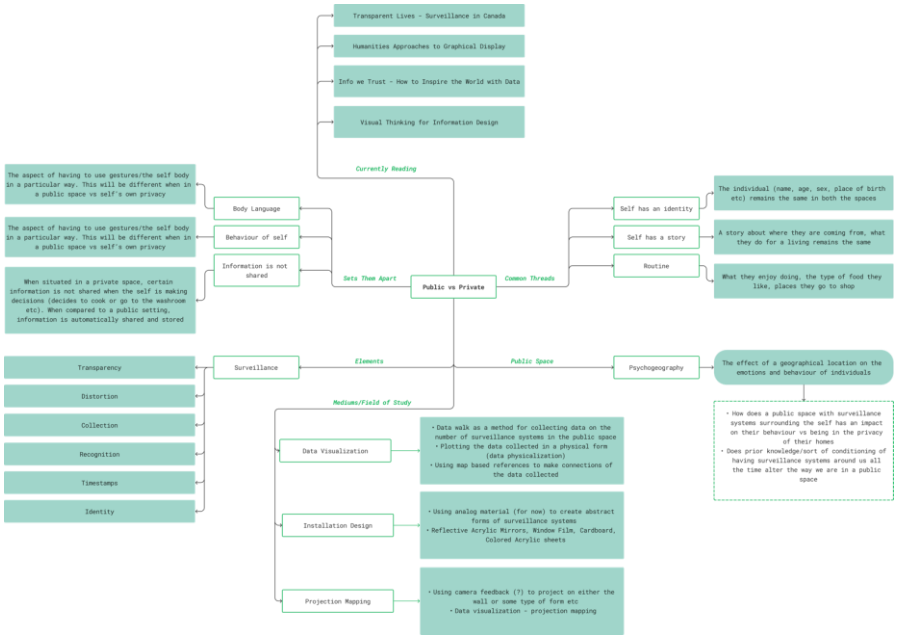

Diagram 3: Conceptualization of sub-theme.

An important aspect during this stage was continuous reading of the literature on surveillance, both before and after conducting data walks. As mentioned in Chapter 2.1.1. Embedding of Surveillance: Canada, many surveillance cameras go unnoticed due to people's unawareness of their presence. They are often placed at heights not in peripheral view and vary in size, enabling them to blend into ceilings and walls (Image 8). I highlight this because even before conducting walks, I started noticing these aspects clearly and in a different light whenever I stepped out onto the streets. As I continued reading and conducting data walks, I "actually" noticed the number of cameras I encountered within just one block, which was quite surprising. It struck me how important it is to visually see the quantity of cameras in person. This led me to ask myself: How can I convey this information in an immersive space where people can discover and learn from this data?

Image 8: Surveillance cameras captured during data walk. Photo by Author

5.1.1. Journey of Mapping the Blocks

The OCADU graduate building is located at 205 Richmond St West, Toronto. On a sunny Wednesday in the month of July, I decided to conduct the first data walk. Not a lot of materials were needed except a notebook, allocated colored pens, a phone, and earphones. Using the graduate building as the starting point, I headed out. By this time, I had already crossed this block several times and had an idea of how I wanted to go about collecting the data. I drew a simple map starting from Richmond St W to Simcoe St and coming back to the building through Nelson St. CCTV cameras and RFID machines are two of the most common surveillance systems that are present in public spaces. Almost every corner on the street would have a camera installed as well as some sort of scanning mechanism. As and when I saw a camera and any black rectangular device with a light on it, I was jotting them down as dots as shown below in (Image 9).

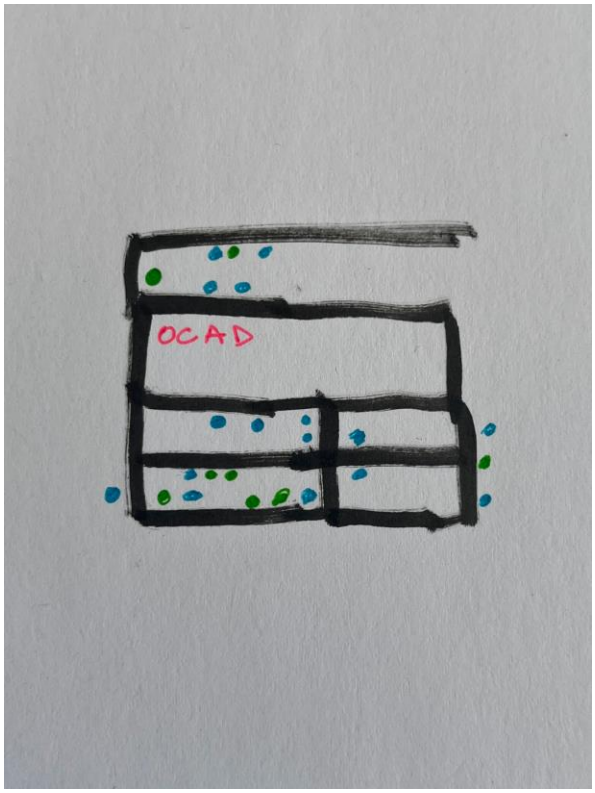

Image 9: Snapshot of map through data walk

I was taken aback by the huge number of little dots I was mapping as I was walking. Certain areas had a larger number of cameras in comparison to RFID systems. However, the variations while mapping within the block are what made me excited to work with this data, as I was able to map out the systems that I walk across on a regular basis. The one underlying challenge during this entire process was that I could not confirm whether the cameras worked at the given location. Even though the devices were physically present there, I wondered whether they were working in real time. Regardless of that, I planned to still go ahead with this dataset as it focuses on the number of these systems installed and I knew that I was off to a good start. The first data walk took about 15 minutes from start to finish and to understand the space and area better, I then decided to plot the same data onto a snapshot of Google Maps. Through this walk, it was visible that there were 15 CCTV cameras and 8 RFID machines as shown in (Image 10) below. It was apparent from this that if just in half a block there were 23 surveillance systems, what would the outcome be if I expanded the area. Instead of going ahead and collecting more data, I decided to work with this for the first prototype. It was important to visually represent this in a physical form and I could focus on the data aspect later. I decided to focus on exploring and playing around with materials and worked on small prototypes with analogue materials as talked about in the next section.

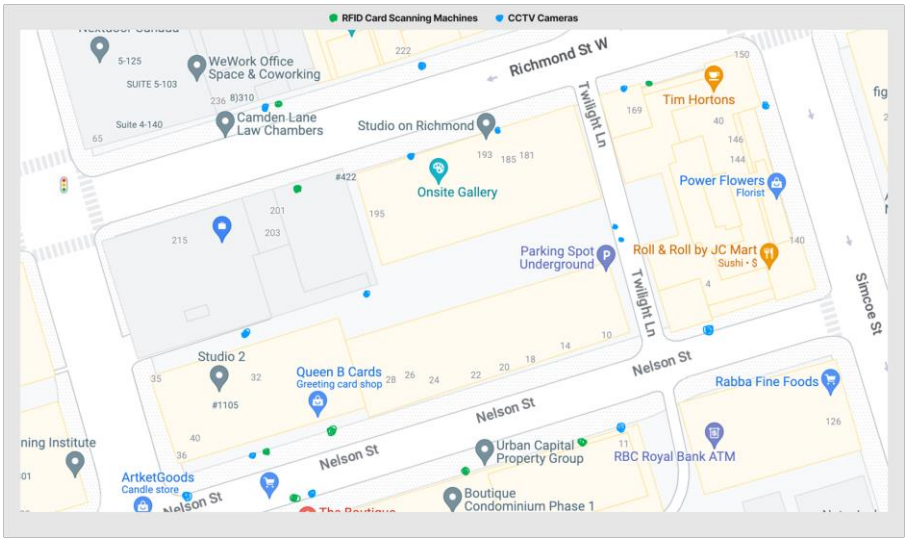

Image 10: Snapshot of data plotted on google maps

5.1.2. Focusing on Analogue Materials

If a comparison would have to be made between a CCTV Camera and a mirror, there happen to be a lot of similarities. The cameras we see on the streets are usually black and white dome-shaped at a higher placement on a building exterior. If we look at the camera from a close distance, we happen to see our reflection on the black screen. A reflection that is sort of distorted and skewed (Image 11). What we don't get to see is how we are viewed from the other side; the side that another individual gets to see while looking at multiple monitors. Now if we look at the physical aspects of mirrors while making parallel connections to cameras; we see some common threads. *Reflection* being one of them.

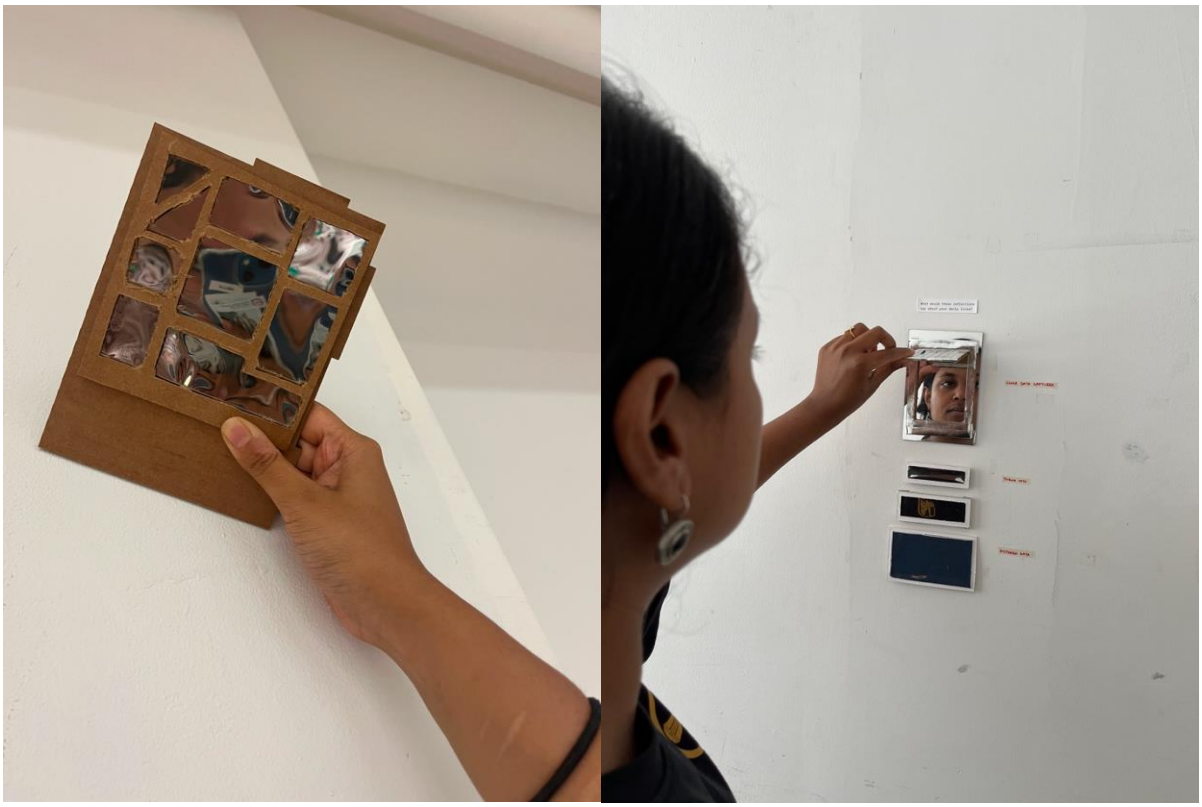

Image 11: Material exploration with reflective acrylic and mirrors. Photo by Author

As I mentioned before, I went into the first stage of creating prototypes with certain goals in mind, one of them focused on using only *analogue materials*. The approach was centered around material exploration and being able to depict elements of surveillance systems through these materials. The materials I used were acrylic reflective mirrors, reflective window film, tapes,

and cardboard (Image 12). Elements such as reflection, distortion, and layers of surveillance were the utmost focus and I wanted to use the materials to enhance these elements. The main reason for not using any digital method for this prototype was to be able to focus on defining and depicting the elements of surveillance. I was keen on having a strong foundation to start the material exploration process and have a base to begin with. I believed that starting with technology right away would hinder my process and slow me down. I wanted to push myself to depict those elements without any digital layer right now.

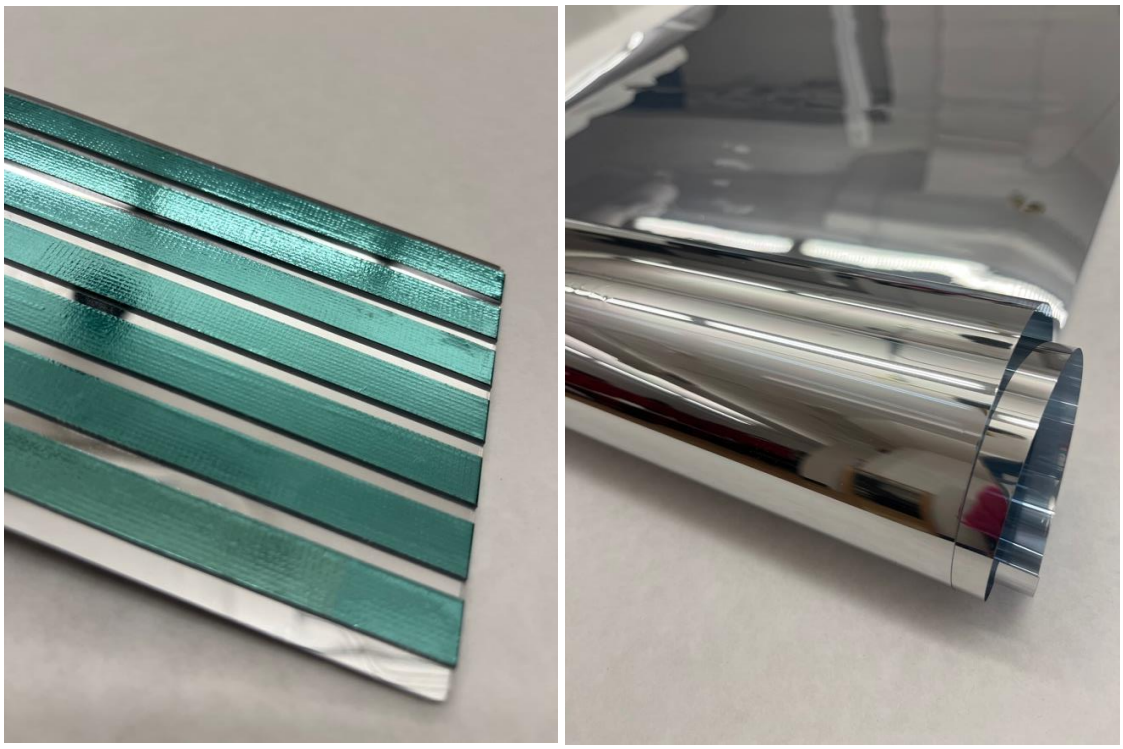

Image 12: Materials used in the installation. Photo by Author

As I began exploring further, I was immediately leaning towards using *mirrors* as a metaphor to depict reflection and distortion. The essence of an individual being able to see themselves in the mirrors, was an aspect that I wanted to highlight. During this exploration stage, I was constantly intrigued by the physical elements of the cameras I saw located on the corner of the exterior of buildings in the public space. Surrounded by these cameras varying in size and placement, I stumbled upon an idea. I wanted to understand whether I was able to communicate what I wanted to through those elements that were being exhibited. This method was an

important way for me to keep on working on different factors that would eventually blend theoretical knowledge and visual communication. When I started playing around with the material, I didn't really have a plan in terms of what I was creating. But as I started to cut different shapes and just experiment with a free mind, I ended up with some interesting forms. In the back of my head, I knew there were abstract forms of maps, roads, lanes, and sidewalks that I was visualizing as I stepped out and slowly, they started to show on the materials as well. This version helped me find a visual way to communicate my idea and pushed me further to keep experimenting with the materials. In (Image 13) below, the data collected through the first data walk was represented for a prototype installation. Along with the data physicalization, I provided context of what the installation was about to provide a visual presentation of what I had observed during the data walk.

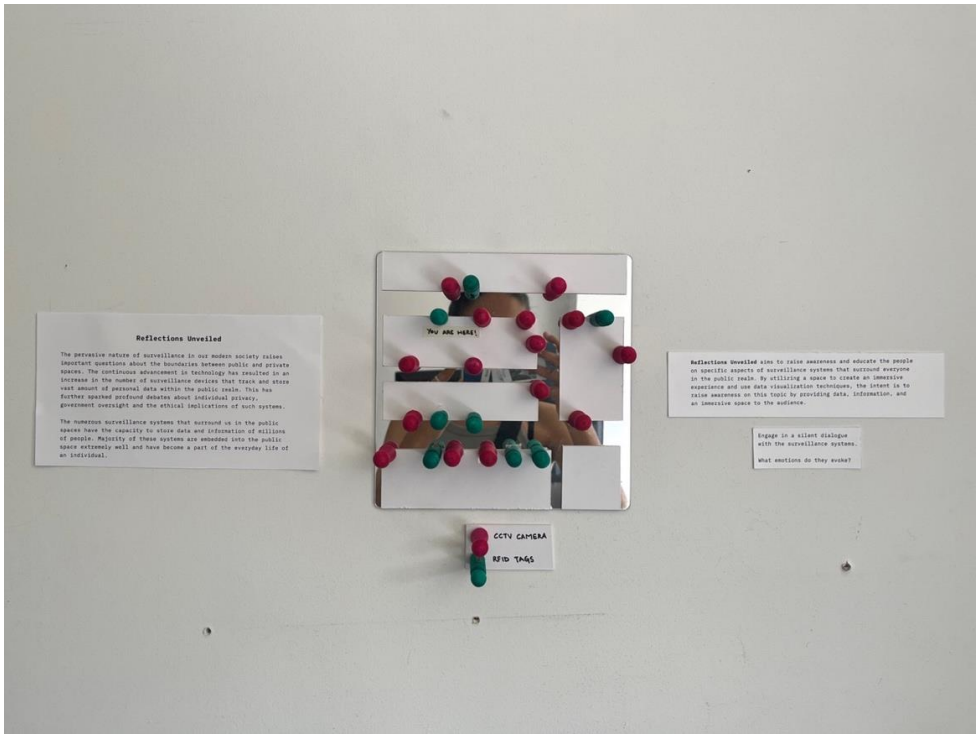

Image 13: Data collected through data walk in physical form. Photo by Author

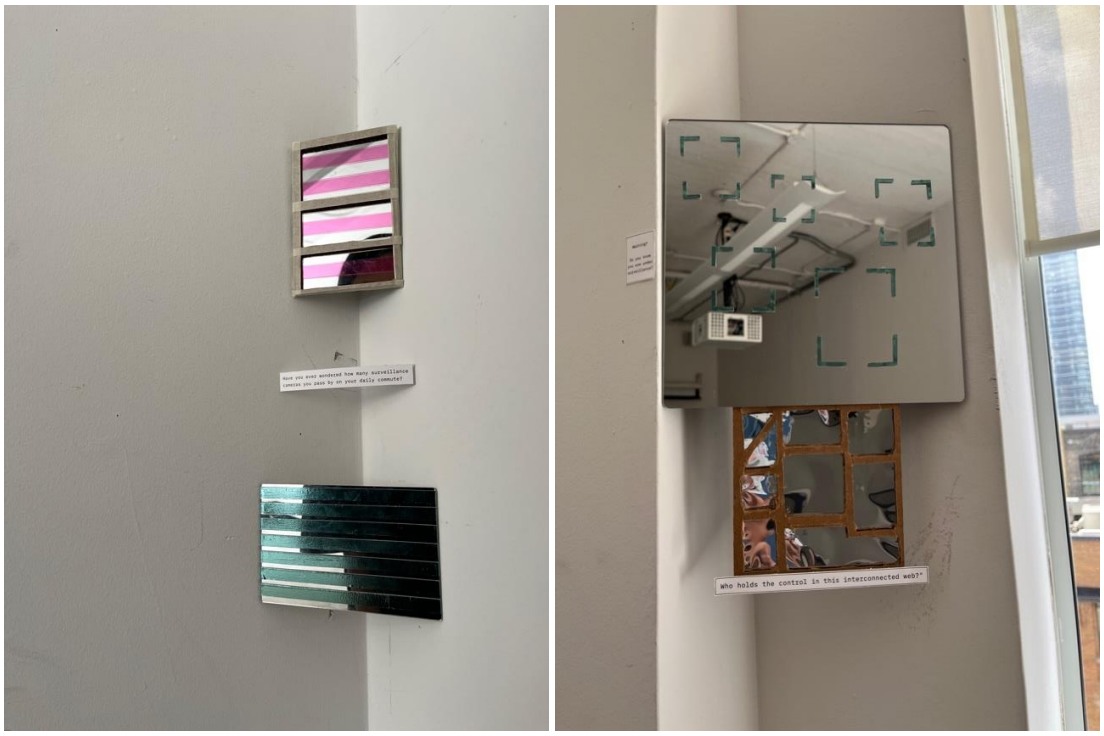

Image 14: Elements placed in installation. Photo by Author

5.1.3. Prototype One: Observations and Learnings

As I put all the elements together for exhibiting the prototype, I realized the importance *space* played in executing the installation. The room I chose to showcase this prototype had multiple distractions such as wires on the floor, and a projector screen, all these things distracted the audience while interacting with the space. Due to the size of the room being relatively large, it hindered the navigational experience as the elements were distributed far apart from each other. The importance of choosing the right space and the placement of the elements was a huge factor. Too big of a space would disrupt the audience's experience of navigating through the space. I also did not want the experience to be a controlled setting but rather wanted the audience to move around and create their own way of experiencing the space. Some important feedback that was received through this prototype was the appreciation of the utilization of a handmade approach (Image 14) to communicate about surveillance technology. The materiality of the pieces, specifically the reflective elements, seemed to embody the critical position of surveillance culture.

While I received positive feedback for the elements created, there was a communication gap regarding the data that was presented. The visitors could not make connections from the data and thought it might be cameras in the building or the floor where the install was exhibited. The visitors happened to notice the small reflective elements from their peripheral vision which was an interesting takeaway. I wanted to reflect on the feedback and the observations I made and think about the areas that could be improved.

5.2. Prototype Two: Space Matters

The goal behind the second prototype was to incorporate the same elements created before within a smaller space. I wanted to work with an area that was enclosed from multiple sides and would help the visitors navigate through the experience (Images 15-16). In comparison to the space chosen for the last prototype, this was a much smaller area with a lot of corners to work with. As there was no change in the materialization aspect, I was relying on the observations regarding how people approached the elements, navigated through the space and whether they took away something at the end of the visit.

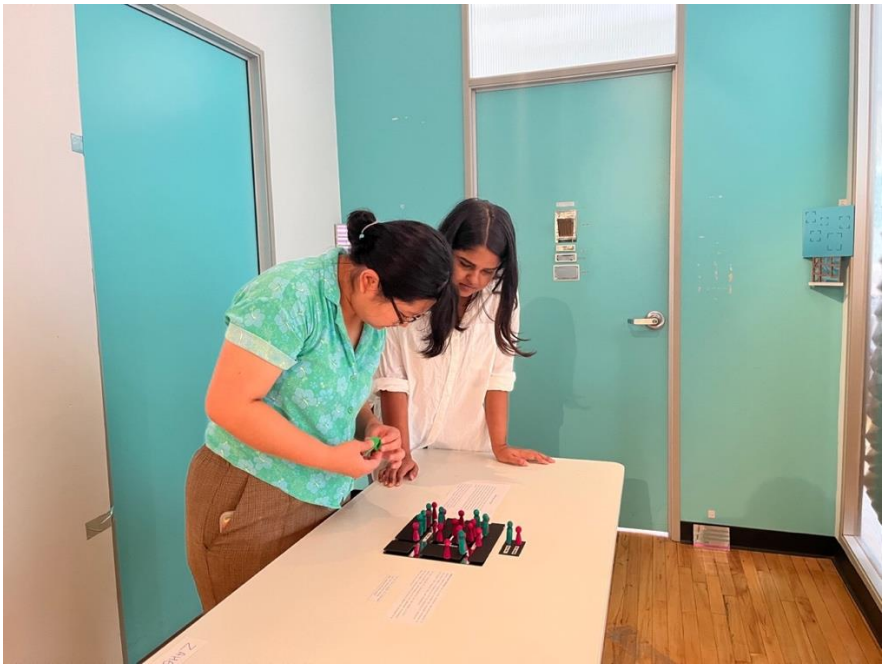

Image 15: Visitors interacting with data physicalization element. Photo by Author

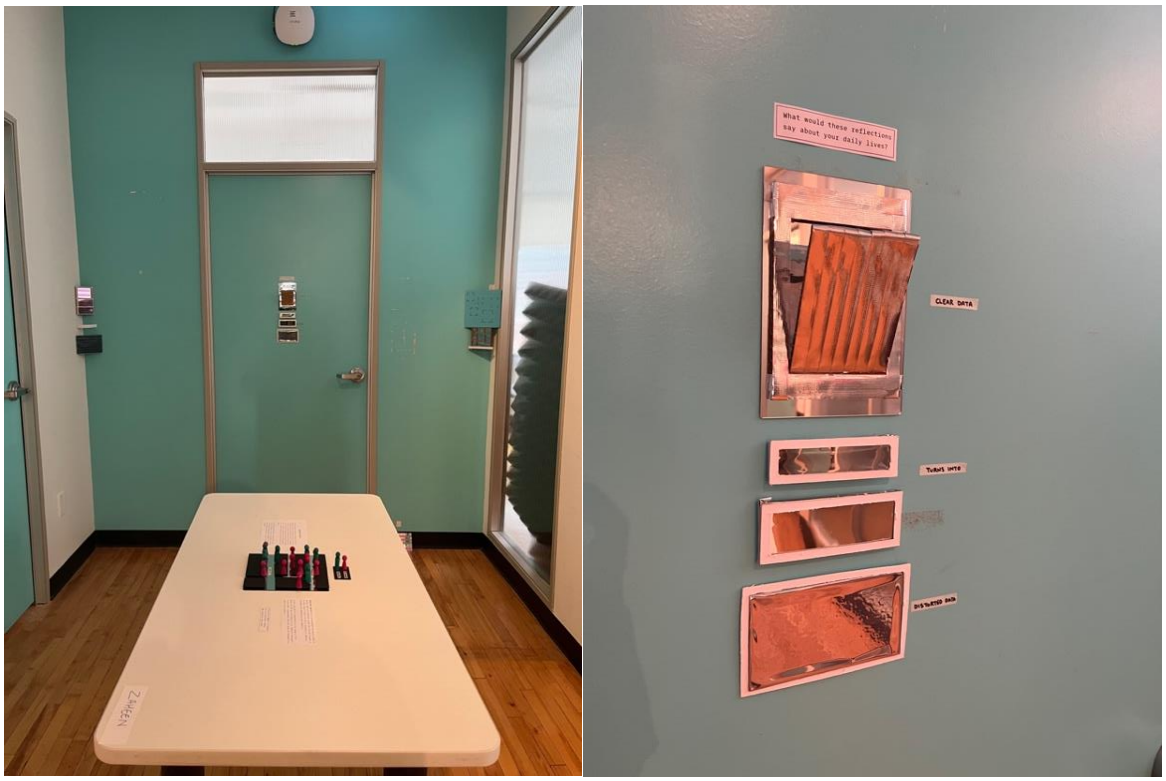

Image 16: Elements displayed in installation space. Photo by Author

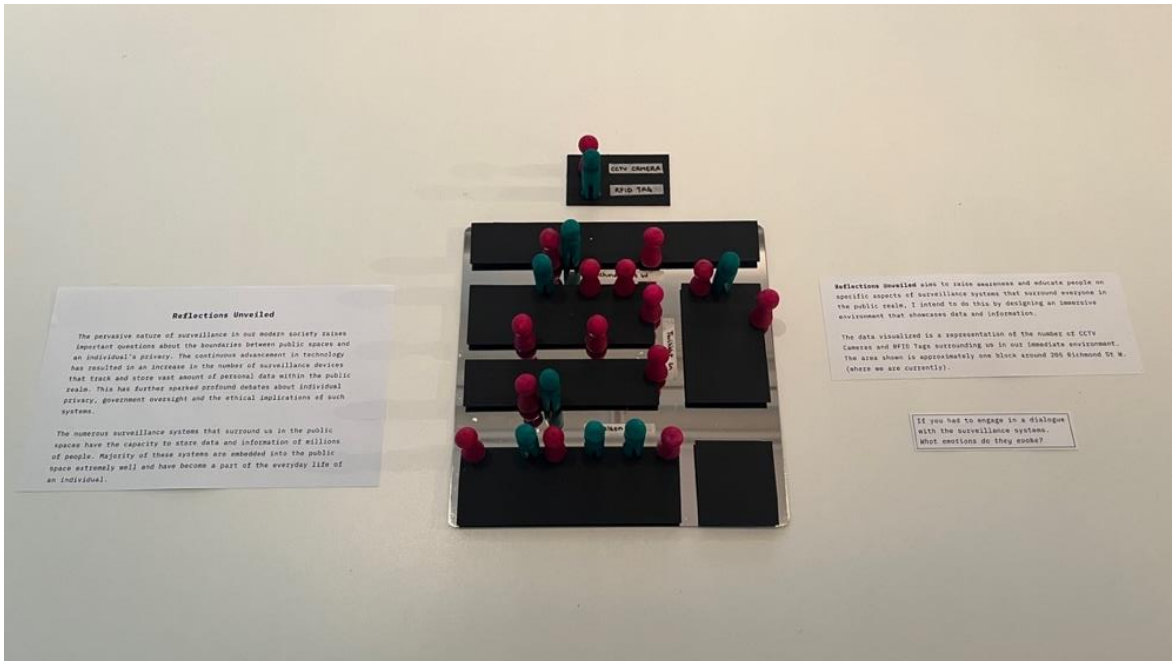

Image 17: Close-up of data physicalization. Photo by Author

5.2.1. Prototype Two: Observations and Learnings

Through this prototype, there was a mixed set of feedback received. The people who had not seen the earlier prototype were intrigued by the materialization used for the elements. The mirrors happen to have an interesting effect when visitors would interact with the space. Visitors were appreciative of the point that even though the materials used were mainly mirrors, there was still a very strong impact created. The use of 3D elements for the data physicalization was also received positively. On the other hand, there was not enough context provided in terms of what I was exactly trying to represent and showcase which in turn confused people a bit. The data physicalization kept on the tabletop (Image 17) ended up not making sense to a lot of people as they thought it was representing CCTV Cameras and RFID Machines in the building itself. As I hadn't made any changes to this element since the last prototype, it was evident that I was not successful in communicating the information. As mentioned before, an important element throughout this project was to successfully represent the data collected so that it is communicative, and people could extract knowledge through that. An observation that I made during the install was that it was a better experience when the setting was not controlled, and people could navigate through the experience through their own choices. I intentionally placed certain items on the floor, like a mirror accompanied by a small notice. Interestingly, most visitors overlooked these details, highlighting the disconnect between their presence and visitors' awareness.

5.3. Prototype Three: Adding the Digital Aspect

There was a significant jump that was made from the previous prototypes to this one. Having previously concentrated solely on analog materials, I aimed to introduce a digital dimension (Image 18) to the experience this time around. The different elements that drove this prototype were the space used, incorporation of materials within that space along with the digital element,

and the creation of the data physicalization on a bigger scale. This prototype brought me one step closer to making sense of the space. (Image 18) shows the space used for installing this prototype.

Image 18: Space utilized for prototype three. Photo by Author

5.3.1. TouchDesigner to Create Visuals

An important aspect that drove this project to unlock a new feature was the incorporation of TouchDesigner[10] for projecting visuals. The key factor I kept in mind while doing this was to make sure the materials created, and the visuals generated would have to go hand in hand. As I had been working with the mirrors and creating the data physicalization, there was an aspect of grids that was showing across all these elements. Using that, I decided to work with a grid layout for the visuals. Even though I had worked with TouchDesigner before, I was still a beginner. However, because of the endless possibilities through this software, I was keen on working with it and using

[10] TouchDesigner is a node-based visual programming language for real-time interactive multimedia content, developed by the Toronto-based company Derivative. https://derivative.ca/

it in the thesis. Resources such as YouTube tutorials[11] and TouchDesigner website helped me to understand the basic terminology as well as how to navigate through the software. During this time, I experimented with a lot of different types of visual treatments as seen in (Images 19-20).

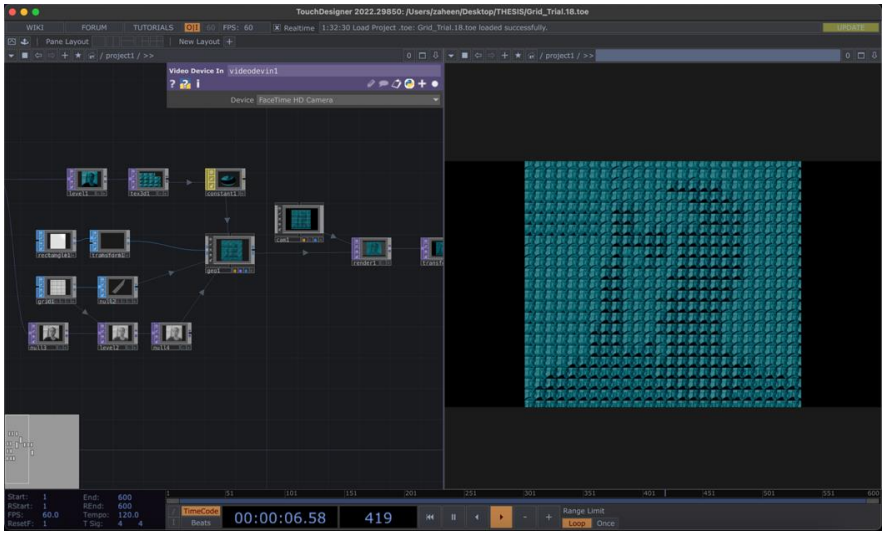

Image 19: Snapshot of TouchDesigner visual exploration

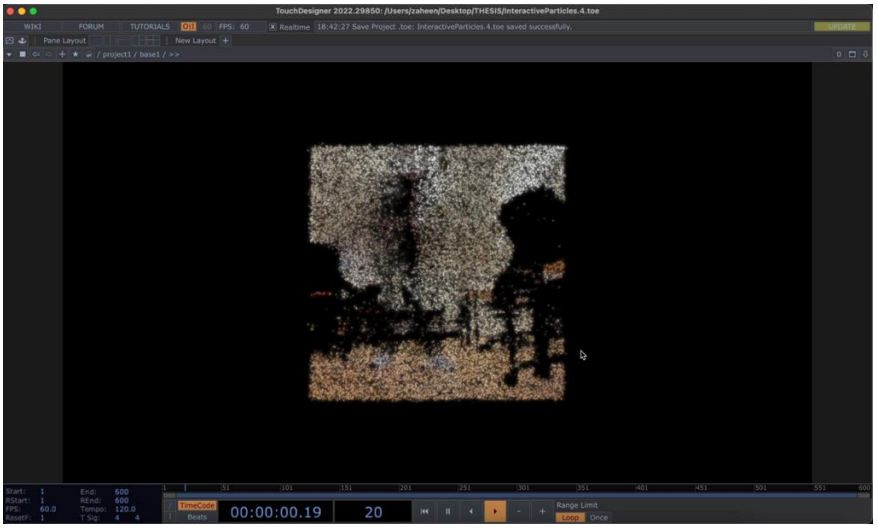

Image 20: Snapshot of TouchDesigner visual exploration 2

[11] The Interactive & Immersive HQ (Director). (2021, July 12). *Reactive GPU Particles: TouchDesigner Tutorial*. https://www.youtube.com/watch?v=g5DM80G5MT0
The Interactive & Immersive HQ (Director). (2021, November 22). *Easy Slitscan in TouchDesigner Tutorial*. https://www.youtube.com/watch?v=1ACBmGYB8uw
Function Store (Director). (2023, August 6). *Interactive Particles using particlesGpu in #touchdesigner*. https://www.youtube.com/watch?v=NnrWjQ_zO-s

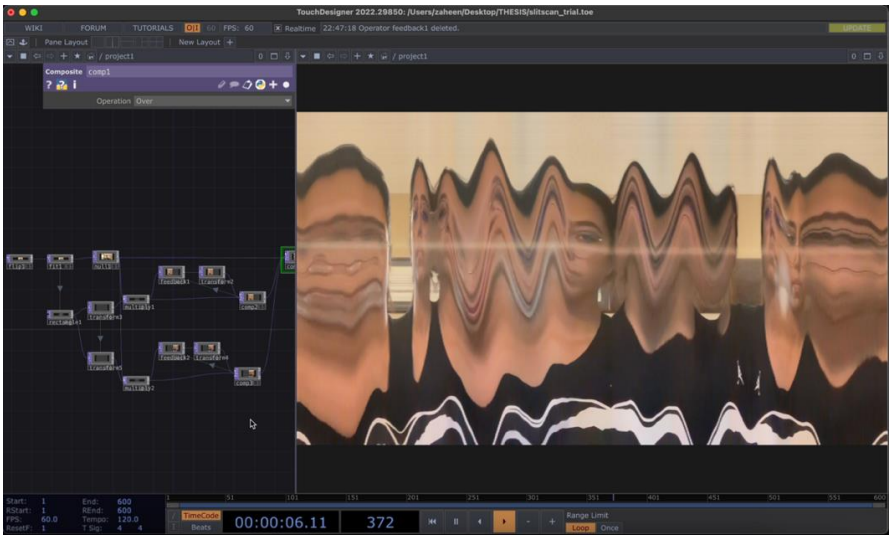

Image 21: Snapshot of TouchDesigner visual exploration 3

To create the effect of a fragmented image while visitors interact with the space, I started with using interactive particles. The motive behind this was to not let the visitors see a clear image of themselves as they would move around the space. Another exploration which was done was experimenting with the slit-scan effect (Image 21). Slit-scan which comes from slit-scan photography has been used mainly for photography and cinematography purposes. Its use has also been seen in scanning cameras for panoramic photography. To achieve that motion of an unclear and distorted visual, I played around with this. While this was a great start to understanding how I wanted to treat the visuals, I was still not satisfied with the treatment and how they were looking. There was clearly a gap in the connection between the space created and the digital aspect. It was then that I decided to work with the grid layout. Making connections with the blocks of the city, it made sense to experiment with these visuals.

5.3.2. Revisiting Data Walk

As shown earlier in prototypes one and two, I was working with a smaller data set but as I had decided to work with a larger space, keeping that aspect in mind; another data walk was conducted. Instead of observing and collecting data within one block, the area was expanded to six blocks. Spanning from Queen St West to King St West and Simcoe St to John St. The

parameters were kept the same: using the same technique as before, collecting numbers of CCTV cameras and RFID machines. As shown below in (Image 22) within those six blocks, a total of 105 cameras were discovered and 33 RFID machines. The data collected was quite surprising and revealed just how well these systems are embedded within the urban space.

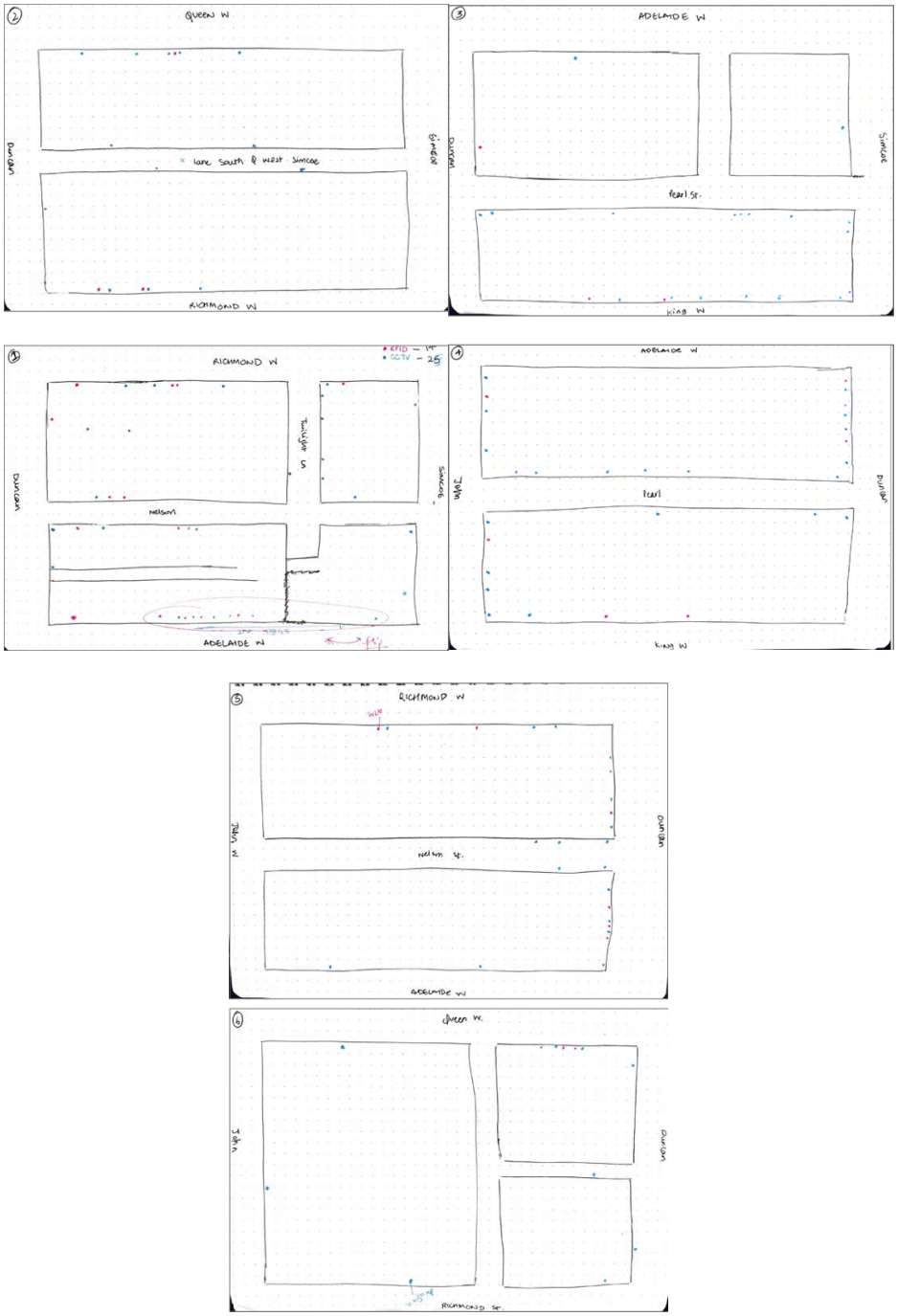

Image 22: Second data walk mapping

The next step was to uncover how I could use this information collected and show that in a physical space (Image 23). I wanted to move away from the small-scale data physicalization done before and decided to map out a more real-life setting. By mapping out the street's names and placing the corresponding block of data onto the floor, I wanted to invite the visitors to be able to walk through the space (Image 24). The motive behind this was to provide them with a sense of the actual physical feeling of the streets as they would discover the data displayed.

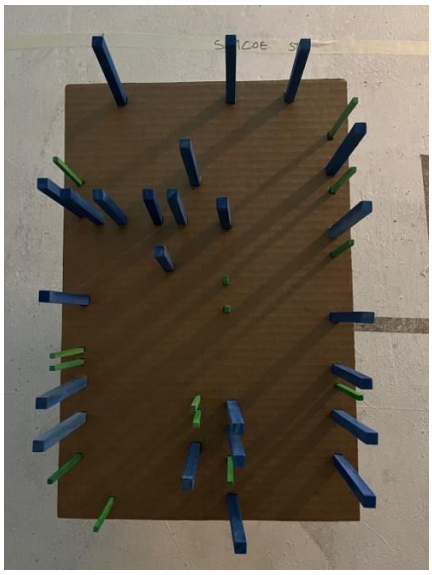

Image 23: Data physicalization created. Photo by Author

Image 24:Visitors engaging with prototype install. Photo by Author

5.3.3. Incorporating Elements Within the Space

During this entire duration, because the final exhibition was not to be conducted in the graduate building but at another location, space was a huge factor that I had to work with. Even though I was creating these prototypes to enhance my understanding of the elements and space; it would come down to how I execute everything in the final space. I decided to place the elements in different places this time and rather than having them all up on the wall, I wanted to see how I could incorporate them by hanging them from the ceiling instead (Image 25). By playing around with different materials such as acrylic sheets to use them as a form of the image being reflected, I really enjoyed going with the flow and trying out new ways to see what works and what does not.

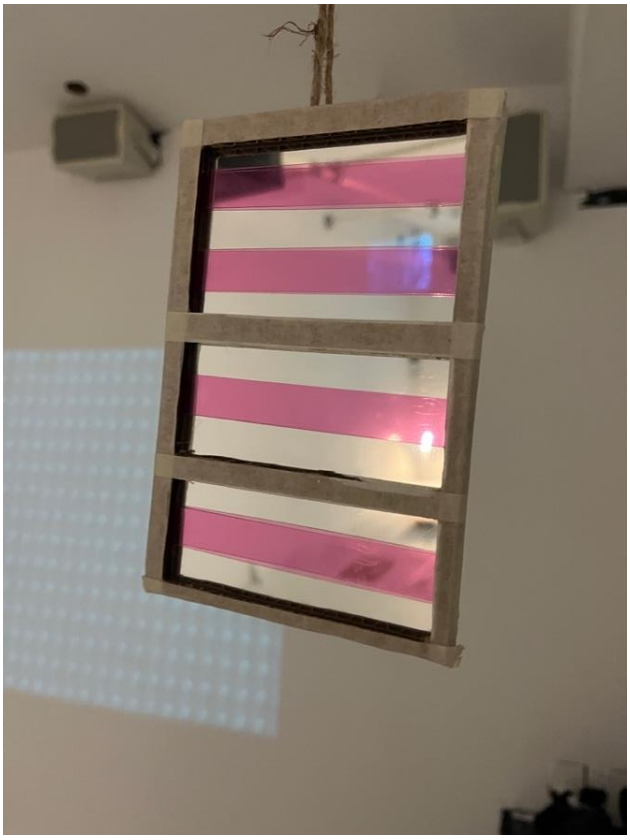

Image 25: Element hung from ceiling. Photo by Author

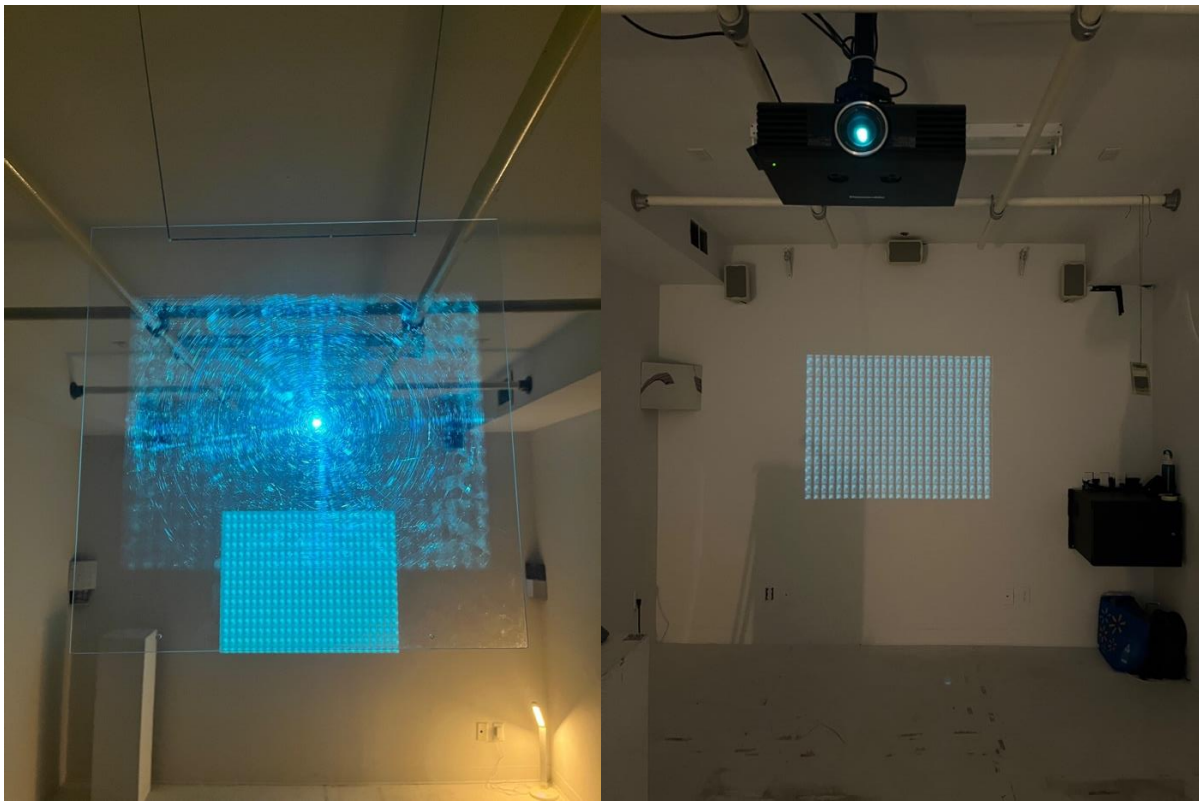

Image 26: Acrylic sheet used to project visuals (on the left), reflected projection on opposite wall (on the right). Photo by Author

Image 27: Placement of camera at the bottom of the floor. Photo by Author

Using an acrylic sheet as a medium to project the same feed onto a wall parallel to it, this exploration was quite an interesting discovery (Image 26). The most exciting aspect that I enjoyed working with was placing the camera within the space that was used for the video live feed for the projections (Image 27). While visitors entered the room and explored the space along with the visuals changing on the walls, they were intrigued by that movement. There was a moment of realization (personally my favorite part) wherein they would walk around the room a couple of times to figure out how that change was happening. Some people thought it might have been a pre-recorded video that was being played but there was that 'oh!' moment when they found the camera that took them by surprise. There was no intention from my side to hide the camera or disguise it as something else, yet it took people a bit of time to put two and two together, which was an interesting outcome. This made me reflect on David Rokeby's quote from Transforming Mirrors where he mentions: "Interaction is about encounter rather than control." To let go of controlling the space and rather let people walk through the space on their own and discover different elements was an important takeaway from this prototype.

5.3.4. Prototype Three: Observations and Learnings

There was a lot to take away from this prototype from both a motivational aspect and things that I could improve on. Having to work with a huge space in comparison to the other spaces before, it enabled me to understand how I would have to use the elements within a chosen space. Suspending some elements from the ceiling resulted in acting as a compelling factor within the space. Some people would bump their heads without realizing it was hanging all this while, which had an interesting connection with the embedding of surveillance in the urban spaces. Even though I intentionally placed them there, it would still go unnoticed by some people.

Incorporating the digital aspect was another attention-grabbing element to work with. I was confident with the level of material exploration I had done and wanted to further explore how I can blend those two together. One critical feedback I received was to remember to keep the

aesthetic beauty of the analogue materials created and not lose that within the new space. This has been an important factor that I had been keeping in mind and something that was tricky to work with at the same time. Through multiple observations made, the attempt to let people navigate through the space on their own (with the data physicalization provided) was not super successful. For some people, walking through the blocks was not their very first action, while others thought it was an engaging way to uncover the data. There was still a barrier between the space created with materials and the data I was showing. This was something I knew I needed to work on for the next few prototypes. As mentioned before, the aspect where people discover the camera and make a correlation with the projection was something I knew I wanted to keep and replicate the same effect while prototyping later.

5.4. Prototype Four: Reflections Through the Mirrors

The fourth prototype was installed in the same room as the last prototype but instead of utilizing the entire room, one-half of it was used. This prompted me to utilize the space in an adaptative manner and made me again make use of the space to incorporate the elements into it. I decided to try a couple of new variations this time and was excited to experiment with the mirrors and projections together. I wondered how the projection would react when displayed onto the mirrors. Using the mirrors as a screen, the results were quite fascinating. Along with this, I tried a new visual treatment using TouchDesigner (Image 28). Moving past the grid layout as done before, I went ahead with a distorted and displacement look. There was something quite fascinating about incorporating the mirrors and the projection as a layer on top of it. The mirrors seemed to reflect the projection in an abstract manner and distorted the image quite well. By using the wall and ceilings as a screen (Image 29), I was now getting somewhere through which I could create an immersive experience. There was one thing I was certain about which was the incorporation of the data physicalization in the space. As I kept trying since the last few prototypes to make it work within the space, at this point I felt to move away from that and find another way to incorporate

the data. That was the goal for the next prototype, to find a way to blend the data along with the space and make it a whole experience.

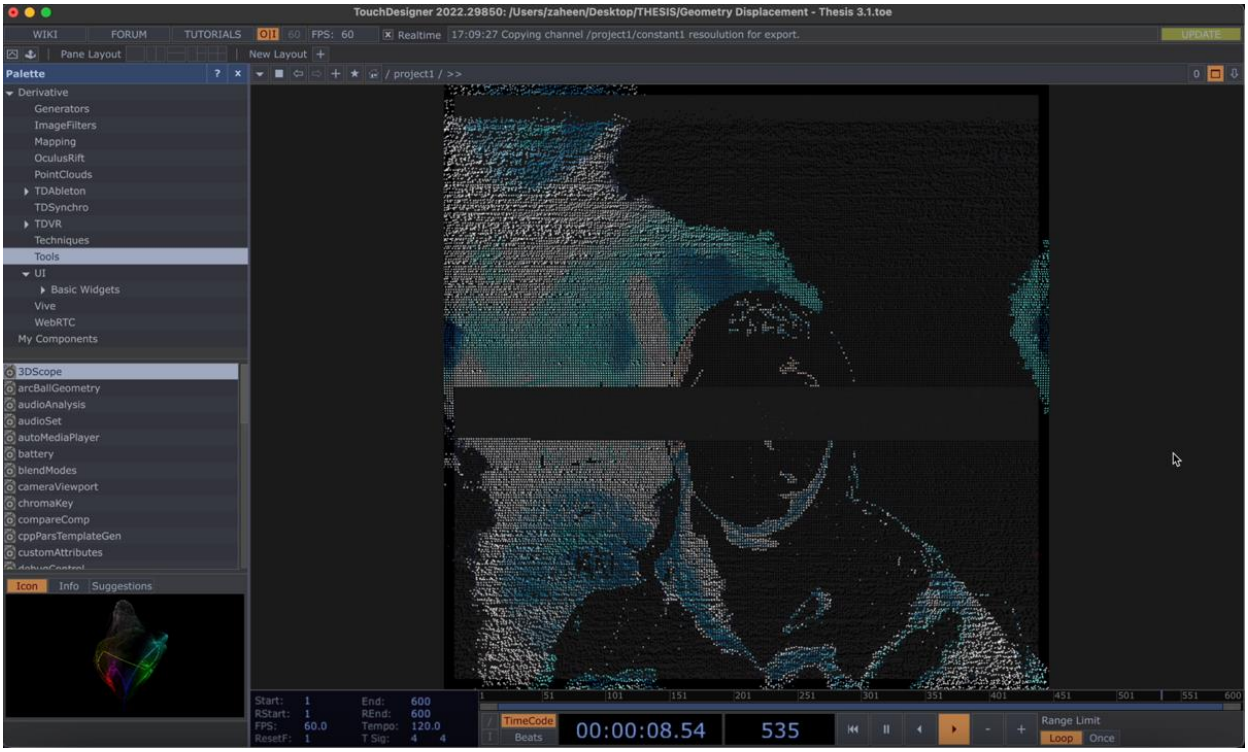

Image 28: Snapshot of TouchDesigner interface. Testing new visual treatment. Photo by Author

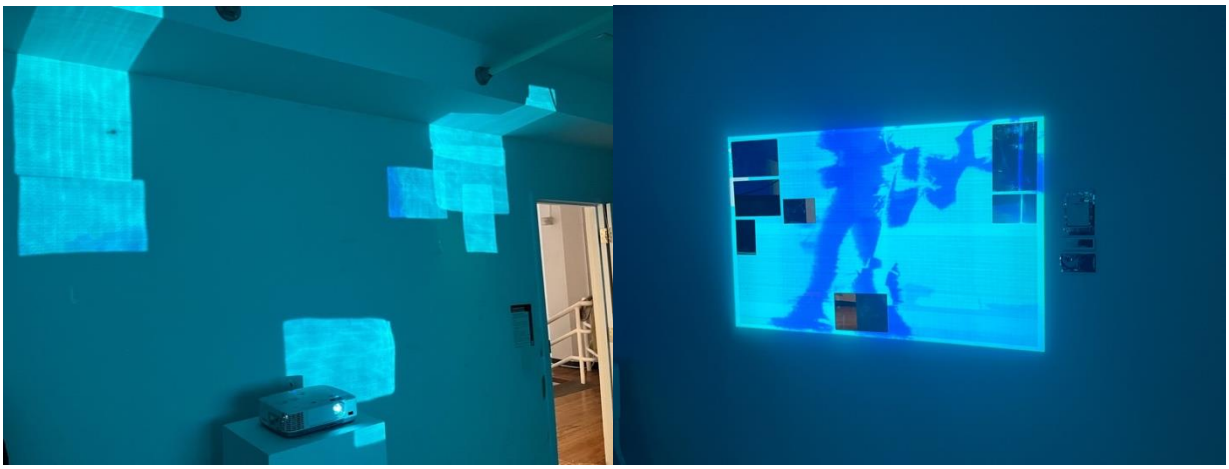

Image 29: Projection reflected on the wall from the mirrors. Photo by Author

5.5. Final Reflections

Through the iterative process of installing multiple prototypes over several months, I developed a comprehensive understanding regarding the elements that would contribute to the final installation, as well as those that would not. This approach provided several valuable insights that translated into the final installation. Some of these insights include:

1. The dynamics between various materials such as the mirrors and their strategic placement within the space allowed visitors to engage with the space freely and it became evident that the interplay between these materials alongside the manipulation of projections, significantly enhanced the immersive experience for visitors.
2. With each prototype, the selection of an appropriate space emerged as a pivotal factor in maximizing the impact of the installation. When working with an overly spacious environment, I realized that the engagement visitors had with both the physical space and the exhibited materials could be potentially diluted. This realization underscored the importance of finding a balance between providing adequate room for exploration while maintaining an intimate and captivating atmosphere.
3. Among the key learnings from the prototype installations was the decision to re-assess the integration of data physicalization into the final installation. Despite the insights I gained from my data walks, it became apparent to me that directly incorporating the data model into the installation posed several challenges. In particular, the disparity between the location of where the data was collected, and the location of the final installation could potentially lead to an added layer of confusion for visitors.

In attempting to address this issue, a significant conceptual shift occurred wherein the purpose of the exhibit translated from data physicalization to installation by having the viewers experience themselves as data rather than having them experience data collected from another location. This conceptual shift not only preserved the essence of data integration but also introduced a more abstract and inclusive perspective, thereby enriching the overall visitor

experience. This shift from data physicalization to immersion allowed for a more dynamic perspective through which the visitors discover how they are mapped in the exhibition space. In the next section, I dive deeper into how the points discussed in this section translated into the final physical installation.

5.6. Final Exhibition Install

Based on insights gathered during prototype installations, I was able to visualize what the final installation would look like. As shown in the accompanying sketch and mockup below (Images 30-31) it demonstrates the integration of elements within the designated space. The immersive experience has been designed considering the room's dimensions, placement of analog materials, and projectors to let visitors explore the space while engaging with the dispersed elements. Upon entry, visitors encounter the mirrors mounted on the wall, offering them an opportunity for self-reflection that symbolizes their visibility under surveillance. Placing the mirrors at different heights on the wall has been done specifically for two reasons: enabling visitors to easily reflect on their own image, through the lower mirrors, while moving around. Secondly, placing some of the mirrors higher up signifies the strategic placement of CCTV cameras in urban spaces hence creating a noticeable sense of observation. The deliberate placement of the mirrors on the wall in front of the entrance has been done to let visitors encounter their reflection first and then stumble upon the live feed projected on the opposite wall. Visitors upon entering the space become active participants in the installation. The expression of this concept can be seen in the projected imagery of the live feed of visitors in the room, taken by the web camera placed in one corner. This has been done to highlight the theme of invisible surveillance; prompting visitors to contemplate their presence within the space.

Being physically present in the space during the process of putting together the exhibit provided me with valuable insights into how sound could enhance the overall installation. Using Sonic Pi[12], I was able to experiment with different synths, notes, and rhythms in creating an ambient soundscape. The intention behind designing this particular sound was to envelop visitors in a captivating atmosphere while also inducing a sense of relaxation and inviting visitors to engage with the space.

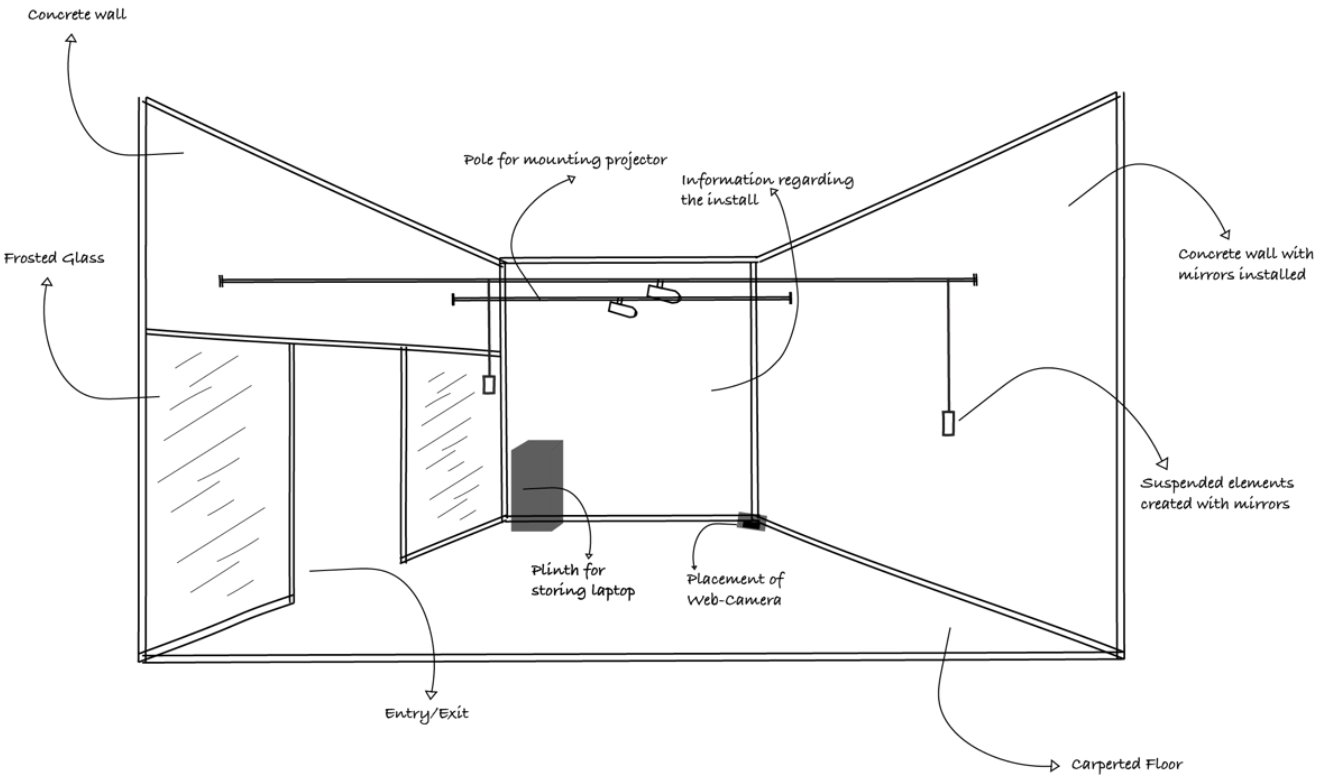

Image 30: Initial sketch of installation

[12] A code-based music creation and performance tool based on Ruby. https://sonic-pi.net/

Image 31: Mockup of final installation

Image 32: Final installation setup. Photo by Daniel Huszar

Image 33: Visitor in the installation space. Photo by Daniel Huszar

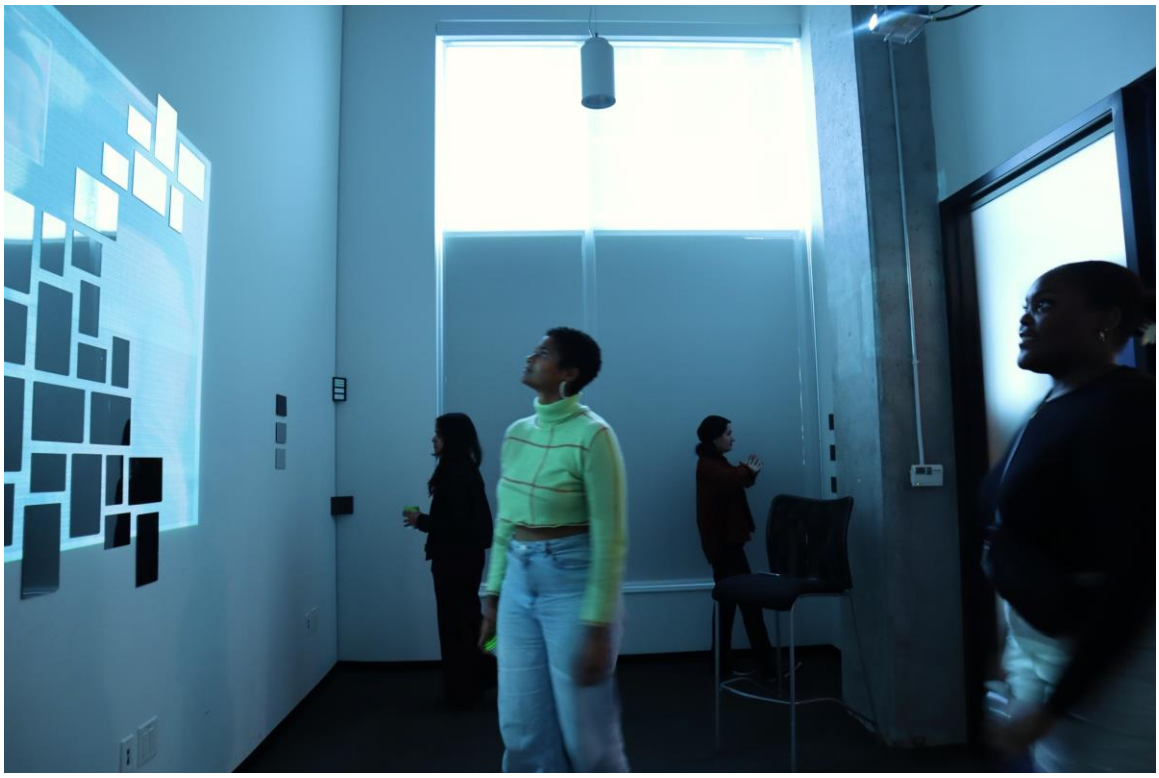

Image 34: Visitors in the installation space. Photo by Daniel Huszar

Image 35: Elements dispersed around the installation space. Photo by Daniel Huszar

Chapter 6: Conclusion and Future Works

6.1. Conclusion

Looking back on the process for creating this thesis project, it has been a mixed journey consisting of observations, learnings, and challenges. My primary goal since the beginning was to inform people about the subtle embedding of surveillance systems in urban spaces and to bring that idea together through an immersive space has been an exciting journey. As I have mentioned before in this thesis document, the creation aspect of this project has been the most fulfilling part and an integral component. Observing the prototypes evolve and come together in a physical space brought immense satisfaction, shaping the course of this thesis project.

The objective of this thesis project was to bring attention to the theme of surveillance in urban spaces by designing a physical immersive environment. The decision to work with a physical space was made to invite visitors to reflect on the visible and invisible forms of surveillance surrounding them in urban spaces. Constant making through iterative prototyping as a part of Research-Creation Methodology, along with insights gathered through data walks, formulated this project toward the objective. The data walks helped in narrowing down the types of surveillance systems that I wanted to work with such as CCTV cameras and RFID machines. Collecting qualitative data, such as the appearance of the surveillance systems and their positioning in the urban spaces, along with collecting quantitative data on the number of surveillance systems present within a set perimeter, enhanced findings that manifested in the prototypes. Parallelly, insights and learnings derived from research conducted through critical literature texts and contextual reviews assisted in understanding certain concepts that were integrated into this project. It was important to understand the theme of surveillance from a historical point of view and this was done by reviewing the disciplinary concept of the panopticon examined by Foucault while making connections to surveillance in today's context. Furthermore, the research also delved into specific aspects of surveillance in urban spaces by looking at it

through the Canadian context as the project started with a location-specific theme. The literature texts also delved into understanding the relationship between bodies and screens and the importance of subjectivity and control in a physical immersive space. In relation to this, taking inspiration from works of different artists, as discussed through the contextual reviews, and making connections while creating elements for the prototypes heavily influenced the making part of this project. Lastly, research conducted on the role of data physicalization, and visual representation influenced the creation of the data physicalization during the initial prototype stages.

While trying to answer the research questions, I believe the process of making and installing multiple prototypes in a physical space influenced the final output. While data physicalization was present in prototypes, it was removed from the final installation to emphasize the experience of *immersion and reflection*. The choice and positioning of analogue materials were specifically done to prompt visitors to reflect upon their own image in the mirrors, making them visible in the space. Additionally, elements of invisible surveillance such as distortion and layering were employed by projecting a live feed of visitors in space on the mirrors. This prompted visitors to become a part of the experience and engage with the space as they were the subjects under surveillance at the location.

6.2. Future Works

Given the omnipresent nature of surveillance in urban spaces, the project holds relevance and potential to examine surveillance dynamics across different contexts. Considering future avenues for this thesis project, I would be interested in exploring the immersive experience aspect by extending it further to various galleries and locations. Each installation can be tailored to reflect the unique characteristics and concerns of the respective urban environment, by focusing on a location-specific theme and using ethnographic method of data walk, prompting engagement and dialogue among visitors. Further exploration with analogue and digital techniques can contribute

to the formulation of new insights, resulting in immersing visitors even more in the installation. Considering the time and space limitations that had been set for this thesis project, I would want to attempt to incorporate the data physicalization into the project by further understanding and exploring that route, keeping in mind the learnings derived such as the effect of materials used. One of the ways through which this could be incorporated is by having the data physicalization as an entry point into the immersive space or presented as a key takeaway component at the end of the experience. Additionally, site-specific sonic elements can be integrated to help enhance the overall experience. I believe that further research into this idea could potentially aid in bringing these elements together while reflecting on the learnings from this project.

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Appendix

Appendix A: TouchDesigner Network Editor

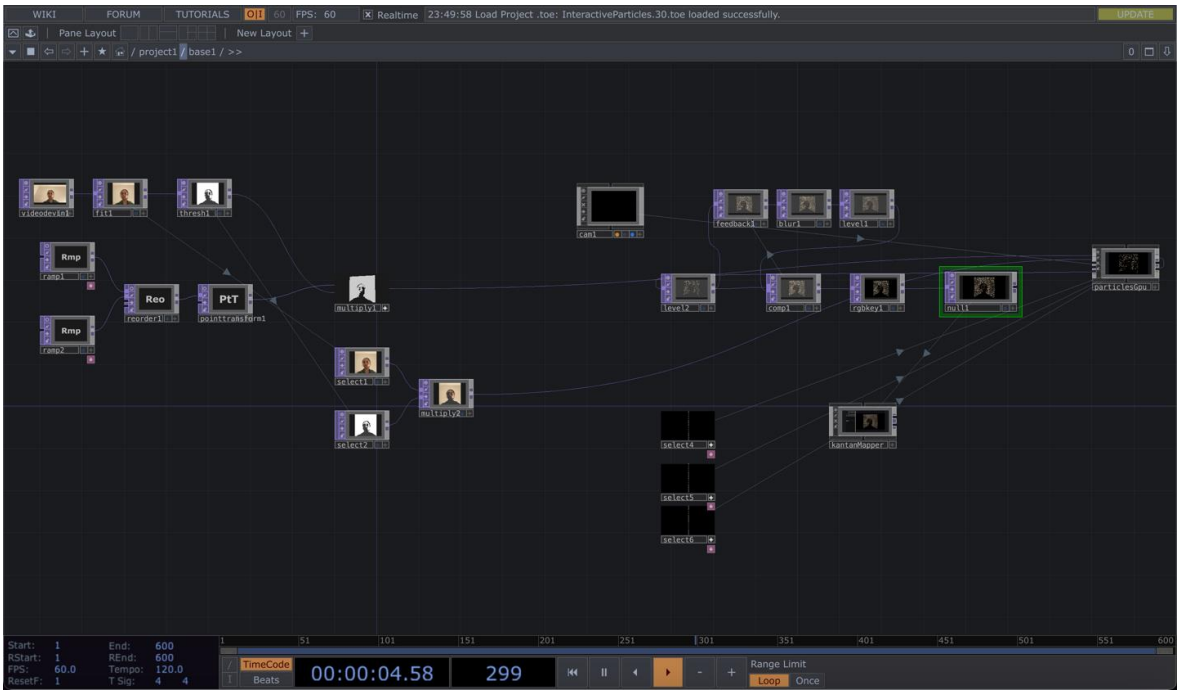

Image 36: Snapshot of TouchDesigner network editor for interactive particles

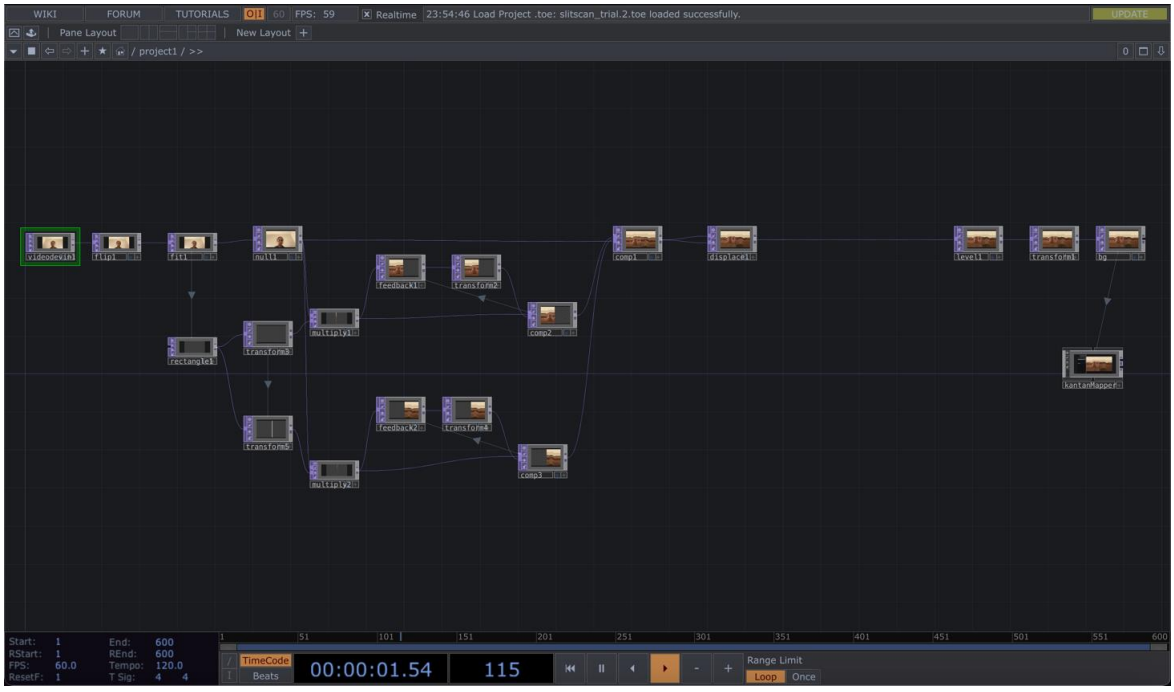

Image 37: Snapshot of TouchDesigner network editor for slit-scan

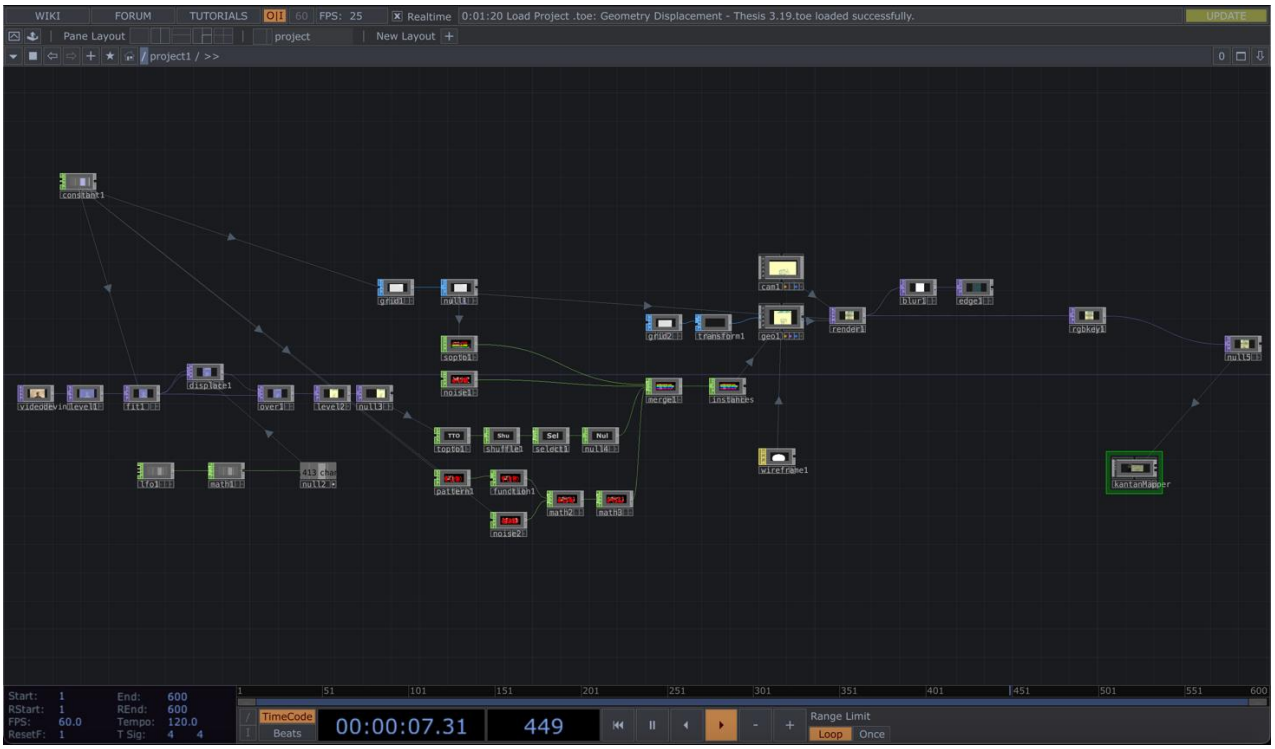

Image 38: Snapshot of TouchDesigner network editor for geometry displacement

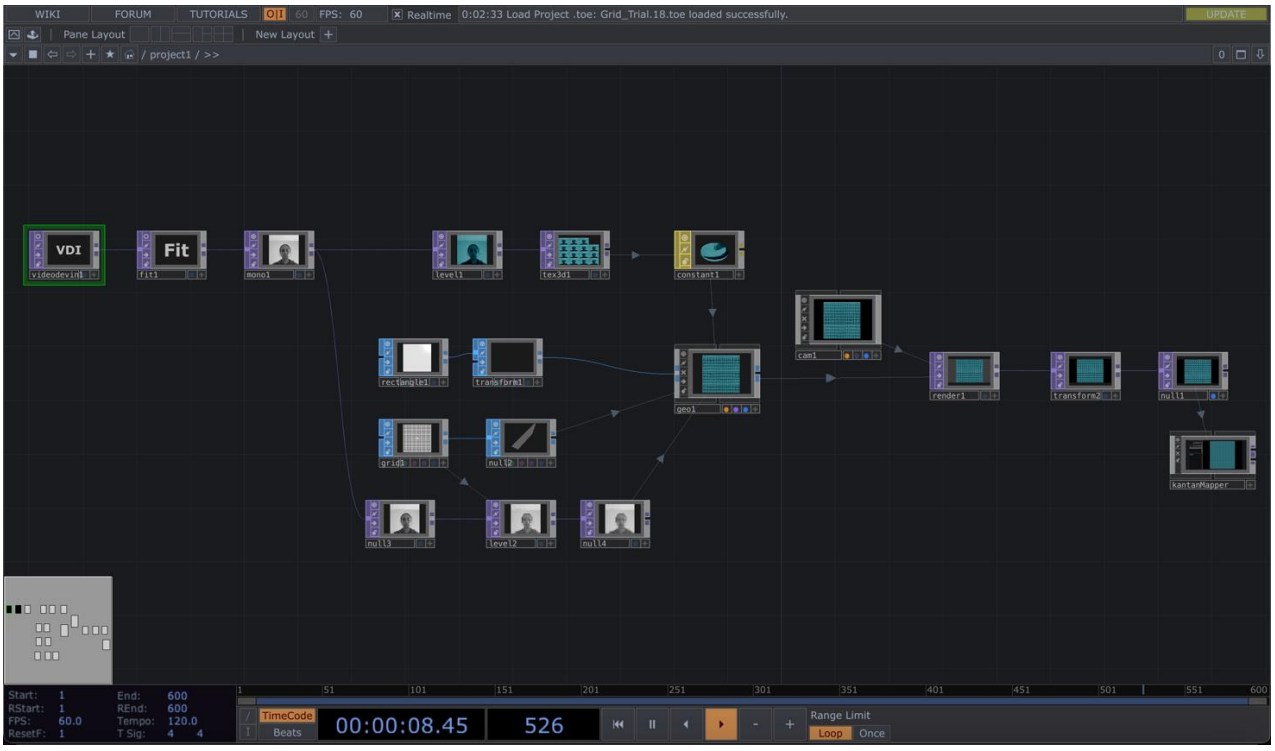

Image 39: Snapshot of TouchDesigner network editor for grid layout

Appendix B: Sonic Pi - Code

```
use_synth :hollow
with_fx :reverb, mix: 1 do

  live_loop :note1 do
  | play choose([:D4,:E4]), attack: 4, release: 20
  | sleep 15
  end

  [1, 3, 6].each do |d|
  | (range -3, 3).each do |i|
  | | play_chord (chord_degree d, :c, :major, 3, invert: i), attack: 1, release: 20
  | | sleep 0.25
  | end
  end

  use_synth :piano
  notes = (ring :E4, :Fs4, :B4, :Cs5, :D5, :Fs4, :E4, :Cs5, :B4, :Fs4, :D5, :Cs5)


  live_loop :slow do
  | play notes.tick, release: 2, attack: 15
  | sleep 0.3
  end

  live_loop :faster do
  | play notes.tick, release: 8, attack: 3
  | sleep 0.295
  end

  live_loop :note2 do
  | play choose([:Fs4,:G4]), attack: 2, release: 10
  | sleep 10
  end

  live_loop :note3 do
  | play choose([:A4, :Cs5]), attack: 8, release: 9
  | sleep 11
  end

Line: 39,  Position: 3

|0| |1| |2| |3| |4| |5| |6| |7| |8| |9|
```

Image 40: Snapshot of Sonic Pi code

```
  | play notes.tick, release: 8, attack: 3
  | sleep 0.295
  end

  live_loop :note2 do
  | play choose([:Fs4,:G4]), attack: 2, release: 10
  | sleep 10
  end

  live_loop :note3 do
  | play choose([:A4, :Cs5]), attack: 8, release: 9
  | sleep 11
  end

  use_synth :hollow
  with_fx :reverb, mix: 1 do

    live_loop :note1 do
    | play choose([:D4,:E4]), attack: 6, release: 20
    | sleep 15
    end

    [1, 3, 6].each do |d|
    | (range -3, 3).each do |i|
    | | play_chord (chord_degree d, :c, :major, 3, invert: i), attack: 1, release: 20
    | | sleep 0.25
    | end
    end

  end
end

Line: 39,  Position: 3

|0| |1| |2| |3| |4| |5| |6| |7| |8| |9|
```

Image 41: Snapshot of Sonic Pi code

Appendix C: Documentation of Exhibition Installation

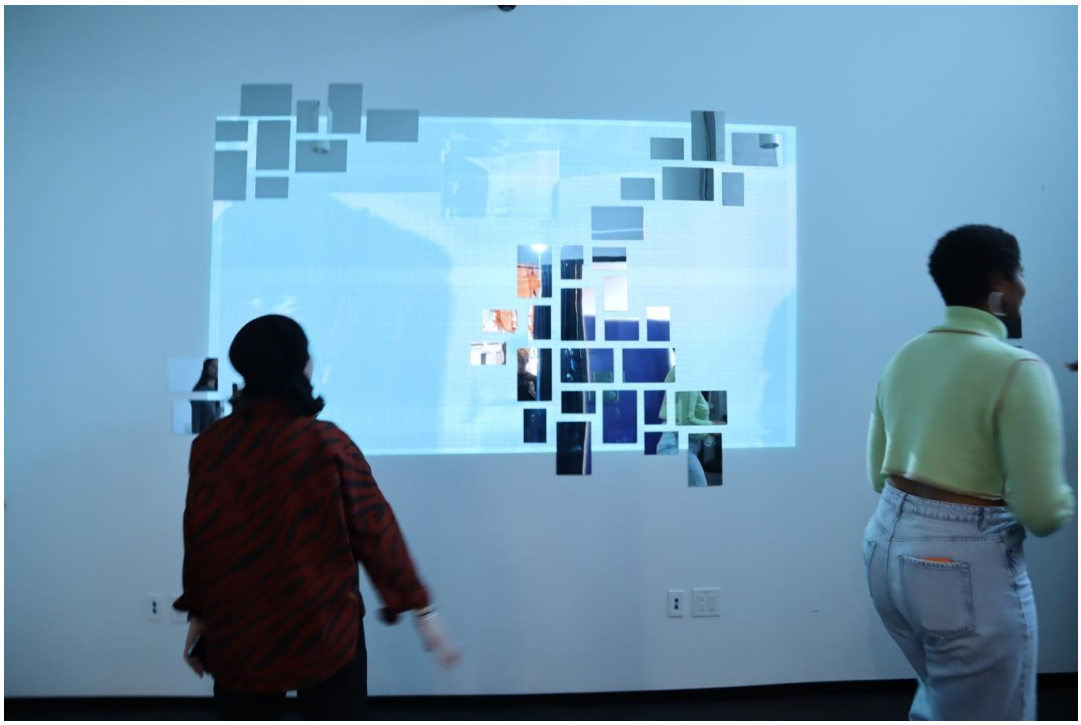

Image 42: Visitors engaging with the installation. Photo by Daniel Huszar

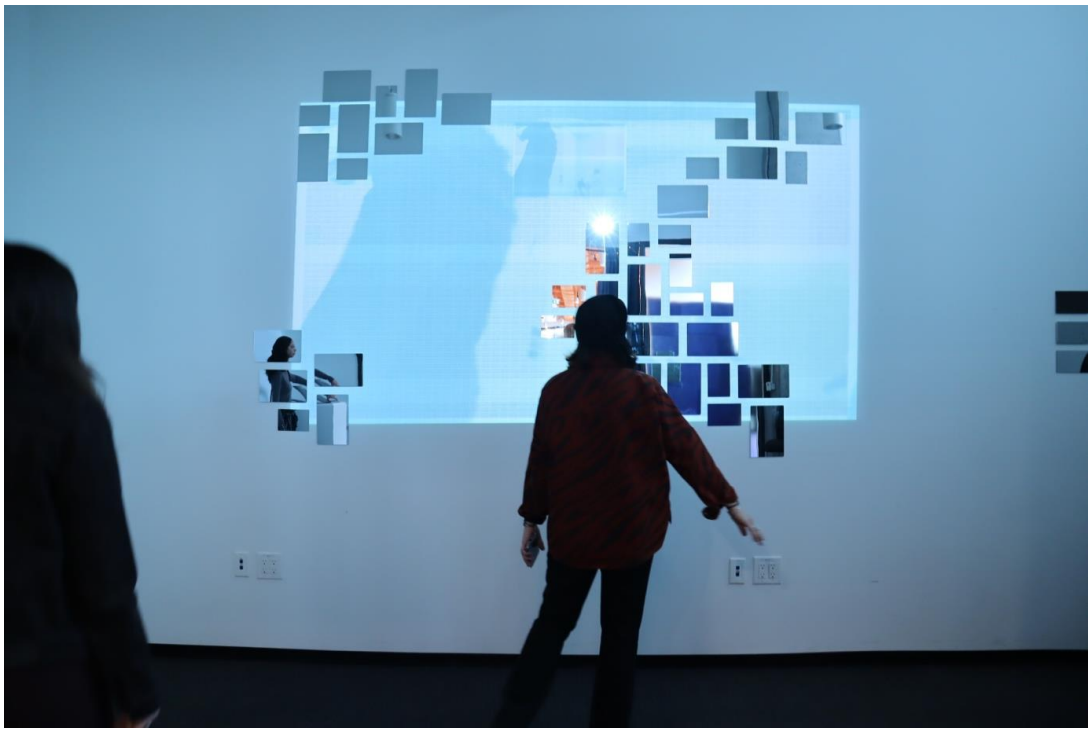

Image 43: Visitors engaging with the installation. Photo by Daniel Huszar

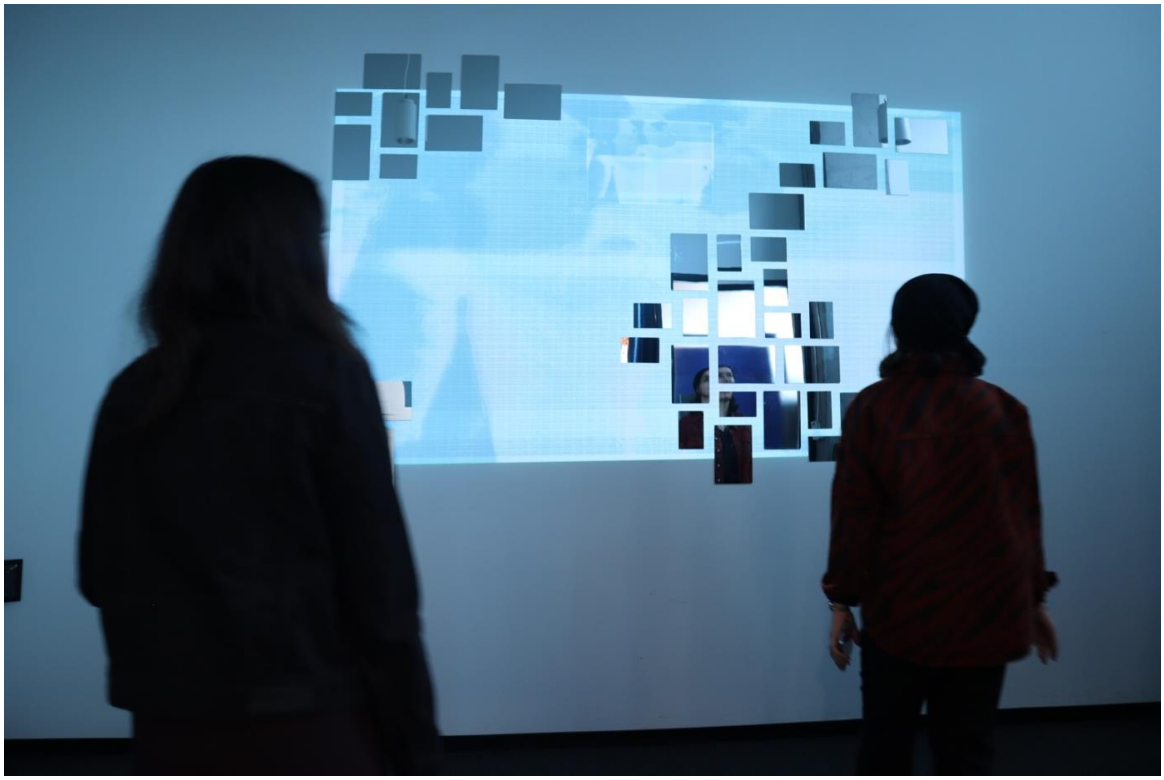

Image 44: Visitors engaging with the installation. Photo by Daniel Huszar

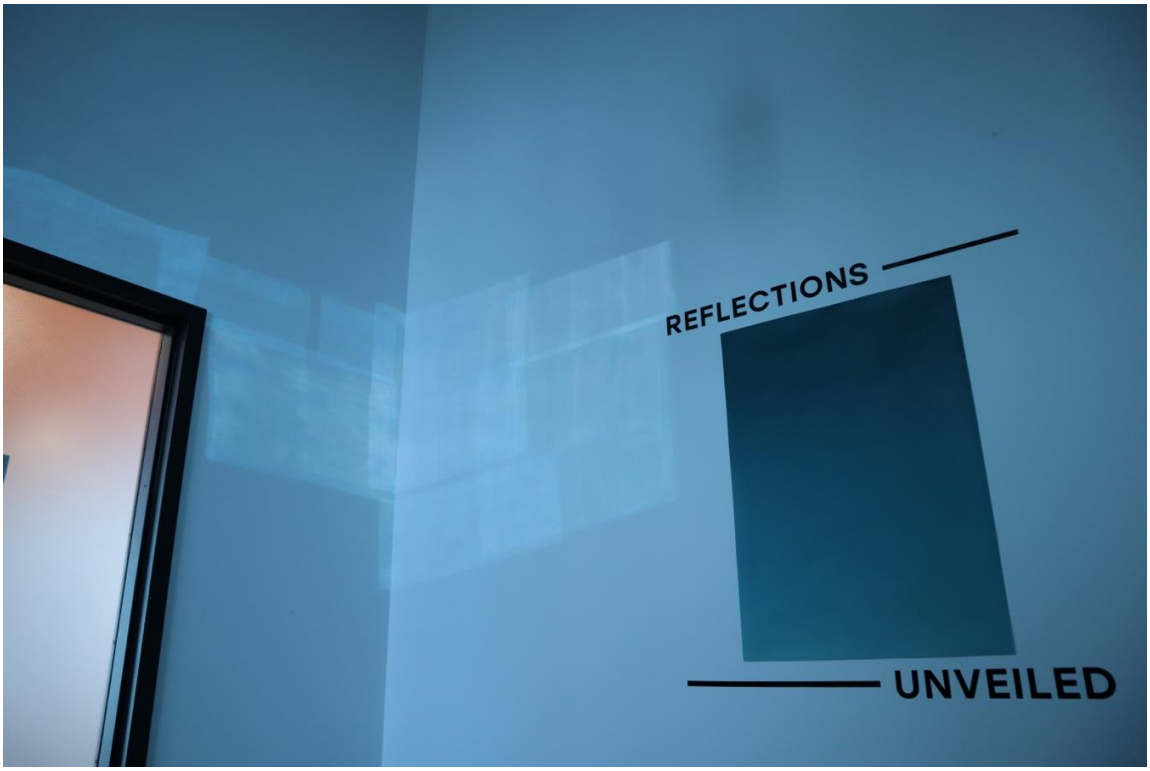

Image 45: Reflected projections on the wall. Photo by Daniel Huszar

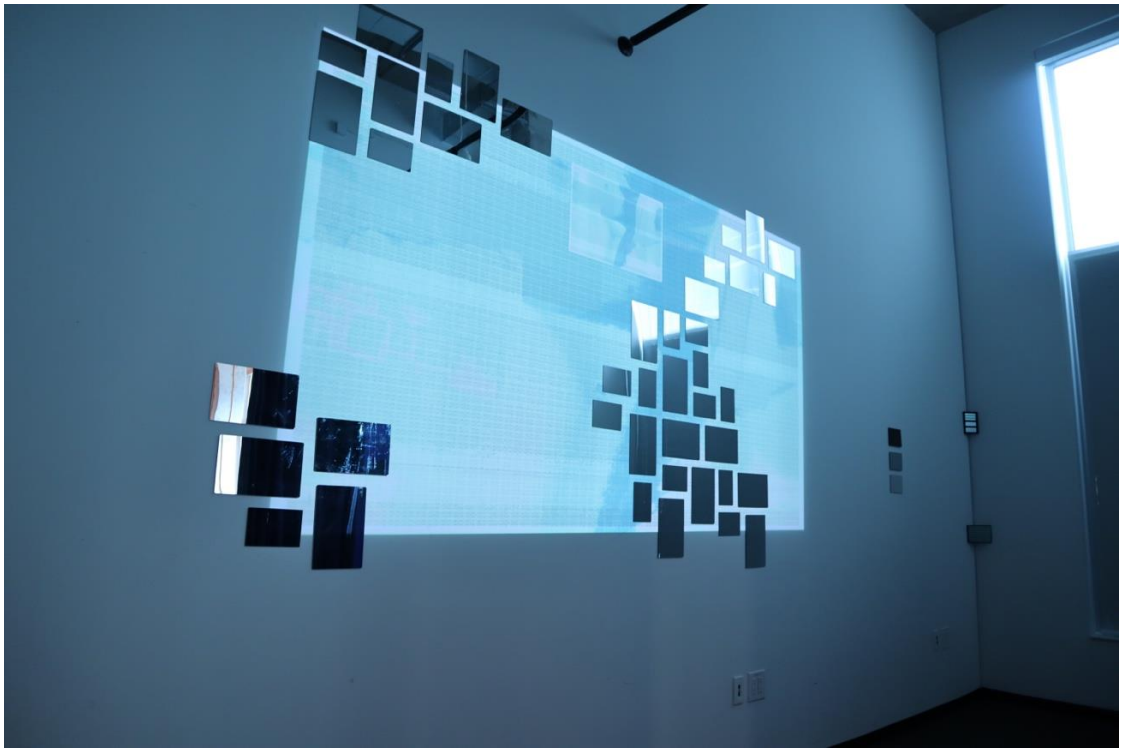

Image 46: Installation set up. Photo by Daniel Huszar

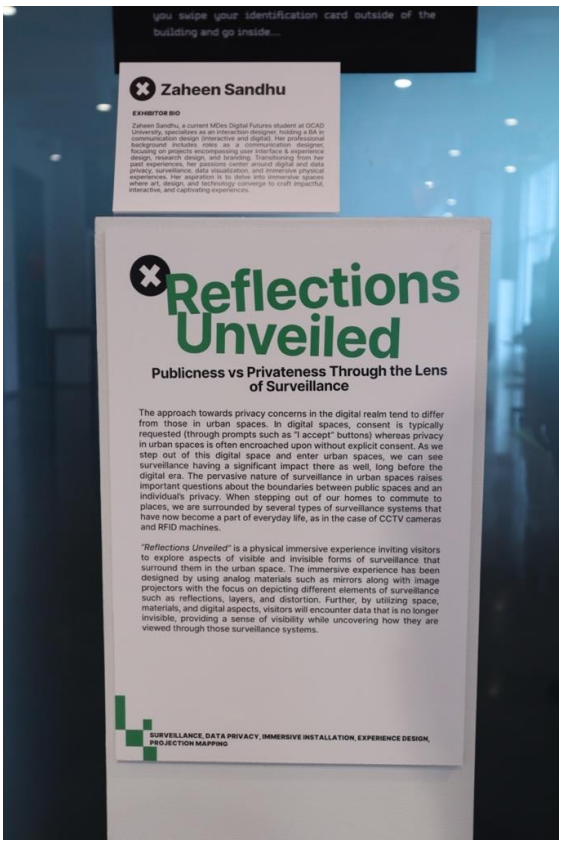

Image 47: Didactic at the entrance of the installation. Photo by Daniel Huszar

Appendix D: Open Research Repository Digital Files

Title: TouchDesigner Explorations

Description: A compilation of screen recorded videos of various explorations done on TouchDesigner during this thesis project. They include three explorations as followed:

1. Interactive Particles
2. Slit Scan
3. Geometry Displacement

Date: 24 April 2024

File Name: https://youtu.be/8DcY_I633zk

File Type: .mov

Title: Reflections Unveiled: Exhibition Installation

Description: A compilation of videos taken at the thesis exhibition of visitors engaging with the installation.

Date: 24 April 2024

File Name: https://youtu.be/twtE_7NLt7o

File Type: .mov