Planning, Protests, and Politics: 'Green' Public Transportation in Santiago de Chile

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1. Introduction

In December of 2019, Chile was scheduled to host COP25, the 25th conference of the parties of the United Nations Framework Convention on Climate Change (UNFCCC). COP is a yearly convention in which 196 countries meet to discuss the avoidance of climate catastrophe and the voice of the poorest countries hold equal weight as the richest. However, just a month before COP25 was set to begin in Santiago, Sebastian Piñera, the president of Chile, withdrew his invitation to host amidst growing protests in the country. While Madrid became the new host, the unrest in Chile only continued to grow.

The Chilean protests began in October of 2019 with a metro fare hike of $0.04, or a 4% increase. High school students began the protests by conducting mass fare evasion on October 7th. Ten days later, protesters set fire to or otherwise damaged 77 metro stations. The protests, however, quickly moved beyond the public transit system in both location and scope. They also turned into what would be the most violence Santiago had seen since the end of the Pinochet dictatorship in 1990 (Larrson 2019). On October 25th, 1.2 million people gathered in the streets of Santiago as the protests became an outcry against inequality in the country. A popular slogan for the protests was "no son 30 pesos, son 30 años," meaning "it's not about 30 pesos, it's about 30 years," referring to the 30 years of rising inequality since the end of Pinochet's rule. The protests were not just a rebellion against the rising costs of public transportation, but one against the increasing cost of living, low wages, lack of education rights, failing pension system, poor public health system, and most importantly, crippling inequality.

The timing of COP25 and the protests provide a compelling contrast between future-focused climate ambitions and the tensions that have been building for decades over inequality. Furthermore, the public transportation system in 2018 and 2019 has seen important 'greening' updates, which add another layer of context to the system's role in the protests. In considering Chile's attention to climate goals, the transportation sector has a critical role to play. The transport sector contributes to about a quarter of CO_2 emissions worldwide and is the fastest growing emissions sector (IEA 2019). If current transportation trends continue, greenhouse gas (GHG) emissions are expected to increase by 50% by 2035, and nearly double by 2050 (IPCC 2014). As countries move to meet carbon neutrality targets, one of the biggest challenges they face is decarbonization of the multi-faceted transport sector. In Chile, about 87% of the population lives in urban areas, making the decarbonization of public transportation a particularly relevant challenge in large cities like Santiago (Ritchie and Roser 2018). Santiago's public transit system has been recognized world-wide as one of the most innovative and efficient public transit systems within lower to middle income countries (Orbea 2018; Santiago Times

Staff 2017). Compared to the rest of Latin America, it is also one of the greenest public transportation systems. The Santiago Metro receives 60% of its energy from renewable sources (Dube 2017) and the city now has over 800 electric buses in their fleet, making Santiago the city with the largest pure electric bus fleet outside of China (BYD 2019). The public transit system which was initially called Transantiago, but has been renamed Red Metropolitana de Movilidad, has two main components, the bus rapid transit system (BRT), and the train system, composed of the Metro de Santiago and light rail lines. This thesis will continue to use the name Transantiago, since it is the name that most people continue to use for public transportation in Santiago.

The combination of Piñera's withdrawal to host COP25, the recent 'greening' of public transportation, and the social unrest in Chile creates an interesting background to investigate the public transportation system in Santiago. Although Chile has been lauded as Latin America's 'tiger' economy, the social unrest shows how this picture of economic success is a fragile one, as the prosperity has only been a reality for those at the top of the economic ladder (de Mello and Mulder 2005). The protests also highlighted how despite its recent attention for efficiency and greenness, the public transportation system of Santiago has not addressed the city's inequalities in its design and implementation. Between the history-making protests and the attention to climate goals in greening transportation and hosting COP25, Santiago's public transportation system becomes an interesting lens through which to analyze the connections between inequality, infrastructure, and the environment. The following section provides an overview of the history of Transantiago's development, as it will be important for understanding the research questions that will guide this thesis.

1.1. Transantiago: A transformation of public transportation in Santiago

In February 2007, the city of Santiago implemented Transantiago, a complete reimagining of public transportation. The design of Transantiago was an extremely ambitious reform, aiming to create a fully integrated public transit system between a bus rapid transit (BRT) network with feeder bus lines that integrate with the Metro, the underground subway network in Santiago. Prior to 2007, the city depended upon a fragmented system of micreros, also called micros or yellow buses, that were rife with service, safety, and operational problems. The city also had three underground subway lines in the Metro system, which received general praise from the public but was not accessible for a large part of the population. The aim of Transantiago was to modernize public transit in Santiago and improve upon the problems in the

micrero system, overall ensuring access to a safe, reliable, and sustainable public transportation system for all citizens of Santiago.

However, Transantiago's implementation in 2007 has been widely considered as a disaster. Transantiago aimed to fix a system that most in Santiago agreed was broken. The micrero bus system was a highly informal public transportation system composed of nearly 8,000 mini buses that operated 289 routes on a concession basis (Bowen 2017). The micrero bus system was operated by 3,000 'companies,' which were mostly very small companies or entrepreneurs with an average amount of two to three buses per operator (J. C. Muñoz, de Dios Ortuzar, and Gschwender 2009). Due to competition amongst private bus operators within this informal system, drivers' wages were based on how many passengers they picked up and created perverse incentives that interfered with quality of service. Bus drivers would often drive very fast and unsafely to be able to arrive at bus stations faster than others to get more customers. The micrero system contributed to a lack of road safety in Santiago; in 2005, a fatal bus-related accident occurred every three days on average (Bowen 2017). The bus drivers would also often skip bus stations that did not have enough people and deny students because students only paid a third of the fare. Bus drivers also depended on pocketing fares for people who tried to bargain for low fares to be dropped off shorter distances than the formal bus route entailed. The bus drivers were often described as rude and violent, driving recklessly to earn a profit and choosing who could have access to public transit, becoming the epitome of urban aggression (Tomic and Trumper 2005). The buses also lacked accessibility for people with reduced mobility, contributed to air and noise pollution, and had long travel times (Gómez-Lobo 2007).

The state of the micrero system in the 2000s can be traced back to the neoliberal policies implemented in Chile in the 1980s. Buses became a major form of public transportation in Chilean cities starting in the 1930s and closely resembled the dangerous, poorly incentivized micrero system already described in the 2000s. The 1940s, however, saw state intervention as a solution to the failures of capitalism, which translated to state control over transportation. In 1945, the administration at the time in Chile established a company parallel to private urban transportation operators, Empresa Nacional de Transportes Colectivos Estado (ETCE), which became fully state owned in 1952. ETCE shared public transport operation with the private bus sector, largely operating trams, but provided service without private profit incentives, allowing the service to reach less profitable locations with safer and more reliable services for passengers and offer fixed wages to employees (Tomic and Trumper 2005). However, with Pinochet's military dictatorship and the neoliberal policies that came with it in the 1980s, ETCE was terminated and the public transit system was left to the forces of the market, which established

the incentive structures that persisted through the 2000s. The civilian-led yet still neoliberal government that followed the military regime was left to deal with the chaotic public transportation system dominated by micreros.

In 2000, a vision was born to completely reimagine public transportation in Santiago with the "Plan de Transporte Urbano de Santiago 2000-2010" (Urban Transport Plan for Santiago for 2000-2010), commonly known as PTUS, which came out of a meeting between four public transit experts at the Ministry of Public Works, Transport, and Telecommunications (MOPTT) (Ureta 2015). As the micreros had resisted any forms of regulation in the 1990s through cartels and debilitating strikes, the MOPTT was looking to the four experts to provide guidance on how to deal with the micreros as the new Lagos administration was beginning. The experts were convinced that the micrero problem would never be fixed with small solutions, but only with a complete transformation of the system, aiming to get rid of micreros altogether (Ureta 2015). This group drafted PTUS which became public policy in Chile in 2000. It did not receive much attention and would have likely never become a reality until Ricardo Lagos, Chile's first socialist president since Salvador Allende, became occupied with celebrating Santiago as a "world-class" city through investigating multiple infrastructure projects to celebrate Chile's bicentennial as an independent country in 2010. Because many of the other project proposals were more costly investments in the long run, PTUS rose to the top of the priority list because of its promise of social improvements with a subsidy-free[1] system, making it the perfect relatively low-cost infrastructure project. Suddenly, PTUS was not just a plan to improve upon the micrero system, but instead became a "worlding project" that promised to set Santiago as a prime example to the rest of the world of a successful urban transformation (Ureta 2015; Ong 2011). From PTUS would come the seven year project of imagining, designing, and finally implementing Transantiago.

[1] Originally, Transantiago was designed to be subsidy-free, being able to fund itself through the revenues of buses and the Metro without subsidies from the government. However, upon implementation in 2007, Transantiago was running at a 35% deficit, so a subsidy was later implemented for the system {Batarce and Galilea 2018}.

	Existing System	PTUS
Bus routes	Almost deregulated, usually very long and intersecting heavily at main streets, high competition	The city divided into 10 main feeder areas connected by several trunk lines run by five companies, with no competition among them
Management	Hundreds of micro-entrepreneurs	15 areas of business operated by one independent company each, centrally managed by an independent entity
Payment	In cash, paid on each ride of a bus or Metro	Made through a contactless smart card; integrated flat fee between buses and Metro
Buses and drivers	Old and highly polluting fleet; drivers receive their income depending on tickets sold	New custom-designed buses; drivers receive a regular salary, eliminating the need to compete for more passengers
Metro	Operating independently	Fully integrated both financially and in terms of routes to the bus network
Infrastructure	Only basic infrastructure	Development of a considerable amount of infrastructure, from bus-only lanes to new bus stops
Information	No formal information system	Information would be continually produced and distributed both to users (travel information) and the general system (fleet management)

Table 1 - Changes from micrero system to PTUS adapted from Ureta (2015) which shows the differences between the micrero system and the changes proposed in the PTUS, which would be implemented in Transantiago

Transantiago aimed to change every component of the previous system. The new system promised to have a single fare for journeys between buses and the Metro, utilize a new digital contactless payment system, have tenders for large centralized bus companies with formalized contracts for bus drivers, and provide new modern buses. The government planned to implement the new system in a "Big Bang" approach, premiering all of the new changes at the same time instead of a gradual phase out of the old system. So on February 10, 2007, Transantiago was rolled out to the public, and much to their dismay, its performance was worse than the previous system it replaced. Users of the system saw unprecedented levels of overcrowding and waiting times for buses because of an insufficient amount of buses in operation. The infrastructure for 'segregated' bus lanes, which are bus lanes that are specifically designated for buses, was not constructed by the time of implementation in 2007, making bus travel time much slower than expected. The payment card system was not ready in the first week and there was not enough information available to users about bus routes. Spontaneous riots

broke out as residents of Santiago were unable to get to work or ultimately use public transportation at all because of the failed elements of the system's implementation. Just 45 days after the "Big Bang," the Minister of Transport and Telecommunications had to resign as the failings of Transantiago ultimately set off a political crisis in Santiago. In the years since its introduction, Transantiago has been referred to as "the worst public policy ever implemented" in Chile (Ureta 2015, 3).

It has now been more than fourteen years since the original implementation of Transantiago and there have been many interesting developments especially in the past five years. Most recently, the social unrest that began in October of 2019 was a direct result of a Metro fare hike. This social unrest has had huge implications for Chile, leading to a plebiscite on constitutional reform on October 26, 2020 for which Chileans overwhelmingly voted to rewrite the constitution with 78% of the vote. Chile's public transit system has also seen recent updates, including the electrification of the bus fleet with the addition of over 800 electric buses in Santiago, which is the largest electric bus fleet outside of China, and partial powering of the Metro via renewable energy sources. In addition, many of the original bus operator contracts reached their expiration date by 2017, which initiated a new tendering process for bus companies in 2016. This process, however, has been repeatedly delayed, first because of a switch in administrations, later because of the social unrest, and now COVID-19. Once finished though, the new tendering process has major implications for the level of service of the system going forward, largely because the original contract structure has made it very difficult to remove poorly performing bus companies. Transantiago has also had over fourteen years to learn from its original failures. Fortunately, it seems that in the fourteen years since its original implementation Transantiago has improved its performance and perception amongst the population.

1.2. Research questions

This thesis aims to investigate the connections, if any, between the recent tensions in transportation in Santiago and the history of failure of Transantiago, the protests of 2019, and the greening of public transportation. Because the central issue of the protests that began in October of 2019 was the impacts of the long history of inequality in Chile, this thesis centers inequality in the research question, asking *can public transportation be a lens through which to understand inequality in Chile?*

The empirical chapters in this thesis, Chapters 4, 5, and 6, answer more specific sub-questions within the broader research question. Chapter 4 looks at the history of Transantiago as

a public policy and planning failure, and asks *what role did planning play in the failure of Transantiago?* A motivation for this research question was the lack of literature looking at whether or not there have been any policy or planning lessons learned from the initial failure of Transantiago over a decade ago, as most literature only looks at the initial technical failures of Transantiago one to five years after implementation. Additionally, the exploration of this question becomes important for the context of the protests that started with a metro fare hike in 2019, which is the subject of Chapter 5. Chapter 5 investigates the role of transportation in the 2019 protests, asking *what was the role of public transportation in sparking the protests?* It more specifically raises the question, *does public transportation have a unique ability to spark protests?* Since the protests have occurred relatively recently, there is little scholarship that analyzes the protests thus far, so Chapter 5 aims to make an early contribution to the scholarship in this area. Specifically, the few articles that look at the protests so far have not focused on the role of transportation, so this thesis presents a unique angle. Finally, in the context of the attention Santiago has received for greening its public transportation system, Chapter 6 looks at the motivations behind this process and how it is situated within broader ambitions for transportation and climate policy. The research question in Chapter 6 asks *how are current greening policies for public transportation contributing to environmental and transportation inequalities?* Similar to the protests, there is very little literature that analyzes the recent green updates to public transportation in Santiago, especially from a social science perspective, so this chapter provides a new perspective on the inequalities present in this greening process.

In answering these questions, I make the argument that *transportation has become a symbol of inequality in Santiago, meaning that many of the experiences and frustrations over inequality can all be seen in the space of transportation*. These inequalities can be seen in the processes of planning Transantiago and its failure to meet the needs of those who depend on it most. The public transportation system in Santiago also embodies many inequalities outside of just income inequality, including gender, spatial, class, and environmental inequalities. Furthermore, I argue that transportation is a unique policy sector because almost everybody experiences or is close to people who use transportation daily. The everyday lived experience of inequalities in transportation then make it a space where a poor policy decision can spark mass outrage in a majority of the population at the same instant. Transportation is a space that is more likely to spark protests like the those that began in 2019 because of the concentration of inequalities in one space and the tangible everyday experience of facing those inequalities.

1.3. Thesis Outline

The remainder of this thesis is structured as follows: Chapter 2 discusses the motivations for the methodology, the data collection and analysis process, and reflections on the research process. Chapter 3 provides an overview of the relevant literature for this thesis. It is structured to first review literature on inequality in Latin America and Chile, then discuss transportation within the broader field of infrastructure and transportation studies, and finally describe the Transportation and Environmental Justice Framework that will be used to provide policy implications for this research.

Chapter 4 provides a review of how Transantiago has been perceived as a failed state policy by transportation experts in papers and interviews. It then analyzes the recent changes to community participation and renewing of contracts today to understand if progress has been made since the initial failure and how the planning process for Transantiago intersects with inequality of planning in Chile. Chapter 5 looks at the protests that began in October of 2019 and explores the role of transportation in those protests. It establishes transportation as a symbol of inequality and argues that it has a unique ability to spark unrest because of the everyday experiences of inequality present in the system. Chapter 6 investigates the recent 'greening' of public transportation in Santiago, looking at the motivations for these changes and how it has been perceived as greenwashing. The prioritization of greening public transportation over private transportation is investigated in the context of income inequality, which makes greening of public transportation a place where the tensions between transportation and environmental justice are paramount.

Chapter 7 concludes the thesis with an overview of the structure and arguments of the thesis, a review of the policy implications and literature contributions of this thesis, a discussion of the limitations, and recommendations for future research.

2. Methodology

This thesis is a qualitative research project that broadly aimed to investigate themes in greening transportation and the social movement in Chile. Research for this thesis was conducted from June through October of 2020. I conducted semi-structured interviews with 12 public transportation experts from academic, business, and government sectors that have worked in Santiago, Chile. I conducted the research remotely while based in Oxford in the UK. This chapter includes four sections which will discuss the motivation for conducting semi-structured interviews, the selection of interview participants and interview process, methodology for data analysis, and reflections on the research methodology. Specifically, the last section will include reflections on the impact of the COVID-19 pandemic on the methodology of the study, reflexively discussing the significant impacts it had on the research design as well as my ability to conduct research and write this dissertation.

2.1. Motivation for methodology

This thesis aimed to investigate the connections between inequality and the public transportation system in Santiago, Chile. It specifically aimed to understand how inequality intersected with the intentions behind planning and greening decisions in the public transportation system as well as understand the opinions on the protests that began in October 2019. With these research aims in mind, I chose to utilize a qualitative approach for this thesis, which would best facilitate an understanding into the perspectives of the experts on public transportation in Santiago. While there was considerable uncertainty about the COVID-19 pandemic during the methodology selection process for this thesis, I eventually made the assumption that 'field work' for this thesis would take place remotely. It is important to note that COVID-19 did not just impact the selection of methodology, but the limited choice of remote-compatible methodologies greatly impacted the scope and direction of this thesis. This impact will be further discussed in the last section of this chapter.

Given the virtual nature of data collection, I chose to conduct semi-structured interviews to collect the data for this thesis. Semi-structured interviews, compared to structured interviews, open up the possibility for knowledge-producing pathways that occur in dialogues by allowing for more freedom to follow up on what the interview participant believes is important (Brinkmann 2014). Because semi-structured interviews take a more conversational approach, they allow the interview participant to bring up what is important and interesting for them within the scope of the research topic (Longhurst 2003). Compared to unstructured interviews, semi-

structured interviews allow the researcher to have more control in establishing the focus of the conversation to the topics of interest for the research study (Brinkmann 2014). Additionally in considering that I would be interviewing 'elites,' or people considered to be experts in transportation in Chile from a variety of sectors, semi-structured interviews were also well suited to this category of interview. Interviews would be necessary to understand the intentions and decision-making processes behind certain policies. Aberbach and Rockman explain how semi-structured interviews are well suited towards elites over structured interviews because elites and other highly-educated people "do not like being put in the straightjacket of close-ended questions. They prefer to articulate their views, explaining why they think what they think" (Aberbach and Rockman 2002).

2.2. Selection of participants and interview process

Interview participants were selected mostly through snowballing methods, or convenience sampling. Snowball sampling methods are typically used when it is difficult to access research participants with the desired characteristics, so the researcher recruits study participants that are acquaintances of prior interviewees or contacts (Naderifar, Goli, and Ghaljaie 2017). Because I could not meet with anybody in person, it was challenging to find the contact information for public transportation experts outside of academia through internet searches. Snowball sampling especially for studies involving elites often relies on getting access to a 'gatekeeper,' or a key individual who can provide access to a wider network of contacts (Mendez 2020). For this study, I initially contacted a few academics who studied public transportation in Santiago, who acted as gatekeepers for my research as they were then able to provide additional contacts to reach out to, providing connections to government officials and those in the business sector. I also searched through websites, such as the "Coalición por un Transporte Justo" (Fair Transportation Coalition at coalciontransportejusto.wikidot.com), to find contacts in public transportation in Santiago. Exclusively reaching out to participants by email resulted in a low response rate for interviews and made it challenging to schedule as many interviews as would have been optimal.

Overall I conducted 11 interviews over Zoom and one asynchronous interview, which all lasted for about one hour each. The interviews were all recorded and automatically transcribed using Otter.ai. I chose to not take notes while conducting interviews so I could pay more attention to the interviewee's non-verbal cues and body language, as well as prepare additional questions in real time based on what they spoke to me about. Oltmann explains how note-taking during interviews can be obtrusive and distracting for interview participants, but how making

note of non-verbal cues and visual details from interviews can add a valuable layer of detail to analysis (Oltmann 2016). Right after an interview was completed, I spent time taking notes on any relevant impressions I got from the interview and important themes that stood out to me while I spoke with the interview participant. After the interviews were completed, I returned to the automatic transcription and made corrections as needed. Some of the interview participants felt most comfortable speaking in Spanish, so for those interviews I included a translator on the call who translated between the interviewee and myself in real time. Appendix 1 includes a list of the interview participants along with the sector they work in and a brief description of their expertise or previous positions. All participants wished to be directly quoted, so the real names of all interview participants are used throughout this thesis except for certain cases where they asked to not be directly quoted.

For each interview, I used a similar set of questions that were slightly customized for the background of each participants. The questions were split into two sections, the first focusing on questions specific to the interview participant and the second focusing on broader questions related to public transportation topics in Santiago. The questions in the first section focused on obtaining information about the interview participant's role in specific elements of planning or study of the public transportation system. The second section focused on understanding the interview participant's opinion on aspects of planning processes, the protests, and greening public transportation. An example of a set of interview questions is included in Appendix 2. The questions were constructed and asked in an open-ended manner to allow for interview participants to have more freedom in providing their answer. Additionally, while I tried to ask most of the questions on my interview question guide in each interview so that I could compare the responses from different interview participants, I also asked follow up questions during the interview based on the content of the conversation.

2.3. Data analysis methodology

I took an inductive approach to my analysis of interview data. Thomas describes a 'general inductive approach' for allowing research findings to emerge from a set of raw data based on the significant or frequent themes present (Thomas 2003). I did not have any established hypotheses before conducting the interviews and tried to ask broad, explorative questions in the hope of being able to notice common threads and themes, or diverging narratives, between interview participants. After conducting interviews, I read through the interview transcripts and summarized the conversation into shorter statements that could be categorized. I then grouped statements across interview participants where connections could be

made. Examples of these groupings were statements that pertained to the perception of public transportation today, the greening of public transportation, and urban inequality, amongst many others. From these groupings, and especially from comparing statements across interviews within these groupings, I pulled broader themes from the interview data. Examples of such themes would be inequality in public transportation or Transantiago as a failed state policy. Table 2 adapted from Thomas shows this sort of data analysis process which is common for inductive analysis processes (Thomas 2003).

Initial read through text data	Identify specific segments of information	Label the segments of information to create categories	Reduce overlap and redundancy among the categories	Create a model incorporating most important categories
Many pages of text →	Many segments of text →	30-40 categories →	15-20 categories →	3-8 categories

Table 2 - Inductive data analysis approach A chart from Thomas (2003) that shows the process of data analysis for an inductive approach, showing the process of categorizing raw data into broad themes.

2.4. Reflections on research methodology

As discussed briefly already in this chapter, the research design of this thesis was greatly impacted by the COVID-19 pandemic. Ideally, I would not have studied a public transportation system I have never seen or used. If I could have travelled to Santiago to conduct field work, the thesis would have been a very different design, integrating observation, my own experiences using the buses and trains, and interviews with people who use public transportation. I had to modify the scope of my research questions and change my methodology to accommodate for virtual research instead.

The qualitative research process and writing of this thesis are intrinsically connected to my perspective, prior experiences, and world view. Before I began this degree, I completed a Bachelor's degree in Mechanical Engineering. My interest and training in the sciences prior to this influenced how I approached the research design and how I interpreted the data. I discovered through the interview process that I really struggle to conduct interviews because of my own personal capabilities. A research design based on non-interview dependent methods would have been much better suited for me. I struggled throughout the writing process to view the process from a development studies perspective and was struck by how different this style of thought was from my natural inclinations. Qualitative methods and analysis do not come

naturally to me, so the way I processed the data I collected was impacted by the way I process information. Furthermore, my positionality as a white woman studying at the University of Oxford, with a previous degree from MIT, shaped my interactions with interview participants. My degree in engineering from MIT and my current study at Oxford certainly gave me credibility, especially since the majority of the interview participants studied engineering. Yet, as I conducted mostly elite interviews in a field dominated by men, my positionality as a young woman likely discredited my position slightly. Additionally, I was certainly an 'outsider' in many ways, not being familiar with the transportation field and having very little familiarity with Chile. For three interviews, I needed to work with a translator because I am not fluent in Spanish. This impacted my ability to gain as much detail and nuance in the interviews as I can when speaking in English, and impacted the dynamics of the interview by adding a third person to the interaction. While these aspects of my positionality have benefits and costs that are difficult to entirely discover, it is nonetheless critical to acknowledge and reflect on these aspects of my identity throughout the research process and integrate it into my research, which I have tried to do within this thesis (Herod 1999).

Additionally, though the semi-structured interviews provided high-quality data, the research design could have been improved through more interviews as well as triangulation through using a variety of data sources. It was difficult to get access to more interview participants between low-response rates and dead ends with snowballing methods. In my original research design, I planned to analyze policy documents and even add spatial data analysis through GIS (geographic information system) mapping. Due to the challenges of the pandemic, it was difficult to increase the ambition of this research project, however. Given the chance to complete this thesis in different circumstances, I would have incorporated relevant data from policy documents, images from the protests, and spatial data analysis.

Considering ethical concerns throughout this research project was critical to ensure that my research was respectful and considerate of the people I interviewed. Before conducting any interviews, I received approval for my research design through the Central University Research Ethics Committee at the University of Oxford. I obtained written consent for all interviews since this was the easiest method given the virtual interview context. All interview participants wished to be quoted directly and I have made my best effort to make sure that their quotes are situated in their intended context. To prevent a purely extractive method of research, I plan to share summarized findings from my research, and my full thesis if requested, with interview participants.

3. Literature Review

This chapter will review the relevant literature and theoretical frameworks for this thesis and is structured into three sections. The first section reviews literature on inequality in Latin America and more specifically Chile, discussing the economic, political, and social costs of high inequality for Chile. The second section provides an overview of infrastructure and urban planning literature in the specific context of transportation. It also discusses relevant literature in transport studies with a brief introduction to transportation and environmental justice theories. The third section provides an argument to link the theories of inequality and justice in this thesis and a review of a framework from Giulio Mattioli that structures the tensions between transport and environmental justice. This framework will be used to link inequality and justice in this thesis, particularly in considering the policy implications at the end of the thesis.

3.1 Inequality

3.1.1. Inequality in Latin America

Inequality is the common theme linking the elements of the public transportation system analyzed in this thesis. In the planning processes, protests, and greening of public transportation, the politics of inequality in Chile, and in the broader region of Latin America, is at the foundation of the conflicts present in each area. There is a rich literature documenting the prevalence of inequality in Latin America. While increasing levels of inequality is a trend being seen in many countries worldwide, the Latin American region has particularly alarming trends of inequality. The Economic Commission for Latin America and the Caribbean (ECLAC) reports that Latin America continues to be the most unequal region in the world (Cecchini and Martínez 2013). The Palma ratio is one measure to evaluate inequality; it compares the income of the richest 10 percent to the income of the bottom 40 percent. While for many developed countries, this ratio tends to be about 1:1, the average Palma ratio for Latin American countries is 2.75:1 (Sánchez-Ancochea 2021a).

As Sánchez-Ancochea explains in his book *The Costs of Inequality in Latin America: Lessons and Warning for the Rest of the World*, what is unique about the Latin American region is that high levels of inequality have been consistently present throughout the history of the region (Sánchez-Ancochea 2021a). Scholars studying the economic history of the region have produced many theories about why inequality has been so high over time and which factors led to this pattern. Many theories point to colonial times as the origin of the region's inequality (Jefferson and Lokken 2011; Cardoso and Helwege 1995). Spaniards attempted to recreate the same economic

and social systems that were present in Spain in the areas they colonized, leading to exploitative systems of labor like 'encomiendas' and later the 'repartimiento' and 'mita' systems that forced local populations to work for elite Spanish colonizers (Sánchez-Ancochea 2021a). The Spanish colonizers created a political system that put their white or mixed race descendants in positions of power, while making sure indigenous people, enslaved people, and women were treated as inferior. Many academics believe that the Spanish colonization of the region produced the highest levels of inequality in the world (Engerman and Sokoloff 2005; Cornia 2014). Some scholars, however, disagree, claiming that inequality was just as high in Europe at the time (Nunn 2008; Sánchez-Ancochea 2021b). Despite this, the important conclusion is that inequality was high in the region at the time and elite dominance was the norm, which was evident in social and political systems across Latin America. When globalization reached Latin America, it only exacerbated the existing inequalities, particularly putting more land and power into the hands of very few (De La Escosura et al. 2007; Sánchez-Ancochea 2021a). These factors form the dominant model of explaining historical inequality in Latin America – institutions and commodity specialization inherited from colonization leading to a dominance of elites in society which was exacerbated by globalization and policies that continued to favor the rich (Acemoglu and Robinson 2012; Engerman and Sokoloff 1994). Interestingly, income inequality began to decrease significantly during the commodity boom of the first decade of the 2000s. While the Gini coefficient decreased in 14 out of 18 Latin American countries and inequality in the region returned to the levels present in 1980, inequality was on the rise in most of the rest of the world during this time period (Sánchez-Ancochea 2019).

Despite the debate over the historical origins of inequality and the brief reduction in inequality during the early 2000s, scholars can still agree that inequality is high in the region and that this trend continues today. The costs of this inequality can be seen in all aspects of society in the region. Sánchez-Ancochea places the costs of inequality into three categories: economic, social, and political costs (Sánchez-Ancochea 2021a). This provides a useful structure to look at the impact of inequality in specific case studies and will frame the discussion of inequality in Chile in the following section. Additionally, it is important to acknowledge that the inequality that is typically referred to in these discussions is income inequality, which is what inequality will refer to throughout this thesis unless otherwise specified. Though there are important contributions from multidimensional inequality studies in the Latin American region, this thesis focuses on income inequality because it dominates the discussion in literature and public discourse (Justino, Litchfield, and Niimi 2004; Santos 2014; Santos and Villatoro 2018). Much of this thesis looks at how income inequality intersects with transportation systems, and the politics

it results in, though it does also touch on inequalities related to gender, the environment, and access. The intersections of income inequality with the themes of this thesis will be closely related to exclusion and the role of elites, which will be further discussed in the context of infrastructure.

3.1.2. Inequality in Chile

Chile is ranked as the most unequal country of the OECD and the costs of this inequality can be seen in recent events, most notably the protests that began in October of 2019 (OECD 2021). Chile's inequality trends are unique amongst OECD countries. Among the bottom 90 percent of the population, Chile's levels of inequality are actually lower than many countries in the OECD. However, Chile stands out in the levels of wealth of those at the top of the income distribution. The richest 1 percent of Chile's population controls over 30% of annual production (Sánchez-Ancochea 2021b). Chile's incredibly high levels of inequality are somewhat surprising considering how it is often considered one of the "stronger states in Latin America in terms of state capacity, corruption levels, and the effectiveness of tax policy" (Flores et al. 2020). Since the end of the Pinochet dictatorship in 1990, Chile has actually been considered a model case for 'successful development.' However, inequality persisted despite development gains. In an attempt to understand why high levels of inequality are so persistent in Chile, López and Miller found that it can be explained by low levels of fiscal expenditures from low tax revenues which have led to low public investments in human capital and innovation (2008).

More importantly for this thesis, it is not the precise dynamics within Chile's political economy that have led to high inequality that are of analytical significance, but the costs this inequality has in society today. The costs of inequality in Chile will be broken down into the three categories of economic, political, and social, as explained earlier. For economic costs, one important cost of inequality is on education and innovation. Inequality in Chile has created a very unequal education system with very few incentives for the elite to improve educational activities for all. This is partially motivated by specialization in industries that do not require high levels of education, like copper mining in Chile (Sehnbruch 2006). Additionally, because elites send their children to expensive private schools, they can easily ignore the differences in educational quality at public schools (Kuczynski and Williamson 2003). These sorts of schools, like the Grange School in Santiago which costs US$10,000 per year and has educated much of the Chilean elite, are completely inaccessible for most of the population, making the best education impossible for most to attain in Chile (Sánchez-Ancochea 2021c). In terms of innovation, incentives for risk taking are stifled because the most profitable industries are run by

a small group of elites. In Chile, just three families – Luksic, Angelini, and Matte – owned all large publicly traded companies in the late 1990s (Sánchez-Ancochea 2017). Since the largest companies can exert considerable political influence, they can maintain policies that further benefit them. There is little incentive then for them to change the status quo and innovate in risky sectors. Additionally, smaller companies struggle to make breakthrough innovations partially because of low levels of productivity. Labor productivity for small firms in Chile is 13 times lower than productivity in large firms (Infante and Sunkel 2008). Chile's tax rates on the rich also remain very low. Any attempts to raise taxes on the wealthy over the past two decades have been almost entirely prevented by the elite (Fairfield 2015). For Chile, the lack of investment in education and incentives for innovation, as well an inability to increase taxation on the wealthy have led to uneven growth levels and further exacerbated inequality (Sánchez-Ancochea 2021c).

The costs of inequality in politics in Chile can be seen in consistent conflicts over income distribution, which has contributed to continually shifting regimes that all manage to cater to the wealthy. In 1973, a military coup was organized with the support of the economic elite in Chile and the US government to end Allende's socialist government (Sánchez-Ancochea 2021c). The years that were to follow under the dictatorship of Pinochet led to much suffering for much of Chile's population, while the elites prospered with the Gini coefficient rising from 44 in the early 1970s to 59 in 1988 (Bulmer-Thomas 2003). Even with the shift to democracy in the 1990s, the elites ensured that their business and political interests would be protected. Sánchez-Ancochea explains how the transition to democracy in Chile benefitted the rich – "new electoral rules guaranteed significant representation from conservative, pro-business parties, preventing a rapid move to the left. Non-elected seats in the Senate were allocated for representatives of the army and for Augusto Pinochet after he stepped down from the presidency. The business sector also devised formal and informal mechanisms to shape public policy, including control of the press and the major think tanks, influence on economic debates—totally dominated by free market ideas—and massive financial contributions to electoral campaigns" (2021c). This trend of politics catering to the interests of the very wealthy continues today and is at the root of many social movements in Chile over the past decade. At the heart of the protests that began in October of 2019 was the frustration of the continually worsening inequality in Chile. For Chile, the political costs of inequality have been borne by the majority of the non-elite population – they have been subject to the political power and influence of the elite who have supported the regimes that benefit them the most, leading to cycles of political instability and conflict with little policy change to benefit the lower and middle classes.

Finally the social costs of inequality are perhaps the most important ones for most of the Chilean population, as they can be seen in many of the frustrations in the recent social movements. Sánchez-Ancochea explains how social inequality in many Latin American countries entails the elite not only separating themselves from the rest of the population socially, culturally, and economically, but physically creating enclaves where they create their own reality separate from the majority of the population (2021c). In cities like Santiago in Chile, there are concentrated sections of the city where the rich live while the rest of the middle class and poorer populations are pushed farther outside of the city center. This becomes particularly important in the context of analyzing public transportation because sprawling cities require well-functioning public transportation but also draw attention to the disproportionate travel burdens that the poorer and working classes must bear to access essential services that are central in the city. In terms of the impacts of inequality on transportation specifically, Iglesias et al found that in Santiago, those in the top quintile of income produced 6.7 times more pollution and had 5.3 times greater car usage yet transportation consumed 4.8 times less of their monthly income compared to the poorest quintile (2019). Furthermore, investment in urban highways, predominantly used by higher income groups, has been much higher than investment in buses and non-motorized transit modes, which are used by lower income groups (Iglesias et al. 2019).

In addition, as touched on briefly already, the wealthy often segregate themselves from the rest of the population by mostly using private services for healthcare and education (Sánchez-Ancochea 2021c). 60 percent of people who use private health care in Chile are amongst the wealthiest 20 percent of the population, and 79 percent of the middle class send their children to private schools (Larrañaga and Rodríguez 2014; Sánchez-Ancochea 2021c). Reports have found that there is 'persistent inequality' of educational opportunities in Chile and that the student protests of 2006 and 2011 were motivated by the inequalities present in the privatized schooling system (Torche 2005; Cabalin 2012). Studies on the Chilean healthcare system show how the two-tier private and public model introduced during the start of neoliberalism in the 1980s has increased inequalities in healthcare, particularly limiting access to sufficient healthcare for the poor, women, and the elderly (Rotarou and Sakellariou 2017; Bastias et al. 2008). Though the 2019 protests have not been extensively analyzed in the literature yet, these sorts of social inequalities were found to be central to the motivations of the social movement and the resulting call to rewrite the constitution (Sehnbruch and Donoso 2020).

3.2. Transportation as infrastructure

3.2.1. Planning processes and urban planning

This thesis investigates a transportation system under the broader characterization of infrastructure, interpreting a public transportation system as one type of infrastructure project. Development studies literature documents the often violent history of infrastructure development globally. Infrastructure development begins by definition through obtaining possession of large amounts of land to build upon. Because of this, the history of infrastructure begins with the concept of 'land grabs.' Land grabs have been understood through Marx's concept of primitive accumulation, and has been further built upon through David Harvey's concept of accumulation by dispossession (Hall 2013). The literature uses these terms broadly and often interchangeably, at their simplest form they can be understood as the process of creating and maintaining capitalist social relations by introducing people and resources into the capitalist system that had previously been outside of it (Hall 2013). Numerous studies have documented the process of primitive accumulation as one that is violent and forceful, marginalizing populations in private- and state-led projects across the globe (Sassen 2010; Levien 2012; Adnan 2013). Massive infrastructure projects such as highways, dams, and trains have historically led to dispossession of people and communities, but have simultaneously been a major element of nation-building projects across the Global South. While many state-led massive infrastructure projects have been well-meaning attempts to improve the human condition, authors like James Scott document and explain how such utopian visions often failed dramatically, marginalizing the populations they were intended to serve (Scott 1998).

The planning processes for these infrastructure projects is a critical component of analysis in this thesis. The history then of urban planning theories is important for understanding the context of the planning processes that have been evident through the development of the public transportation system in Santiago and planning processes in Chile more broadly. There is a thread of urban planning literature within the social sciences that critically examines the practice of planning in the development of urban infrastructure. Theories of urban planning follow a long intellectual history that has moved from documenting opaque authoritarian planning processes to theorizing methods of creating more inclusive and just planning processes. Though there are many versions of this history, it typically begins with the 'rational model' of planning, which James Scott refers to more broadly as high-modernism (Scott 1998). The development of high-modernist ideals can be seen as a reaction against the pre-modern, unplanned cities that could not be understood, and therefore controlled, from above or the outside. Rational planning revolves around the idea that in order for cities to be controlled from

above, cities need to be transparent to outsiders or the state. Rational planning then aimed to install a technical logic or order into cities to facilitate quick transparency into the city's functioning for the state, all with the aim of being able to enforce control over a city's population. Le Corbusier, a somewhat controversial Swiss-French urban planner, imagined utopian cities through the lens of a high modernist or rational planner. His visions came to life in the creation of the cities of Brasilía and Chandigarh, which are prime examples of the ideals of high modernism (Scott 1998).

However, the rational model had obvious problems in its theoretical underpinnings and later models responded to its shortcomings. Davidoff developed the 'advocacy planning' framework as a criticism of the top-down, technocratic rational model. The advocacy planning framework works to dismantle the objectivity of planning processes set up by the rational model by having planners understand and expose the political intentions of these technocratic visions (Davidoff 1965). In this framework, the planner acts as an advocate for the voices of the marginalized to ensure that they are heard in the planning process. However, this still views the planner as the expert, speaking on behalf of the population, necessarily in the language of a planner, filtering the voices of the people who will be most affected through the perspective and language of an 'expert' (Davidoff 1965). Another critique of the rational model came in the form of Lindblom's 'incremental model,' which served as the direct opposite approach. As the name implies, the incremental model sought to implement small, short-term changes in planning projects. This stands in direct contrast to high modernism, which saw disruptive changes to the city and even the creation of whole new cities necessary to create order and design an understandable city. Lindblom's model focused on the assumption that since the future is unknown, grand planning projects are deemed for failure from the outset. Therefore, small changes are preferable to leave room for the city's unpredictable future trajectory (Lindblom 1959). However, this model was very conservative by design, not leaving room for larger planning projects that were often beneficial for cities, leading many to criticize it in the years after its development.

Theories for planning processes continued to push back against the power dynamics and authority granted to 'experts' or planners, exploring how people who would be affected by these processes could be included. A more radical approach to planning, called the 'communicative model,' was developed by Judith Innes as a response to both the advocacy framework and incrementalism (Innes 1995). In this model, which built off of the work of Jürgen Habermas and John Forester, planners act as mediators between stakeholders in planning projects (Habermas 1984; Forester 1987; Innes 1995). Planners acting as mediators attempted to account for the

power dynamics inherent in planning processes. According to Forester, a Habermasian understanding of power dynamics could lead to negative outcomes in planning such as secrecy, manipulation, and fallacies, while a Foucauldian understanding of power imbalances could be used constructively by planners to encourage dialogue, translate documents to "everyday language" and question value choices (Forester 1989).

However, some theorists argued that power and knowledge imbalances between urban planners and city populations inherently lead to irreconcilably unjust planning decisions. Theorists of the 'just city' believed that a planner acting as an advocate or a mediator cannot resolve these power imbalances alone (Fainstein 2014). The model of 'justice planning,' which is the ideal behind the concept of 'just cities' then aims to lead to planning processes that improve the outcomes for the marginalized, pushing for contrary visions of the city (Fainstein and DeFilippis 2016). Fainstein describes the just city as aiming for three goals – equity, diversity, and democracy – and proposes specific policy measures to achieve these goals in urban planning processes (Fainstein 2010). In addition to the attempts to envisage a type of urban planning that aims to include the voices of the marginalized and integrate justice frameworks, theorists have recently been grappling with integrating sustainability into planning processes. Theorists have made attempts to deal with the tensions that arise in creating sustainable cities that ensure environmental, social and economic justice (Campbell 1996; Mell and Sturzaker 2014; Homsy and Hart 2019; Khakee 2020). Many of these studies point to the conflicts inherent in 'sustainable development' where the goals of trying to make cities more just and more climate friendly are often in tension with each other. Mattioli's framework, which will be discussed in the third section of this chapter, attempts to create structure for these tensions to help with these difficult decisions in policy making going forward (Mattioli 2016).

3.2.2. Transportation studies and justice

The multidisciplinary field of transportation studies specifically focuses on transportation infrastructure projects, and its contributions importantly link planning theories, inequality, and justice frameworks to critically analyse transportation systems worldwide. Similar to urban studies literature, the field of transport studies has recently been grappling with how to build sustainable cities via the decarbonization and reduction of emissions from the transportation sector. Some recent studies, with goals similar to those of 'just city' theorists, have focused particularly on issues of 'greening' transportation while at the same time promoting infrastructure development. A thread of literature focuses on the idea of transportation justice, as well as environmental justice in the context of transportation. Pereira, Schwanen, and Banister

provide a simplified definition of justice, defining it as "a broad moral and political ideal that relates to (1) how benefits and burdens are distributed in society (distributive justice); (2) the fairness of processes and procedures of decision and distribution (procedural justice); and (3) the rights and entitlements which should be recognised and enforced" (Pereira, Schwanen, and Banister 2017). Studies related to transportation justice tend to focus on the former two types, distributive and procedural justice, meaning that they consider issues of accessibility and questions about the people that are involved in transportation planning processes. Transportation justice is complicated when considering its intersections with environmental justice. Often, the goals of transportation justice and environmental justice are in direct conflict in the process of planning or designing transportation systems (Mattioli 2016). Mattioli describes the phenomenon where these tensions in achieving optimal justice outcomes often leads to a 'transport policy stalemate,' where policy makers interested in both transport and environmental justice never see progress on either (ibid).

Much of the transport studies literature in the Latin American region focuses on evaluating or describing progress of transportation systems and descriptively understanding inequalities that are exacerbated through transportation (Falavigna and Hernandez 2016; Mejía-Dugand et al. 2013; Bocarejo, Portilla, and Pérez 2013; Pereira et al. 2019; Viscidi and O'Connor 2017; Schleeter 2013). Transportation justice and environmental justice have only been recently applied to a few specific case studies of transportation systems in Latin America. One example of this is a Maia et al's study that examined distributional justice and accessibility for low-income residents in the city of Recife in Brazil, providing an understanding of their transportation needs to address procedural justice concerns in their prior exclusion from policy making processes (Maia et al. 2016). For Santiago, Chile, the city this thesis focuses on, very few studies examine issues of justice in transportation though there are many descriptive quantitative studies for the city's transportation (Navarrete and Ortúzar 2013; Krellenberg, Kopfmüller, and Barton, n.d.; Zegras 2010; Beltrán, Gschwender, and Palma 2013; J. C. Muñoz and de Grange 2010; J. C. Muñoz, Batarce, and Hidalgo 2014). In one study, Ureta looks at how social exclusion is affected by mobility for a group of low-income families in the borough of Renca in Santiago, which shows the shortcomings in access to transportation for low-income areas in Santiago. More broadly, there is not just a lack of scholarship on distributive and procedural justice concerns in transportation in Latin America, but for much of the global south.

3.3. Theoretical Framework – Transport and environmental justice

3.3.1. Links between inequality and justice

While creating a link between the philosophical definitions of justice and inequality is beyond the scope of this dissertation, I hope to briefly establish a connection between inequality and justice to help contextualize the usage of a justice-based framework. The concept of justice is largely rooted in the field of moral philosophy and there are four broad categories that are widely recognized – distributive, procedural, retributive, and restorative. For the context of this thesis, the two relevant types of justice are distributive, which deals with who receives goods or benefits in society, and procedural, which deals with fair treatment in societal processes. Since inequality is broadly being used in this thesis to describe income inequality, the connection between distributive justice and inequality is easy to make. High levels of inequality, like the levels in Chile, can be seen as a form of distributive injustice, a failure to fairly distribute income in a society. Procedural justice is not as obvious, but there is still a connection to be made. In the specific case of Chile, where high levels of inequality are tied to governments prioritizing the needs of the elite, there is procedural injustice in not treating all citizens fairly. Furthermore, as will be explored in the first empirical chapter, the planning processes for policy making in Chile often do not allow for citizens from lower income brackets to have their voices heard, which can be considered a procedural injustice. A much longer discussion could be made here about what level of inequality can be compatible with justice, if any at all, but such an argument is outside of the scope of this thesis. While inequality will frame the discussion in the empirical chapters of this thesis, the conclusion will incorporate the justice framework below using the connections made between inequality and justice in this section.

3.3.2. Transport and Environmental Justice Framework (Mattioli 2016)

Giulio Mattioli in 2016 proposed a novel framework to reconcile tensions between social and environmental justice goals in transportation planning. This framework, which I will refer to as the Transportation and Environmental Justice Framework (TEJF), will be used to link the inequality concerns present in Santiago's public transportation and planning processes with the recent 'greening' of the system in this thesis. The framework will frame a discussion of how Santiago can create a more socially and environmentally just transportation system moving forward.

The TEJF is an attempt to move beyond simple recognition that a tension exists between the goals of transportation and environmental justice to instead create conceptual tools to frame this issue in a novel way, which hopes to help in agenda setting for policy makers (Mattioli 2016).

The framework utilizes a combination of human needs theory and structuration theory. In the human needs component, Mattioli emphasizes the difference between human needs and need satisfiers. For the purposes of this framework, needs are defined with "the basic notion that there exist a number of needs that are the same for all human beings" while need satisfiers are defined as the "objects, activities, and relationships which can satisfy our basic needs" (Mattioli 2016). The key difference between needs and need satisfiers is that needs are generally invariable over space and time while need satisfiers are variable, depending upon culture and history.

Mattioli then goes on to explain the role of transportation within need-satisfaction using human needs theory. He utilizes the idea of 'hierarchical chains of need satisfiers' to situate the role of transportation in human needs theory (Mattioli 2016; Doyal and Gough 1984, 40). For any basic need, there is a chain of need satisfiers for it. For example, to achieve the basic need of subsistence or economic security, the first order need satisfier could be a system of labour at the societal level, second would be having a job, third would be travel to get to work, and the fourth may be accessing a car. Another chain could be for the basic need of protection or adequate healthcare: the first order would be a health system at the societal level, the second would be visits to the doctor and hospital, the third would be travel, and the fourth could be accessing a car. These chains are represented in Table 3 below from Mattioli (2016).

Chains of need satisfiers including transport and car.

Need		Subsistence (Max-Neef et al., 1992); economic security (Doyal & Gough, 1991)	Subsistence (Max-Neef et al., 1992); adequate food (Doyal & Gough, 1991)	Protection (Max-Neef et al., 1992); adequate healthcare (Doyal & Gough, 1991)
Need satisfiers	1st order (societal level)	System of employment at the societal level including division of labour, distribution of workplaces across space, etc.	System of food production and distribution at the societal level including e.g. distribution of retailers across space, etc.	Health system at the societal level including distribution of health care services across space, etc.
	2nd order	Paid employment	Food shopping	Visits to the doctor and hospital
	3rd order		Travel	
	4th order		Car	

Table 3 - Chains of need satisfiers from Mattioli, 2016 page 123

Generally, the lower order satisfiers are more flexible, however, it is clear that transportation is necessary for at least some level of basic need satisfaction. A model for car dependence can be formulated from this chart. Mattioli explains that "in the 'need-based' definition put forward here, there is car dependence when car use (4th order need satisfier) is essential to be able to travel (3rd) to access services, opportunities and social networks and/or to under-take practices (2nd) which, within current societal structures (1st), are essential for the satisfaction of human needs. In a car dependent situation the satisfaction of human needs is

conflated with access to an energy-demanding, low-order need satisfier" (2016). In this case, lack of access to a car would produce a high level of injustice via not being able to satisfy basic needs. At the same time, however, heavy car dependence produces intergenerational and global injustices related to the climate, meaning that car dependence also necessarily entails "stronger trade-offs between different types of injustice" (Mattioli 2016). The generalization Mattioli makes here is that tensions arise when the satisfaction of human needs is dependent on low-order and energy-demanding need satisfiers (Mattioli 2016). Summarized, the argument can be understood as the idea that lower order need satisfiers are where tensions between transportation justice and environmental justice are more likely to be high. Importantly, the chain of need satisfiers has important policy implications. Many other transportation justice studies focus primarily on transportation access. However, Mattioli points out that in principle, travel is only a means to an end in accessing necessary services. Focusing on accessibility to transportation obscures the fact that needs can be satisfied through other means such as changing the spatial distribution of necessary services (2016).

The framework then goes on to describe the structuration theory component, which aims to describe the changes in need satisfaction over time. Structuration theory here aims to describe how human actions over time change social structures which can alter need satisfiers. This process can play out at the level of institutions and social processes, as well as at the level of physical infrastructures. In the context of transportation, structuration theory can be used to describe how individual decisions to use cars for a variety of personal reasons eventually leads to 'car dependence' via the construction of more infrastructure for cars and the spread of services across space to only be accessible by car, creating a cycle of increasing car dependence. The use of cars originally by a small section of the population then can trigger changes over many decades to create a set of infrastructures and policy measures to make cars an essential need satisfier.

These two theories of human needs and structuration are combined to form the TEJF, which is shown graphically in Figure 1. In summary, there are invariable basic needs for all people in society, which are met by need satisfiers that are impacted by history, politics, and culture. The ways in which individuals choose to pursue need- or want-satisfaction, however, can impact over time the need satisfiers present in society. This can create a feed-back loop where human agency can change need satisfiers over time.

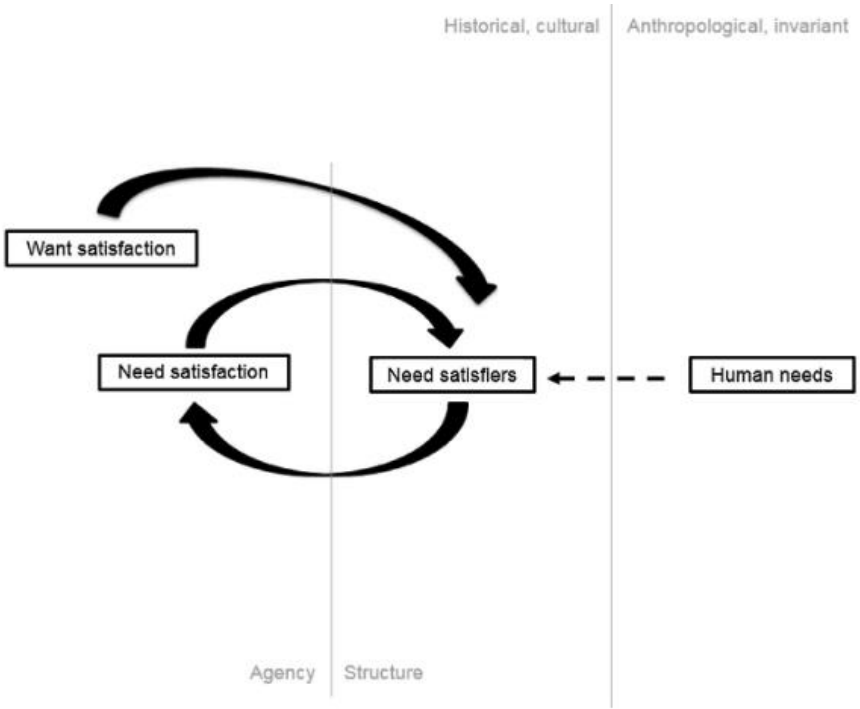

Figure 1 - TEJ Framework adapted from Mattioli (2016)

The intended goal of the TEJF is to impact policy decisions at the agenda setting level. Mattioli stresses two areas for policy application: (1) understanding the role of transportation in shaping need satisfaction changes over time through structuration processes and (2) bringing more attention to 'excess travel' or travel practices that do not come from need-satisfaction (2016). In the first area, there is an emphasis on taking a historical perspective in understanding how human actions have led to the development of need satisfiers that have become increasingly resource intensive over time, as well as an emphasis on taking a future-oriented perspective to see how current processes can be structured to alter need satisfiers going forward. For the second policy area, while it is currently considered taboo to assume that all travel is not actually necessary, Mattioli suggests that reducing travel for want-satisfaction may be the only way to meet climate targets going forward because it will enable necessary transportation for the transport disadvantaged while not causing undue harm for those able to still do necessary travel.

While the TEJF is a relatively new framework, I use it in this paper as it aims to provide a structure to the tensions that are present between achieving social transportation goals and environmental transportation goals. For the case of the rapidly evolving public transportation system in Santiago that intersects with social and environmental inequalities present in Chilean society, the framework will provide structure to discuss this system and make recommendations

for how these inequalities and justice issues can be addressed going forward near the end of the thesis.

4. Planning Inequalities and State Failures in Transantiago

The introduction of this thesis provided context for the failure of Transantiago in its implementation and the history behind its development. The question that naturally follows an event of disastrous public policy is what are the reasons it failed? Many have tried to answer this question in regard to Transantiago over the years since its original implementation. While this thesis does not solely focus on the failure of Transantiago, this chapter will provide an overview of common understandings and analyses of failure and interrogate them with the data I have collected. The aim of this discussion is to provide a context for the tensions over inequality in planning processes and the perception that those in lower income groups are not prioritized by the government in Chile, which will be critical for the following chapter that covers the protests that began in 2019. This chapter will specifically address the research question introduced in the first chapter – *what role did planning play in the failure of Transantiago?* The first section of this chapter discusses three categories of explanations of the failures of Transantiago, which are (1) technical failures, (2) failures of 'experts', and (3) institutional or structural failures. The second section will discuss how inequality intersects with these failures, making public transportation in Santiago a physical space in which inequalities become tangible through exclusion and the lack of community engagement. It will specifically discuss the lack of progress since the original implementation of Transantiago, which contextualizes the growing frustrations over inequality.

4.1. Transantiago as a state failure

Previous published explanations for Transantiago's failure can be grouped into three categories: (1) technical flaws in the design of the system and implementation process, (2) placing blame on technical experts and (3) structural failures because of top-down, expert-led institutions in Chile. Many authors' analyses and many of the people I interviewed included explanations across these categories. Despite overlap between explanations, grouping them into these categories allows for more meaningful analysis of this broader failed infrastructure project in considering which actors or institutions have contributed to the perceived failure.

4.1.1. Technical failure

Perhaps unsurprisingly, the most common explanations for Transantiago's failure fall under the category of technical flaws or errors in the design and implementation of the system. Typically, for a project to be considered a failure, there need to be physical or tangible flaws that the population can point to as failed elements of the system. Additionally, the implication that a

project fails means that there is some outcome that it was supposed to meet but did not. Venugopal describes how the "verdict of failure must be actively constructed through a long chain of actions that begins with the decisions over goals, the identification of measurement indicators, the way the data is collected, collated, and analyzed, and the way results are contextualized, elaborated, and interpreted" (2018, 239). In other words, a project on the scale of Transantiago fails in many ways when compared to expectations set by a multitude of actors, and its degree of failure depends on the ways in which its performance is measured or quantified.

The technical failures of Transantiago then can be categorized into three types that depend upon which groups of actors are evaluating them. These three groups of actors are technical experts or engineers, politicians and government officials, and residents of Santiago, particularly those who use public transportation. The way each of these groups evaluate Transantiago varies significantly. Technical experts and engineers tend to view the failures of the system in terms of performance metrics that had been set in the design but were not met in the actual implementation of the system. In papers written by such experts after the implementation of Transantiago in 2007, a main reason they attributed to failure was the system being rolled out before all of design assumptions were fulfilled. Examples of this included how the city had not yet constructed most of the segregated bus corridors, the payment system was not yet working on all of the buses, and delays with GPS technology installation in buses (J. C. Muñoz, de Dios Ortuzar, and Gschwender 2009; J. C. Muñoz, Batarce, and Hidalgo 2014). This was also supported by the interviews I conducted with such technical experts, who were quick to give lists of performance failures – ways in which the system did not perform as it was supposed to according to models and design plans.

Politicians or government officials also viewed the failure of the system in terms of performance metrics, but they had a set of performance metrics distinct from those of engineers. Particularly important in the failure of the system from the government perspective was the cost of the system. Originally the system was designed to be subsidy free, largely because of pressure on technocrats from the government. Multiple interview participants that would identify themselves as transportation engineering experts described the constraints set by financial goals on the design process. Ricardo Hurtubia, a transportation scholar and assistant professor in the Department of Transportation and Logistics Engineering at the Catholic University of Chile, described how the amount of buses in the system was forced to be decreased because of the government's desire to keep the system 'economically viable':

> "The technical people at some point say, oh, we need 6500 buses, this is what we need. And then they continue simulations until they reach something like 5000. Because 5000 was the number that some economist decided was the right number in order to have a successful bidding process. Because otherwise it would have been not successful and who wants to have an unsuccessful bid? That would be terrible for the bid and this has to do with the power, the balance of power between the… Finance Ministry… they are much stronger. They have muscles, right? … They were forced to reduce the number of buses… and they would move the parameters until they forced them to reach 5000." (Interview with Ricardo Hurtubia, Digital Interview, September 1, 2020)

Because Transantiago was designed to fund itself once implemented, while maintaining the fares of the previous system, it was a favorable project for the government. When the system was implemented, however, it was clear within just a few weeks that the system could not function with a high quality of service subsidy-free, and this became a point of failure for the government. Additionally, the government had broader goals for Transantiago being a world-class project that would bring Santiago to the international stage for its excellence in transportation. Its initial implementation causing so much chaos and largely performing as a partially-functional system made Transantiago a failure at least initially in this broader vision of trying to make public transportation in Santiago like that of a 'first-world' city.

Residents of Santiago, and more specifically users of public transportation, had a different set of expectations for the system. Some of the most important include the level of the fare, journey times, number of transfers, comfort of the ride, level of crowding, safety, and availability of information. In the initial implementation of Transantiago, all of these were far from expectations for passengers of the system, with the exceptions of the level of the fare and safety. Users of public transportation expected that service in the new system would, at the very least, not be worse than the previous system of micreros, but in all of these areas it did perform worse, at least for the first few months. Media coverage from the first few weeks in February and March described spontaneous riots on the streets, as Ricardo Hurtubia described it, from "all kinds of people who do not usually riot," simply because they could not get on a bus to get to work for hours. When they could finally get on a bus, they were faced with extremely overcrowded conditions, very long journey times, and numerous transfers to get to their final destination (J. C. Muñoz, de Dios Ortuzar, and Gschwender 2009). In the beginning stages, there was also a lack of information available to passengers about the bus routes and timetables for service. A government's project promising a 'world-class' public transportation system to its

citizens is then bound to be a failure in the eyes of the citizens if its implementation falls far from the promised vision. While these technical failures are essential in understanding how Transantiago failed and how this failure varied across actors in the system, analysis of the failure at more meta-levels allows for a deeper understanding of such projects. I discuss one such explanation next.

4.1.2. Failure of technical 'experts'

One analysis of this sort is the second category described above, which blames the failure of Transantiago on the technical autocrats or experts who were responsible for designing the system (Ureta 2015). This line of argument tends to follow a logic of how technical experts were only concerned about making the most technically efficient system without considering the knowledge of residents or any concerns that fell outside of models and system plans. More broadly, this assumes that the design of the system itself was flawed. Even if the implementation were to meet design goals, it still would have failed because the design itself did not fully grasp the problem at hand and create an adequate solution. In *Assembling Policy*, Sebastián Ureta argues from an STS perspective that the technocrats of Santiago's transportation planning used models to construct users that were purely fare and time optimizers, forcing the behavior of passengers into the constructs that engineers designed for them. In the engineers' quest to optimize the system and make it as efficient as possible, they failed to consider the actual priorities of users. When the system was actually implemented, passengers' behavior deviated from the model's expectations because it turned out that people often prioritized comfort over fares or travel times. Many people who use public transportation would prefer to have a journey where they would sit in one seat the whole time and avoid transfers, even if it meant they had to pay more or have a longer journey time (Ureta 2015). If a model is based off of a critical assumption like this that does not actually represent reality, the system is then destined to fail because it was built upon a false understanding of reality, in this case users' preferences.

Additionally, Ureta describes in detail how engineers seemingly arbitrarily assigned numerical values in their models to describe people's preferences. As an example, the model includes factors to give weight to users' perceived travel times for walking, waiting, and riding in a vehicle. Based on the numerical values assigned to each travel mode, the model assumed that people "perceived walking and waiting time as two and almost four times longer than the time involved in properly traveling" (Ureta 2015, 78). When viewed from this perspective, the planning process resembles James Scott's conception of a high-modernist planner (Scott 1998). Scott describes elements of high-modernism as aiming to make populations legible through

numerical assignments and data, particularly in reference to censuses, and through this legibility the state is able to leverage control over the population. However, at the same time such technical values can never really describe a city or population truly; they make crude estimations along axes of interest for the state to enable it to gain power over the population (Scott 1998). It is because of this latter point that Transantiago failed in part. The estimations that the technocrats made for the residents of Santiago did not actually describe people accurately. Passengers on public transportation were more complex than the engineers' models could accommodate for; the complex behavior of the residents of Santiago could not be codified and therefore simplified into equations.

When put under a more critical lens though, placing the blame on technocrats or engineers becomes an explanation that is both too simplistic and narrow in focus. None of the interview participants I spoke with were willing to blame technocrats for the failures of Transantiago. Here my positionality and the background of the interview participants becomes important. As mentioned in Chapter 2, there is of course an important bias, which most participants frankly acknowledged, in that eight out of twelve of the participants had engineering backgrounds. I also have a bias myself since I am coming from a technical background with a degree in engineering. But importantly, the other interview participants, who had backgrounds in the social sciences and business, also did not place blame for the failure on technical experts. To them, placing blame on one category of actor was unfair and they preferred to place blame equally across all actors involved in the design process. Additionally, Ureta's argument that technocrats were purely involved with efficiency and had no interest in involving the user in the process is not the reality of how the planning dynamics worked out. Engineers I spoke with that were involved with the original planning of Transantiago described how the engineers did not have much choice in designing the constraints for their models. Instead, the government officials handed them very specific parameters and asked them to simply do the calculations and modeling based on the parameters already decided upon by government officials. So the technical experts did not have the freedom to start with a clean slate and imagine how the best system might be designed, the system parameters were handed to them and they were just told to run the numbers. As Rodrigo Quijada, a transportation engineer with over 20 years working in citizen's organizations and a year and a half working in the Ministry of Transportation in Santiago, described:

> "the task engineers got was very, very restricted and they did their job. If you take the documents, back then what you see is that the government contracted a company or

> consulting firm, full of engineers, but to make the simulations *they* wanted, that *they* decided to make. 'So let's imagine these conditions, now you simulate what's going to happen… and tell me, what's the result?' And they did that well enough." (Interview with Rodrigo Quijada, Digital Interview, September 22, 2020)

This, of course, does not mean that engineers were free from blame for the failure of the system. There are still clear examples, like failing to accurately understand users' preferences, that contributed to the failure of the system at the hands of the technocratic experts. More accurately, the engineers are at fault for the failure of the system, but no more than any other actors in the system.

4.1.3. Structural failures

However, it is the institutional and structural reasons for these technical flaws that are more interesting and bring more insight into why projects fail at such large scales. A majority of the people I spoke with were partial to the explanation that the role of Chilean institutions and political values were instrumental in the failure of Transantiago. Specifically, most pointed to these shortcomings: autocratic institutions that could not accommodate for knowledge from non-experts and had no capacity for structural change, lack of cohesive visions for urban planning in the city, and lack of political prioritization for buses and overall misplaced urban priorities. These broader institutional failures provide some insight into both how the technical failures in implementation occurred and why the design of Transantiago itself was flawed.

Chile's autocratic institutional structure is rooted in the country's political history, particularly Pinochet's military dictatorship and the neoliberal policies that followed this regime in the return to democracy. Two important outcomes of this institutional structure is a state that is skeptical of urban planning visions and a state that is unwilling to seek out citizen involvement in decision making processes. Lake Sagaris, who became a scholar in transportation and urban studies after founding the community organization called Living City, describes the role of Chile's political history in urban planning:

> "I think there's a little bit of the military regime where we had a very autocratic authority. (They had) certainly no concern whatsoever of what people would think about the decisions they were taking, they would probably discredit them. And I think we had authorities that were very skeptical about the role of city planning. So when you think that the city should evolve, basically, depending on private initiatives, and think that

> because a private initiative emerged, it must be good for the city, and you do little planning - I think in that mindset, you will have no interest really in asking people what they think about what you're doing." (Interview with Lake Sagaris, Digital Interview, October 23, 2020)

The autocratic, expert-led institutions in Chile also lead to a paternalistic sense of decision making. Rodrigo Quijada, who has extensive experience in activism work in Santiago, described the process of the decision making for Transantiago as an expectation from the state that the residents would just trust that the 'experts' knew what was best for everybody. It felt as if the state officials were saying "we're doing this for the good of everyone and trust us." Rodrigo also described Transantiago's aims to modernize Santiago as a leap of faith the governments expected the citizens to believe in:

> "I think the framing was that Santiago was modernizing, you know, and modernization hurts, you know, … what seemed to be, kind of, the general message was this will be for the best, we just have to adjust. It'll hurt a bit at first, but this is how we modernize, this is for a better future." (Interview with Rodrigo Quijada, Digital Interview, September 22, 2020)

Trust in the state's enforced vision is particularly difficult for the public to embrace when they also feel that their government does not care what they think or does not try to involve them in decision making. Multiple transport engineers and scholars as well as social scientists explained how community participation is not part of Chile's political system. In the process leading up to Transantiago's implementation, the government held a series of public participation sessions that were really just a series of information sessions given by transportation engineers. These experts would give a presentation on what they were planning to do, with zero intentions of modifying their plans based on feedback from the audience. Abby Moy, who studied community participation in the development of Transantiago as a Fulbright project, described how at these sessions it became clear that "the decision making itself was incredibly closed, and the people felt that, and the people resented that." Other than these 'participatory' sessions, there were no channels through which the public could influence decision making in the process of designing Transantiago.

There are many examples where involving the community would have likely made a positive impact on the perception of Transantiago. In the case described above where the

engineers' models imagined users as purely fare and time optimizers, a simple survey of the public on their preferences in public transportation would have allowed the model to incorporate comfort as a key variable. Another example is in the design of the payment system for Transantiago. In the previous system of micreros, there were multiple problems with using cash for fare payments such as drivers taking cash for themselves and difficulties involved with issuing change for fares. So in the design of Transantiago, they decided to get rid of cash entirely and have a system based entirely on fare cards, which sounded like an excellent, elegant solution to the problem on paper. However, the fare cards were a huge issue for the people that typically rode public transportation because many of these people are low-income workers that make just enough money to pay for their day's journey. Many had no savings or bank accounts to allow them to preload their fare cards the day before taking their public transportation trip. Abby Moy further described how even a basic level of community participation could have shown the planners fundamental issues in this design:

> "They could have just asked a random person on the street, 'How does this sound to you?' They'd be like, 'This is a problem. I don't have enough cash on hand to keep a fare card stacked.' And then … just very, very simple decisions like that which to say a civil engineer or someone on paper, it looks fantastic. Because then you get rid of all these corruption problems and a lot of these like space and you know, collection issues. You can tax things, everything sounds great. But if they had just even had a session where they opened up in public, like, 'What do you think of this?' They would have had to think of a lot of other issues. But they never did that. They never did things like that." (Interview with Abby Moy, October 2, 2020)

Citizen participation allows planners and engineers to understand the basic preferences and needs of the population. If the process of Transantiago's design were to have included community participation, perhaps some of the disappointments users had when the system was implemented could have been avoided.

In addition, the institutions in Chile, particularly as a result of neoliberal policies implemented after the end of the military regime, still hold skepticism of broad state-led urban planning visions and initiatives. Many interview participants spoke about how Santiago has never had a moment where people have come together to discuss what kind of city they want to have. This becomes an issue then for planning a revolutionary public transit system, as Ricardo Hurtubia explained "in order to have a vision for the public transport system, you need to have

first a vision of what city you want to be" (Interview with Ricardo Hurtubia, Digital Interview, September 1, 2020). And this lack of a vision is obvious in the way the city has grown. Planning and urbanization has happened *to* Santiago. Many of Santiago's issues in spatial inequality and urban sprawl result from a lack of intentional urban planning from the government. The city has just become the way it is from an amalgamation of private initiatives and independent developments over time. As Juan Carlos Muñoz, a renowned transportation scholar and professor in the Department of Transportation Engineering at the Catholic University of Chile, described,

> "But I think I think that there's little vision about how the city should evolve. Now, I think if you put your eye only on the transport system and not in the land use system, you're only reacting, you're only reacting to a city that will probably evolve in the opposite direction you want. So that's a problem. So having a vision for the public transport system without intervening the land use system, I think it becomes like wishful thinking." (Interview with Juan Carlos Muñoz, Digital Interview, October 14, 2020)

Decisions for the city are "atomized," as Ricardo Hurtubia noted, in that the government makes separate decisions about the future of the city based on what seems like a good opportunity in the moment, but not in pursuit of some grand vision for the future of the city. A major element in this lack of a unified vision for the city's planning is the lack of a Metropolitan Authority. There is no local authority in Santiago that makes decisions for the city itself. Santiago's 34 municipalities all have elected mayors that make independent decisions with no central authority to unite them. Otherwise, any other decisions or plans for Santiago are made at the national level. This leaves the national authorities as the only entities able to make decisions for Santiago as a whole, which leaves obvious questions for urban planning in the city in the future.

4.2. Lessons learned and connections to inequality

Thus far, this chapter has considered why Transantiago was considered to be a failure. Since it has been over 14 years since the original implementation of the system though, an essential question to consider is has Santiago learned anything or made improvements from this failed project? The answer to this question is complicated, but overall there are mixed results. For the remainder of this chapter, I will discuss two topics to show both the stagnation and progression of learning from Transantiago's initial failure: (1) the recent tendering process for new bus operator contracts and (2) developments in community participation processes. The

recent tendering process has shown more progress, while community participation has made some progress yet ultimately has not developed much. The relative lack in improvements though is important in understanding the public perception of how inequality is linked to government processes, which is important in the context of the protests that began in 2019. In the lack of community engagement and prioritization of making improvements in infrastructure that services lower income groups, transportation becomes a space where inequality, and the frustrations over it, is present every day.

The tendering process to renew the bus contracts has offered the most substantial opportunity for improvement in technical shortcomings of Transantiago. In 2016, a process was initiated for a new tendering process since the original bus operator contracts were set to expire in 2018, ten years after they were first established. This tendering process presented an opportunity to fix elements of the system's design that did not work in the original version of Transantiago, one article calling it Version 2.0 of Transantiago (Global Mass Transit 2017). In particular, a major problem preventing the improvement of quality of service on buses is that the current contracts make it very difficult for poorly performing bus operators to be replaced. Many interview participants cited poorly designed contracts and incentive structures within them as a major issue preventing Transantiago from continuing to improve today. The incentive structures within the contracts to make sure bus operators provide satisfactory levels of service are not designed well enough to actually ensure high service levels. For example, bus operators currently receive 70 percent of their payment based on how many passengers they pick up and the other 30 percent is from the kilometers traveled. A few of the transportation engineers interviewed described how this does not incentivize the companies to provide good service, but instead just pick up as many passengers as possible. The service that they provide is how far they actually drive since their operational costs vary by distance, not number of passengers, assuming main operating costs are fuel. Additionally, poorly performing companies are very difficult to replace because they own so much capital between their buses and bus terminals. The new contracts though have an update to separate the ownership of capital from the operators. So in the new tender process, the state will get ownership over buses and bus terminals. Operators making bids will simply be operators, they will not own the buses or bus terminals. This will make it much easier in the future to switch out bus companies that are not meeting satisfactory levels of service for their passengers.

Unfortunately, despite the promise that this process holds for improving the service of Transantiago, the tendering process has been continuously delayed with little insight into when it will actually happen. The process was initiated in 2017 during Bachelet's second term. This

process was delayed and then cancelled by the incoming Piñera administration 2018. A new process was initiated in 2018, which included the changes to property assets as described above, but the process has been delayed by the social movements that began in October 2019. The process has been further delayed with the COVID-19 pandemic in the spring of 2020 and the constitutional referendum process that happened in the fall of 2020. With all of these social and political upheavals occurring over the past two years, it is unclear when the tender process will actually be completed. In addition, separate from the tendering process, many of the buses have been replaced in the past two years. Since the majority of the buses currently in the fleet have been running for over ten years, the quality of the bus service was being greatly negatively influenced by the outdated buses. The replacement of the buses with new electric and hybrid buses has been a positive improvement for passengers. The tendering process will bring a much higher degree of change to the system though, so hopefully it will finally conclude soon.

In the years since Transantiago's implementation, community participation has been recognized by many to be important for transportation planning decisions, yet institutional change has not occurred. Many transportation experts that I spoke to, in particular those who were ex-undersecretaries and previous leaders of Transantiago, spoke of community participation efforts they designed while they were in office and piloted to varying levels of success. However, these efforts, to their knowledge, did not continue once they left office. There are also community participation committees, called COSOCs, that have now become mandatory to host in municipalities where new projects are going to be implemented. Yet interview participants I spoke to explained to their disappointment that these are mostly aesthetic processes. Most of these committees occur because they have to but the reports that are generated from them never actually impact the projects. In a more positive light, all interview participants I spoke to expressed their disappointment that community participation was not a part of Santiago's transportation decision making processes and wanted to change this. However most expressed exasperation in that Chile's institutions are not able to accommodate change and new ideas, such that any new initiatives never become absorbed. There were hints of hopefulness though that the rewriting of the constitution that is set to occur over the coming years will bring changes to Chile's institutions, allowing them to have the capacity for valuing citizen knowledge in policy making processes.

The relative lack of progress in renewing the bust contracts and implementing community participation for over a decade since the original implementation of Transantiago provides background for the following chapter which will discuss the 2019 protests. While a discussion of why transportation specifically became the location for these protests will be in the

next chapter, the events discussed in this chapter play an important part. First, when a government fails to allocate enough resources and energy to improving the infrastructure that the poorest residents of the city use daily, and instead focus on the infrastructural needs of the upper classes like highways, the populace visibly understands which groups the government views as more important. This lack of prioritization for the lower income residents of Santiago can be seen in both the initial disastrous implementation of Transantiago, as well as the failure to renew the contracts after ten years of service. The buses currently running in the system are over ten years old, which is past their expected service lifetime, leading to a poor level of service in recent years. The constant pushing of the tendering process to different administrations has had direct negative impacts on the everyday experience of many of Santiago's residents. It is easy to see how residents of Santiago could feel that the government does not care about their everyday challenges when these necessary policies are continually deprioritized.

Additionally, the complete failure of Chile's institutions to include the public in policy making lead to a sense of exclusion for much of the population, especially when they continue to see policies implemented that do not serve their interests. Throughout the development of Transantiago, there have been very few examples where planners or government officials sought out the opinions of the people who would end up using the system daily. Only those who have power or financial resources have the ability to influence the decision making of the government. When it comes to infrastructure projects like transportation, the exclusion of lower income groups actually becomes a visible reminder of the inequalities present in the government's planning processes. The following chapter will discuss in more detail how these inequalities in society more generally intersected with transportation, resulting in the protests that began in October of 2019.

5. Chilean Protests 2019-2020 & Transportation Inequalities

This chapter aims to explore the role of transportation in the protests that began in October of 2019. As mentioned in the introduction, the protests began in response to a 4% increase in the metro fares and quickly became the largest social movement Chile has seen in decades. While the Metro was the initial location and reason for the protests, the protests quickly moved beyond the Metro in both location and scope, broadly becoming a movement against the high levels of inequality that the country has failed to deal with for years.

Specifically, this chapter asks why the most powerful social unrest Chile has seen in over three decades began with a metro fare hike. Almost all interview participants agreed that the metro fare hike was the final straw, that after years of building frustration over growing inequality and unfair government policies, the price increase set off years of existing tensions. But interview participants had diverging views on the specific role of transportation in this. Some thought it was just a coincidence that the protests began as a result of a metro fare hike as it could have just as easily began with something else. Others believed that transportation played a uniquely significant role in starting the protests. This latter reason is a more intriguing one. Since transportation ranks below public policy areas like healthcare, education, and pensions in importance to the public in Chile, it is not at first obvious why transportation could have the potential to spark social unrest on its own (CEP 2020). But the unique characteristic of transportation is that compared to other areas of policy, transportation is the only one that almost everybody has to deal with every day. This brings up the question of the possibility that certain public policy areas, like transportation, could be more likely to spark social movements compared to others. For the case of Santiago specifically, I will make the argument that transportation has become a visible everyday symbol of inequality, which provides a unique sector where one negatively perceived policy change can set off social unrest.

Overall, this chapter seeks to answer two research questions – (1) *what was the role of public transportation in sparking the protests?* and (2) *does public transportation have a unique ability to spark protests?* The chapter is split into two main sections. The first section will explore the three explanations listed above – the metro fare hike as (1) the final straw, (2) a coincidence, and (3) a unique spark for social movements – that provide answers for what role public transportation played in the protests that began in October 2019. The second section will then conclude the chapter with a review of the arguments, focusing on the links between transportation and inequality. This will provide context for the following chapter which discusses in more detail how environmental inequalities intersect with transportation.

5.1. The role of public transportation in Chile's October 2019 protests

5.1.1. "Fue la gota que colmó el vaso" – the Metro fare hike as the final straw

While many popular media outlets across the world expressed shock about the protests that began in October of 2019, the citizens of Chile and those who had been paying attention to political and social tensions in the country saw the protests as an event that was in the making for years, it was just a question of when it would happen. Chile is often lauded as Latin America's success story for economic development, but the picture of prosperity crumbles when one digs below the surface. Though Chile has the highest GDP per capita in Latin America, it follows the same trend as the rest of the region, that is one of staggering inequality (World Bank 2021). When comparing Gini coefficients, Chile ranks as the country with the highest levels of inequality out of all 37 OECD countries (OECD 2021). If split equally among all citizens, Chile's per capita income would mean everybody would make over $2,000 a month. However, in reality a majority of Chileans make less than $550 a month, or 400,000 Chilean pesos (Durán and Kremerman 2020). A 2018 study from the Ministry of Social Development and Family showed that the richest 20% earned 13.6 times more than the poorest 20% in Chile (Gobierno de Chile 2018). Given the crippling levels of inequality in Chile, there has been a lingering tension that the majority of the population has not been benefiting from the economic prosperity the country has been gaining on the whole.

The high levels of inequality in Chile do not just play out in economic terms, but in a sense of frustration from all classes against the elites. There is a general sentiment that the elites in Chilean society are always on the winning end of government decisions, while everybody else continues to fall behind. A report from the United Nations Development Program in 2017 found high levels of discontent around unequal access to education and healthcare and unequal experiences once granted access to these services (UNDP 2018). In policy areas ranging from education to pensions, Chileans can clearly see the benefits granted to the elites through privatization, benefits they often cannot afford to access. Most articles cite that education, healthcare, and pensions are the top concerns for Chileans. All of these areas are guided by their formation during neoliberalism's rise in Chile and are today policy areas where inequality is obvious.

Chile's educational system is split between private, partial private, and public schools. In 2018, only 30% of students who took the PSU, Chile's standardized test for college admissions, received a score high enough to apply to college. Compare that to the fact that 79% of students in fully private schools received scores high enough to apply to college.

In regards to healthcare, Chileans can use the public healthcare system or opt out for private health coverage. Those who pay for private healthcare receive access to separate health facilities and services, whereas those using the public system are often relegated to lower levels or services, outdated facilities, and long waiting times. Though many may wish to opt in to the private system, it is prohibitively expensive for most people. In 2015, the average premium for private health coverage was equal to 45% of the minimum wage (Crispi et al. 2020).

In addition, Chile's fully privatized pension system has not provided a reasonable level of living for retirees. This pension scheme has been singled out to be the most important issue for protesters in opinion polls (Heine 2020). About 80% of pensioners receive less than the minimum wage (Heine 2020). The program set up in 1982 initially promised that people could retire at 70% of their salaries, however now that it has begun to pay out, it has only granted 20-30% of participants' wages (Heine 2020). This has left elderly Chileans destitute, reliant on family or friends or left to beg for enough to live.

Protests about these inequalities are not a new phenomenon. Chile saw major protests in 2006, 2011, and 2016 around education and the pension system. The 2019 protest also followed the same trend of being led by students as in the past sets of protests. What was new about these protests though was their scale. Chile had not seen such widespread social unrest and intense violence since the end of the Pinochet dictatorship. In an article in Vox, Julio Pinto, a professor studying social movements at the University of Santiago, explains "what's really new this time around is that all of the tensions flared up together in an explosion that covered the entire country and almost every social sector with a unison that hasn't happened before" (Johanson 2019). These protests were truly historic – over one million people, or over 5% of Chile's population, marched on October 25 – a crowd size that has not been seen since the end of Pinochet's dictatorship in the late 1980s. After years of building tensions and frustrations over the inequalities in all realms of Chilean society, it just took one more frustrating policy to set off these monumental protests. This view was one shared by most that I interviewed and is further supported by media articles.

The sentiment that the metro fare hike was "the final straw that broke the camel's back" is popular in many media articles and was a sentiment shared by a majority of the interview participants. Many quote specifically the idiom in Spanish, "fue la gota que colmó el vaso," or it was the last drop that filled the glass. The newspaper El Salto explained how "unos cuantos céntimos de euro, insignificantes a priori, pero que fueron la gota que colmó el vaso," or how a few Euro cents may seem insignificant but were the last straw (Bordel Gil 2020). América Economía, an economics and business magazine headquartered in Santiago reported that the

metro fare hike, along with an image of Piñera eating at a pizzeria during the protests, were "la gota que colmó el vaso" according to protesters (America Economía 2019). A brief Google News search returns 29 articles published between October of 2019 to February of 2020 that are about the Chilean protests and include the phrase "la gota que colmó el vaso." Because the protests quickly evolved to express discontent with all types of inequalities in the country, it would be impossible to argue that the protests were just about the metro fare hike. The metro fare hike was just the last injustice – the final straw – the population could take before fighting back against the inequalities they faced. This explanation on its own seems to be one that the majority can agree with. The more interesting and contestable question then becomes – was transportation a coincidental spark for the protests or is there a meaningful quality about transportation that can make transportation-related policy decisions likely to cause social unrest or conflict? The next two sections will explore this question.

5.1.2. Metro fare hike sparking protests – a coincidence?

Given the long list of inequalities Chileans were protesting against, it was not necessarily obvious that a metro fare hike would finally be the spark to ignite the kindling flames. In theory something totally different could have started these protests. When Rodrigo Quijada, a transportation engineer with over 20 years working in citizen's organizations and a year and a half working in the Ministry of Transportation in Santiago, reflected on the protests that began in October, he explained to me that "most of us believed that it didn't really matter what the trigger eventually was going to be… if it was the transport fares or not, it could have been something else in theory." Chris Zegras, a professor of urban planning and development at MIT who has been both an analyst and observer of Santiago's transportation system for decades after spending time living and working there, expressed similar remarks as Rodrigo Quijada. Speaking about the role of the metro fare hike in the protests, he explains "it's quite easy to point the finger [at transportation but] it could have just as easily been water or something [else]. But, that was the perfect tinderbox… because it was the accumulation of basically violations against people's dignity for so long."

Media articles present similar theories that this metro fare hike just happened to be the spark that set off existing tensions. In a World Resources Institute blog post, Dario Hidalgo writes "while a 4% fare hike of 30 pesos ($0.04) on Oct. 18 was the initial spark, the protests are really the explosion of a pressure cooker that has been growing for years, fed by profound socioeconomic inequalities" (Hidalgo 2019). Many articles simply mention the metro fare as a

spark for the protests and then go on to explain how the protests are about widespread inequality in the country, ignoring the role of transportation for the rest of the piece.

5.1.3. Public transportation - uniquely capable of sparking protests

Many interview participants and media articles, however, were not so quick to write off the metro fare hike as just the spark for the protests. It seemed clear for many people that transportation had some characteristics that made it uniquely capable of sparking the protests. For them, they agreed that the protests were a result of years of frustration, but it was also no coincidence that an unjust transportation policy was the spark for this social movement. There were a few common explanations for these special characteristics of public transportation. First, transportation is a system that puts every type of inequality in one space, making it a symbol of inequality. Second, compared to other policy areas that people expressed frustration about, transportation is the only one that everybody has to experience every day. And last, that transportation is the quintessence of what the protests are about, that is an experience of inequality of course but also of exclusion and failures of democracy.

In Santiago, the public transportation system is a visible and embodied experience of inequality for the Chileans that use it. Many interview participants brought up the Metro system as an example of how public transportation emphasizes and even serves to worsen the spatial inequalities and urban segregation in the city. In an interview, Ricardo Hurtubia, a transportation scholar and assistant professor in the Department of Transportation and Logistics Engineering at the Catholic University of Chile, linked urban segregation as the main reason for the protests over the metro fare hike:

> "The metro is the visible face of this, but actually it's not the metro, it's the lack of, I would say, it's the lack of urban planning. It's the fact that you have people living 30 kilometers away from their jobs because the city grew freely, without any control. And I would say that's the main problem" (Interview with Ricardo Hurtubia, Digital Interview, September 1, 2020)

Another interview participant described this phenomenon in detail. Juan Carlos Muñoz is a renowned transportation scholar and professor in the Department of Transportation Engineering at the Catholic University of Chile. He founded the Center for Sustainable Urban Development (CEDEUS) and the Bus Rapid Transit Center of Excellence (BRT) at the university and has served as an advisor for the government on Transantiago for multiple projects

since its implementation, overall studying public transportation in Santiago for over two decades. After he described the frustration Santiago residents felt over the metro fare increase, he went on to explain how he sees public transportation as a factor that continues to increase urban inequalities rather than reduce them:

> "Somebody could argue that the metro lines in some way make the system less unequal. But what you're doing is you're moving people very far, far, far away. And you're not really changing the root of the problem, which is how segregated the city is. When you build a new metro line, what you're doing is trying to let the city keep on moving and equally embracing segregation. And we will try to let people move very fast to reach those places. But still, it will take those Metro riders probably more than an hour to get to their destination. And the city will keep on moving farther and farther from where low and middle income people live." (Interview with Juan Carlos Muñoz, Digital Interview, October 14, 2020)

The rampant urban segregation in Santiago means that often public transportation serves as a method of maintaining or even increasing these spatial inequalities. If public transportation continues to improve in quality, the low and middle classes can keep moving farther away from city center because their travel times may not become much longer with new and improved metro lines continually added.

The connection between urban segregation and public transportation is not just visible through the growth of the public transportation network but also in the dynamic between the majority of the residents and those making decisions for the city. There is a commonly-held view among middle and low class residents in Santiago that the rich residents and government officials do not understand or care about the quality of life of the majority of the residents in Santiago. Most of the people who work in government in Santiago live in the middle of the city, in areas in which they do not need public transportation to get to work because they are already in the city. They also tend to own cars for the situations in which they do need to leave their area. Ricardo Hurtubia explained how those with high incomes in Santiago "shelter themselves from the rest of reality." Since most government officials have made a bubble to separate themselves from the reality of life for ordinary Santiago residents, it is perhaps easier to understand how they implemented a metro fare hike. To them, such a small difference in value is negligible. But for many taking public transportation every day, the price change was huge, especially considering how much monthly income already goes to paying for transportation.

Guillermo Muñoz, who served as the Director of Transantiago for four years and has a background in transportation engineering, talked about his understanding of the frustration that the people of Santiago felt against the people in government making transportation decisions:

> "It's not my area of expertise, but behind everything, there's a problem of inequality, and on top of that inequality or inequity, there's a sense of rage when you can't be heard with empathy. The problem with inequality wasn't created by this government. But if you can't be empathetic with your citizens, if you can't listen to them when they express something, that creates larger problems. So the role of the government is to understand that this inequality exists and to understand the reasons that people express themselves against it. And when you raise the fare by 30 pesos, maybe for professionals, for someone who has an adequate standard of living, if you add that up, it's nothing. It's not that much. But that's the problem. To raise a fair by 30, pesos is crazy." (Interview with Guillermo Muñoz, Digital Interview, October 9, 2020)

Calling the fare hike 'crazy' may seem to be an overstatement, but the Metro fares in Santiago are relatively very high compared to average incomes in Santiago and compared to fares in cities in the rest of Chile. In Santiago, researcher Juanizio Correa estimated that for a low-income household, transportation costs on average represent 28% of a family's monthly income, compared with just 2% for high-income households (Hidalgo 2019).

Income inequality is also visible in Santiago's transportation system. In many cities, especially in Latin America, public transportation is mainly a mode of mobility for the working and low-income classes, which is the case for Santiago today. As Carlos Melo, the Undersecretary of Transportation in Chile from 2016 to 2018, put it simply, "people of high income in Chile don't use the public transport (system)". However, it was not always this way in Santiago, which makes the typical ridership on the Metro today even more stark. The Metro used to be used by all classes, especially the middle and upper classes because the Metro previously did not even reach many areas of the city with lower income populations. The implementation of Transantiago was a major force in changing the rider population on the Metro because more Metro lines were created and bus feeder lines were created to bring riders to Metro stations. Chris Zegras recounted his experience living in Santiago many years ago where there was a real mix of people using public transportation:

> "There was a time in Santiago, where… the metro was actually a mix. It was like, you know, you would see all the classes there, you would actually see even on the buses, everyone. It was more of an equalizer - not to diminish the fact that still, you know, the poor people had four hours of travel with three different transfers on the bus and had to pay triple the fare, because there wasn't a single card and all of that. I'm not trying to diminish that, but there was still more of an equalizer." (Interview with Chris Zegras, Digital Interview, October 21, 2020)

In addition, the rising standard of living along with the increasing middle class is a major contributor towards the current ridership trends since more of the population is moving towards cars to suit their mobility needs. In Chile, as in much of Latin America, cars have become the symbol for the attainment of middle class status. As people begin to make higher incomes, the one purchase that people strive for to show that they have achieved this status is cars. Chris Zegras describes this 'paradox of development' in the case of Santiago:

> "This is the paradox of development. Especially when it comes to transportation, you know, as the country gets richer… for better or worse society seems to attribute the private vehicle, a car, as this like accoutrement of the middle class itself. It's a, it's not just a mode of transportation. It's… it's a tool of the middle class. And it becomes a way of being middle class. [It] changes where you can send your kids to school and changes how you can go shopping, it kind of changes how people perceive you, it changes where you can live and where you can't live. So it's a conflict but at the same time… a system of transportation that accommodates this middle class tool is gonna just worsen the inequalities unless it's incorporated into the system very carefully. But instead, you get highways that divide cities, you get, you know, worse air pollution, you get worse traffic accidents, and all of this stuff that always, always falls more onto the backs of the poor." (Interview with Chris Zegras, Digital Interview, October 21, 2020)

When Zegras speaks about the car as a 'tool' of the middle class, he quotes the work of Eduardo Vasconcellos, who is a transportation scholar in Brazil. Vasconcellos describes the car as a tool of the middle class, meaning that the car is a means of class reproduction. Being a member of the middle class requires a set of social, cultural, and economic activities that can only be performed with the freedom in time and space granted by the ownership of a car (Vasconcellos 1997). The car becoming the ultimate tool for the middle class is importantly not only shaped by

consumer demand, but by state policy promoting the automobile over public transportation. Vasconcellos speaks on the case of Brazil, but much of this is true for Chile as well:

> "In addition, a built environment which enhances the need for car use was also generated: large investments in new urban and regional highway systems were provided, while railways were dismantled and public transportation systems were kept subjected to permanent crisis (Barat, 1991; Figueroa, 1991). The development project envisioned middle sectors committed to a new lifestyle who would then use all tools thought to be necessary to drive to a better future. In this sense, one can talk about a *symbiosis* between the middle class and the automobile, for one cannot survive without the other. It is the longest lasting and happiest marriage of our times. In addition, one can talk about a mutual sustaining relationship between the built environment and the automobile. It is like a *trap*, within which the middle class was born and guided from its inception to understand that the dream of social mobility would be possible only with the automobile." (Vasconcellos 1997)

This pattern is hugely important in Santiago and contributes to the frustration over inequities in transportation policy in the city. Santiago has consistently put more resources and attention into the establishment of infrastructure for cars, particularly highways, over public transportation infrastructure. Chris Zegras speaks about this lack of emphasis on public transportation infrastructure in Santiago:

> "For many years before [the implementation of Transantiago] the government was putting all of its real effort into building highways. And they were putting lots of effort, lots of, you know, institutional capital, financial capital, and technocratic capital into building a large urban highway system. Well, they kept talking about public transport priority improvements. And so they did it all on the cheap. *So they, you know, build these beautiful highways, and then they can't even put in nice bus stops."* (Interview with Chris Zegras, Digital Interview, October 21, 2020)

When the majority of citizens in the city use public transportation to get around, this skewed prioritization of infrastructure for private automobiles that serve the middle and upper middle classes makes the experience of accessing the city unequal. Additionally, when residents see new highways being built in the city, it both fuels the desire to own a car to be able to use the city's

infrastructure and brings feelings of resentment when purchasing a car is not possible. Ricardo Hurtubia describes this desire to be able to use the city's infrastructure for cars, "a lot of low income people, what the main thing they want is do to buy a car because well they put these highways here, I want to use them; and you see the other rich people, they drive cars, I want to do the same as them" (Hurtubia 2020).

Public transportation is also a space where gender inequalities are visible and abundant, especially in Santiago. One way in which this occurs is in the context of the reasons women need to use public transportation compared to men. Because women tend to be caregivers, many trips made by bus or train are care related. Yet public transportation is not friendly to caregiving needs. Gender inequality was rarely mentioned in the interviews, though this may not be surprising because only two out of the twelve interview participants were women. The one interview participant to mention gender inequality was Lake Sagaris, who was previously a journalist but moved on to become a scholar in urban studies with a social science approach after founding a community organization, Ciudad Viva or Living City, in Santiago to advocate for communities in the planning of infrastructure and other public projects in Santiago. She currently is an Associate Professor and Researcher at the Catholic University in Chile and has spent more than two decades being involved with transportation and urban planning in Chile, from the perspective of both an activist and scholar. When speaking about modes of transportation that are used in Santiago, she described the gendered components of public transportation:

> "If you actually map how people travel in our metropolitan region, you will find that in many areas, the majority of trips are made walking. And of those trips, 80% are made by women. So there's a very strong gender component there… there's the very strong issues related to gender, care trips two or three times, the carrying trips are done by women. So there's definitely a strong gender component related to trip purpose. And in many cases, and it's clearly demonstrated that women face major problems to use public transport, because it's not very friendly to their needs to carry people to carry things, to get on and off to sometimes make long distance trips from one part of the city to the wealthy areas, which are quite distant for most of the very low income city, parts of the city." (Interview with Lake Sagaris, Digital Interview, October 23, 2020)

Lake went on to describe further inequities women face on public transportation, in particular safety and concerns about crime and sexual harassment. She explained "women who used to feel

very safe on the metro no longer do because of overcrowding. And not only the usual harassment or fears due to common crime, but also sexual violence" (Sagaris 2020). These gender inequities are not just a problem in Santiago, but a well-documented pattern on public transportation across the world. Public transportation systems around the world are designed for 'formal work,' misclassifying trips taken by women for care work as trips for leisure (Gauvin et al. 2020; de Madariaga 2016). This results in public transportation systems not designed to accommodate the needs of women, making their experiences more difficult and burdensome. Fears of sexual harassment and violence and other forms of crime on public transportation worldwide are extremely limiting for women, non-binary, and transgender people's mobility and therefore access to opportunities (Loukaitou-Sideris 2014; Dunckel Graglia 2016; Mazumder and Pokharel 2019; Lubitow et al. 2017).

One could argue, however, that people face these categories of inequalities in every public policy or government-led project they interact with, so what is so unique about public transportation in the context of starting social movements? The answer lies in the frequency with which people interact with public transit. Many interview participants agreed that the everyday usage of public transportation amplified inequalities even more, as they are frustrations people have to deal with almost every day. Lake Sagaris has had some time to reflect on this specific question and conduct research on it, which ended up being delayed by the pandemic. She expressed how the everyday nature of public transportation made issues within it so much more obvious to the public. Though the protests became focused on the macro social issues of education, private pensions, and healthcare, she says:

> "But at the same time, there's transportation that was the last straw that that sparked it off and that is not coincidence. That is not a coincidence. Because your pension hits you when you're old. And health care system inadequacies hit you when you're sick, or when you're having children, or whatever. Transport hits everyone every day. And so it can touch off a conflict. And then it can disappear." (Interview with Lake Sagaris, Digital Interview, October 23, 2020)

This sentiment that the everyday nature of public transportation was instrumental in sparking off the protests came up in multiple interviews. Chris Zegras in speaking on the origins of the protests expressed how "transportation is a very easy place to point the finger because we live it every single day, right? It's visible, we got to deal with it." Rodrigo Quijada spoke about how even though transportation ranks much farther below other policy issues in public polls (CEP

2020), he "personally believe[s] that that transport is much more important, even if people don't declare it as such. Because it's an everyday thing. So you experience it *every single day*. So if every time it gets worse, if it gets worse, you again, experience it every single day."

Intuitively, this argument for the everyday nature of public transportation makes sense. When other policy changes are implemented and people are unhappy with them, it rarely will actively affect a large percentage of the population. Though most of the population uses and needs policies like healthcare and pensions, most are not using these programs when policy changes are made. This is the opposite of public transit where a policy change like a metro fare hike affects a vast majority of the population. Even if an individual is not directly affected, it is likely that many of their friends and family will be affected and outraged about it. Juan Carlos Muñoz expressed just this:

> "I think, when you have over everything, or on top of all these inequalities, on top of waking up extremely early to take three different services to reach my destination, to not be able to board the first bus or the first train because it comes full to traveling very undignified conditions, to take more than one hour and a half of trip. To see my mom doing this, my grandma doing this, my fiancé doing this and feeling that in some way, the city is not supportive. And you take so long every, *every day*, on top of that, you feel that the fare increases and you feel that you have less and less money to pay your bills. I understand that people could see this as totally unacceptable. Especially when side by side you see rich people driving in very fast freeways, and being very unsupportive of investing in better public transport. So it's a symbol of inequality." (Interview with Juan Carlos Muñoz, Digital Interview, October 14, 2020)

Though this has thus far been framed as everyday experiences of inequality on public transportation, these frustrations are not fully encapsulated by inequality alone. Abby Moy, who spent a year doing a Fulbright fellowship in Santiago from 2004 to 2005 studying citizen participation in the years leading up to Transantiago's implementation, describes transportation as the quintessence of the problems Chile's citizens face – exclusion and inequality. This thread ties to the previous chapter in that transportation planning embodied the issues with exclusion and lack of democracy. Building off these two chapters, transportation is a space where exclusion is visible in the design of the system itself as well as the process of building and planning it.

5.2. Transportation as a symbol of inequality

The social unrest that erupted in October of 2019 over a metro fare hike was a unique and unprecedented event for Chile in many ways. The demonstrations were the largest public gatherings Chile has ever had. Yet there were no formal organizers or leaders of the protests. The protests also had no formal set of complaints or goals. They were largely just a spontaneous public showing of dissatisfaction and anger over years of policies and government administrations exacerbating the growing inequality in the country and ignoring the lived experiences of the majority of the population. This led me to investigate the question of what factors led to the metro fare hike being a spark for these protests? Was there something unique about transportation that made it capable of producing a social movement of historic proportions?

This chapter explored three possible explanations for the role of transportation in sparking the 2019 protests in Chile. The first explanation was the most popular one, which was that the metro fare hike was the last straw. After so many years of inequality and the lower classes feeling excluded from government policy considerations, the metro fare hike was the final unfair policy that struck a tipping point. Residents of Santiago had been feeling the effects of inequality for decades and seeing healthcare, pension, and education policies that never served their needs, catering only to the upper classes and elites. The metro fare hike that rested most heavily on the poorest residents was the last policy Santiago residents could deal with. Opinions were split over the latter two explanations though. Some believed in the second explanation, which was that the metro fare sparked the protests by coincidence, meaning that in theory, some other unfair policy could have started the protests. Media articles in particular tend to follow this explanation, quickly passing over the role of transportation in the protests. However, most of the people I interviewed agreed with the third explanation, which was that transportation is uniquely capable of sparking protests.

The important element of the third explanation is that it is the everyday, tangible experiences of inequality in transportation that make transportation a symbol of inequality for many people. When every type of inequality can be experienced in one space and on a daily basis, that space becomes a massive point of pain and frustration. What also makes transportation unique is how many people use it daily. Other aspects of government policy do not affect as many people at the same time. Transportation is special in this regard because the vast majority of the population either uses it or knows somebody who uses it every day. So, when a bad policy is implemented in transportation, a majority of the population will face the frustration against this policy at the same time. Whereas pension or healthcare policy will affect

small amounts of people at different points in time, making these sorts of policy areas less likely to spark a protest.

While this chapter discussed some types of inequality that are experienced through transportation, like spatial and gender inequalities, the next chapter goes into more detail about environmental inequalities in transportation.

6. Greening Transantiago

The previous chapter looked at how transportation could be seen as a symbol of inequality in the context of the protests that began in October of 2019. In particular, it discussed how many different types of inequality intersected with and became tangible in public transportation. This chapter seeks to look at environmental inequalities and the intersections between income inequality and environmental issues in transportation through analyzing the recent 'green' upgrades to the system. As mentioned in the introduction, these 'green' updates include the incorporation of a fleet of electric buses, which now makes Santiago home to the most electric buses outside of China, as well as renewable energy sources for the Metro. This chapter will address the research question – *how are current greening policies for public transportation contributing to environmental and transportation inequalities?* The chapter aims to first describe the motivations for implementing these green transportation updates, describing a disconnect between their outward climate policy alignment and the actual motivations behind their introduction. It then discusses how 'green' public transportation is an oxymoron and how Chile's focus on these policies shifts the focus away from reducing emissions of cars. This has important implications for inequality, as car ownership is only accessible for the upper middle classes in Chile.

6.1. Santiago's green updates to public transportation

Santiago has implemented two main updates to 'green' the public transportation system. The first is the inclusion of over 800 electric buses into the city's bus fleet since the end of 2020. This has made Santiago the city with the largest electric bus fleet outside of China. The second was the announcement that the Metro would obtain 60% of its power from renewable energy sources, 42% of this from solar and 18% from wind from locations in the Atacama Desert. As the Metro is one of Santiago's largest consumers of electricity, this was a major improvement in shifting the city's energy consumption towards more sustainable sources. Both of these changes have been perceived as positive policy projects of the Piñera administration with widespread approval. They also work towards Santiago's and Chile's greater project of modernizing the city. President Piñera was quoted saying "we are taking this great leap forward and into the future" after taking a tour on an electric bus in a new terminal in 2019 (Intelligent Transport 2019). The following sections explore the motivations behind the greening of the public transportation system as well as Chile's transportation climate policy and perceptions of polluting sources in

Santiago. It particularly describes the disconnect between international perceptions of sustainable transportation updates and the local motivations for pursuing this policy in Santiago.

6.1.1. Motivations for greening public transportation

An important question for the context of this greening public transportation system is asking what was the motivation for these changes in the first place. An obvious first answer is that pursuing these policy changes was an effort to meet Chile's climate policy goals through the reduction of emissions from the transportation sector. This is a particularly important sector for Chile's climate policy as carbon emissions from transportation only rank below the emissions from electricity and heat production. As of 2014, transportation accounts for 31% of total CO2 emissions in Chile compared to 43% for electricity and heat production (World Bank 2014b; 2014a). Greenhouse gas (GHG) emissions from the transportation sector accounted for about 20% of Chile's total GHG emissions in 2018 (World Bank 2020). Chile has also recently become one of the first few countries worldwide to submit an updated Nationally Determined Contribution (NDC) in early 2020, a more ambitious update to their Paris Climate Agreement Commitments that is expected of all participating countries every five years. Chile's NDC addresses emissions from the transportation sector through its "National Electromobility Strategy" which aims to electrify 100% of public transportation and 40% of private vehicles by 2050. The National Electromobility strategy was actually introduced in 2017 as a result of a shared effort between public and private initiatives to reduce GHG emissions and improve mobility and quality of life for Chileans. The introduction of electric buses and switch to renewable energy for the Metro then in this context seem to be obvious first steps towards achieving the goals set out by the National Electromobility Strategy.

However, the interviews I conducted provided little evidence to support that these green updates were directly related to Chile's broader climate policy ambitions, most interview participants believed that they only happened to conveniently align at best. Carlos Melo, who was the Undersecretary of Transportation in Chile from 2016 to 2018 during which the National Electromobility Strategy was introduced and the pilots for electric buses began in Santiago, described to me the context for the decision to introduce electric buses in detail. Importantly, he highlighted how the Ministry of Transportation makes their decisions from the perspective of what is best for business without making environmental considerations. The lack of coordination between government ministries in Chile does not bode well for making integrated policy decisions. The lack of coordination across the Ministry of Transportation and Ministry of the

Environment for the introduction of electric buses to align it with Chile's environmental policy goals is just one example of this decentralized decision making.

Many interview participants actually pointed to local air pollution as a main motivator behind the electric buses rather than global contributions to GHG emissions. Multiple interview participants explained how there is a perception in Santiago that buses are highly polluting – what I will refer to as the 'bus pollution' narrative – even though this is an inaccurate perception today. Rodrigo Quijada, a transportation engineer with over 20 years working in citizen's organizations and a year and a half working in the Ministry of Transportation in Santiago, spoke on how this perception is strong amongst Santiago's population today:

> "We have a history in Santiago of being one of the most polluted cities in the world, air pollution [in particular] and back in the 80s, one of the most important polluting sources was buses. And that is true. And that kind of stuck in people's minds including all the politicians and the regular people. Buses pollute the city. And it's not true anymore. So from the 90s and the early part of this century there were increasing restrictions on the technology of buses that truly lowered the amount of pollution they produce. The government data is very clear about it - the government data says that, I don't know the last time I saw it like four years ago, the buses are responsible for, I don't know, like 1.5% of the total pollution and so it's really not a priority. What pollutes the city today our cars like in most developed countries. But the idea that buses pollute is very strong." (Interview with Rodrigo Quijada, Digital Interview, September 22, 2020)

The restrictions Rodrigo refers to are the implementation of increasingly strict policy measures to reduce vehicle emissions that have been introduced over the past 30 years in Santiago. These standards include "stricter vehicle emission standards (EURO 5 is mandatory for light duty vehicles since 2012), improved fuel quality for both gasoline and diesel (unleaded gasoline since 1994 and a maximum of 15 ppm since 2013), as well as a massive introduction of after-treatment devices (three-way catalytic converters since 1992 and diesel particle filters since 2010)" as well as the dramatic consolidation of the bus fleet through the introduction of Transantiago and stricter emissions standards specifically for buses (Gallardo et al. 2018). Trends for both fine and coarse fractions of pollution in Santiago have been steadily decreasing since 1988 due to the policy measures mentioned above (Gramsch et al. 2021). Gramsch et al estimate that fine particulate pollution has decreased by 60.4% from 1988 to 2018 (2021). Additionally, in 2016 the Ministry of the Environment committed to Euro VI standards for all new bus purchases made in the city

which serves to even further reduce buses polluting capabilities once enough older buses have been phased out (World Bank 2020).

My interview with Héctor Moya who is the Director of METBUS, the company that owns Santiago's electric bus fleet, provided further evidence to show the disconnect between Chile's broader climate policy and the decision to introduce electric buses as well as the power of the narrative of 'bus pollution'. When I asked him about the company's process for the inclusion of electric buses into their fleet, he started by providing some initial motivation:

> "To give you a little bit of context, Santiago is one of the most polluted cities in the world. It's situated in a bowl, like a depression. So for a company that runs its buses over millions of kilometers every month, the question for us was how can we avoid contributing to that pollution? So in 2016, we were seeking ways to do this and we were considering on the market. At the time there were diesel buses that were hybrid buses that have a small gas engine and electric engine and then there were 100% electric buses." (Interview with Héctor Moya, Digital Interview, October 7, 2020)

So according to the company that pursued the introduction of electric buses, there was no directive from the Ministry of the Environment for this action, it was only a desire to reduce pollution. Moya went on to explain the other motivating factors for the increasing of electric buses in their fleet. Importantly, as other interview participants commented, he explained how electric buses had now become the more cost effective option, especially with the introduction of the Euro VI standards. He described how the reduction in price of electric buses was instrumental for this transition, especially considering that "since we purchased those first two buses, the price of electric buses has almost halved, such that the price of electric buses now is comparable to the price of a diesel bus." When considering lifetime costs in particular, the former Undersecretary of Transportation Carlos Melo explained to me, the electric buses are the best business strategy because their lifetime costs are now cheaper than diesel buses. The impression then from Héctor Moya was that METBUS's main motivating factors for integrated electric buses into their fleet was to reduce local air pollution and to make a wise business decision.

While pollution reduction and business strategy were important motivating factors for electric bus introduction, the improvements for user comfort and overall modernization of the bus system are critical factors in continuing to increase the electric bus fleet size. User perceptions are motivating factors for both business and politics, and luckily for the people in

both sectors, the electric buses were a phenomenal success in the eyes of bus users. Héctor Moya remarked on the success of the electric buses, telling me that "the success has been truly tremendous. Users can rate public transport on a scale of one to seven, and for those electric buses, we're at a rating of 6.4 which as you might imagine is very difficult to achieve in public transit." The reasons for the high ratings for these new buses seem to vary by age group. Surveys from METBUS found that "people aged 18 to 30 value greatly the fact that the buses don't pollute people [while people aged] 50 and older don't value the fact that the buses don't pollute, they appreciate that they're air conditioned, that the seats are cushioned - things to do with comfort" (Moya 2020). In fact, a survey of bus users conducted for the World Bank's 2020 report "Lessons from Chile's Experience with E-Mobility" found that people were actually willing to wait longer for an electric bus over a typical diesel bus because of improvements on electric buses that included technological improvements, less noise, and fewer emissions (World Bank 2020). Multiple interview participants described how people were impressed with the level of comfort and quality that the new electric buses presented. Ricardo Hurtubia mentioned how people enjoyed perks like free WIFI on the buses while Guillermo Muñoz emphasized how these buses had quality improvements that included more comfortable interiors and air conditioning. In considering the early failures of Transantiago, it is obvious how much these factors matter to bus users, which is part of what has led to such a positive public perception of the electric buses in Santiago.

6.1.2. Electric buses as politically convenient greenwashing

Though the introduction of the electric buses should be celebrated as a success, they have at the same time become a convenient way for the government to publicly act like it is making progress on transportation related emissions reductions while completely ignoring the real issue in the transportation sector for meeting climate policy ambitions – cars. Two interview participants actually mentioned how they believed the electric buses were really just a greenwashing strategy from the government. And even more interview participants expressed concerns that even though the electric buses are a welcome improvement, they are afraid it will and are already witnessing it take attention away from other more important transportation emission reduction strategies.

A popular perception from interview participants was that the electric buses were a step in the right direction for environmental goals, but at the same time they were concerned that the move would take attention away from the more important environmental policies that should be implemented, particularly in the transportation space. Alan Thomas, who is a transportation

scholar at the Catholic University in Chile and was a lead engineer at SECTRA where he was in charge of developing the models for public transportation and specifically worked on the models for Transantiago, described just this sentiment, explaining that electric buses are good but not nearly enough. He argued that it is hard for a city like Santiago that bets on highways in its model of development to be able to reduce emissions. Thomas also lamented over the lack of unified transportation and environmental policy, instead there are differing goals amongst agencies like the Ministry of Public Works, Ministry of Transportation, and the Ministry of Housing that lead to more patchwork policy solutions like the electric bus implementation. Juan Carlos Muñoz expressed a similar sentiment towards the electric buses as well. Though he had much to say to praise the addition of the electric buses, particularly because so many people loved the level of service they provided and how they are good for the environment, he also worried that he did not see any initiatives to shift away from cars or other sorts of transportation related climate initiatives. Specifically, he mentioned how certain projects like building more bike lanes and prioritizing greener modes of transportation like cycling were projects that the government sees the benefit of and would like to build them, but there seems to be a persistent problem of the government not actually implementing these projects. To him, the government understood many of these problems and comprehended viable solutions but lacked the knowledge of how to actually go about implementing them, which was frustrating for him.

Many were also concerned that the electric buses would overshadow the more important improvements needed for public transportation and bus services specifically. When speaking with Rodrigo Quijada about the electric buses in Santiago, he acknowledged that the buses were going to be helpful for environmental problems but also worried that:

> "it takes the attention away from all the things that are bad with the system, like the quality of service - like we don't want to be in crowded buses, we want to move fast in the city, we don't want the buses to be stuck in traffic, we want the drivers to drive the buses carefully, to stop at the bus stops then and so forth. And I think the problem with the electric buses is that it takes the attention away from other problems. The surveys also show that people in general are not very, are more interested in those other variables - frequency, crowding, and not the environmental aspect of it." (Interview with Rodrigo Quijada, Digital Interview, September 22, 2020)

Though other surveys have shown that younger people do care about the environmental aspects, still many care more about the comfort and quality of service aspects. The electric buses provide

an additional level of comfort that people really appreciate, but it is important that the improvements do not exclusively focus on switching over to electric buses without making changes to improve the issues like frequency of buses, overcrowding, and safety of passengers and drivers.

Another shared concern was that the electric buses were a city-specific solution for pollution which meant that other cities would not get access to higher quality buses, inflaming already existing tensions over inequalities between Santiago and Chile's other cities. Because of the previously described lack of centralized policy making in transportation and other government agencies, policy implementation tends to vary depending on local problems rather than considering the problems of the country as a whole. Carlos Melo, whose role in the Ministry of Transportation presided over transportation for the whole country, spoke on this frustration that the electric buses were only responding to local pollution rather than being a national climate policy initiative:

> "The priority in Chile to reduce transport emissions is very related to the local problems, okay? You have, for example, a problem of pollution here in Santiago related to the transport sector, so we develop a policy here in Santiago, okay. And in Santiago, you have for example, the electric buses, you have the Euro 6 norm to the to the rest of the buses, and so on. But if you go to another city in Chile, the regulation is different because in the rest of the country, the pollution problem is not a problem mainly caused by the transport sector. It's a problem related with their use of wood for [warming] the houses. And in these cities there are no policies to reduce the emissions of the transport sector. So I think it's a policy very located in the case of Santiago, and that is very sad because the people of the other regions of the country see the difference … you have better buses in Santiago [and] you have, for example, a network of electrical chargers for vehicles. And if you go to any region in Chile, you can see that [difference] in the cities. So I think it's not a country policy, it's more like a city policy, and it's motivated for the local emissions. And that is important because for the rest of the world, it's (the electric buses) a policy for climate change. But I think that the truth [is that] it's a policy for local emissions here in Santiago." (Interview with Carlos Melo, Digital Interview, October 16, 2020)

What Melo speaks about at the end is really intriguing. From a global perspective, electric buses are seen as a broader climate policy, and Chile can therefore leverage this policy to appear to be

working on climate goals. However, as many of the interview participants have pointed out, the heart of the problem that electric buses were meant to address was not reducing global emissions but simply responding to local air pollution in Santiago.

The local nature of the electric buses importantly ties into the claims of some interview participants that these greening transportation policies were greenwashing, and additionally ties into broader issues of inequality. One interview participant did not wish to be quoted directly on this, but felt that the electric buses were a case of greenwashing as they allowed the government to appear like they were making progress on climate goals, but really not making any progress elsewhere. Lake Sagaris also had brought up greenwashing, but in relation to the Metro's energy sourcing. To her, the Metro still being dependent on 40% traditionally polluting energy sources is not a great accomplishment. Especially since they have not announced plans to convert the rest of the power to renewable sources, it is concerning that there may be a lack of pressure to push for the rest of the reform. Furthermore, the inequality between cities adds another level to the inequality discussed in previous chapters. As the main metropolitan region and capital of the country, Santiago accounts for almost half of the country's GDP and is the center for government (Brookings and JPMorgan Chase 2016). It is often the focus for many government policies and new initiatives. The inequalities around public transportation between cities in Santiago has been acutely felt since the implementation of Transantiago over a decade ago. Residents from cities outside of Santiago can very visibly see the differences in technology between Santiago and the rest of the country, and the electric bus fleet is just the newest technological addition to widen this gap.

6.1.3. Green public transportation – an oxymoron?

Though the interview participants spoke on greenwashing for these specific policies, the greenwashing could also be understood at a higher level – what does it mean to make public transportation 'green'? In a way 'green' public transportation is an oxymoron. When governments make claims that they are making public transportation more sustainable like Chile is, it seems like a misplaced policy goal. After all, public transportation is already the most sustainable mode of transportation other than walking or cycling, which are not modes that can be used over long distances anyways. For a country like Chile, that has focused its resources for infrastructure of prioritizing cars over all other modes of transportation for decades and has made its population dependent on the car, putting efforts into greening *public* transportation seem misplaced and intentionally misleading. It also plays into the inequality this thesis has discussed already – the upper classes who can afford to have cars in the first place and contribute

to pollution at much higher rates on a per capita basis are allowed to continue with their behavior while the pressure for reducing pollution is placed on buses instead.

While buses' contribution to pollution in the city certainly cannot and should not be ignored, the public perception of their polluting power provides a convenient pathway to ignore the much more problematic source – cars. It is difficult to find recent data on transportation emissions in Chile, but estimates from 2011 report that the transportation sector accounts for about 28 percent of Chile's greenhouse gas (GHG) emissions. Yet while buses account for just 10 percent of GHG emissions in the transportation sector in Chile, cars and taxis account for 45 percent (O'Ryan and Turrentine 2011). When further considering that 49 percent of trips are taken by bus while 16 percent of trips are taken by car in Santiago, this means that on average people who travel by car contribute about ten times as much GHG emissions than those who travel by bus, on a per trip basis (O'Ryan and Turrentine 2011). In considering air pollution as already discussed earlier, buses have a popular perception of being highly polluting while cars do not. However, Ossess and Fernández report that "public transport buses and the rest of diesel vehicles play a significant role in the emission of particulate matter and nitrogen oxides. On the other hand, private gasoline vehicles have a high degree of accountability for carbon monoxide and volatile organic compound emissions" (Osses and Fernández 2005). It is unclear why there is a perception of buses being the main source of air pollution in Santiago, but the data shows that they are not uniquely polluting especially with the improvements in standards for buses in recent years. Additionally, trains only account for 1 percent of GHG emissions in Chile (O'Ryan and Turrentine 2011). Given this perspective, the focus on 'greening' public transportation appears to be a misplaced priority over working to 'green' cars and shift travel modes from private transportation to public transportation.

Chris Zegras, a professor of urban planning and development at MIT who has been both an analyst and observer of Santiago's transportation system for decades after spending time living and working there, spoke to me about how Chile's only climate transportation policy option is the electrification of cars.

> "For me, it was always quite clear that … a key aspect of any energy policy for the country has to be transportation. Because … for better or worse, their grid is pretty green, right? … It's got its issues… let's not talk about the damming of the rivers … and then concerns about the gas from Argentina, which were the big issues in the day. But, you know, quite clearly transportation was [Chile's] oil dependency problem. And… everything you observed in their de facto transportation policy at the time, was to just

> accelerate that and entrench it. I don't think it was purposeful … I'm not trying to be anything more than a hypocrite, given what we've done [in the US]. But, pretty much making the country automobile oriented – once you do that, you really have to have a silver bullet. The electrification of the car is the *only* energy policy, the *only* climate policy that Chile can really have. I mean, it's true and that's pretty hard nut to crack. Because without any Transportation Technology that the country builds, they're entirely dependent on the rate of progress of the Toyota's and Tesla's and … the battery producers and so forth. But that's it right now, Chile has no choice – their way to be green, to have a climate friendly transport policy [is] electrification as soon as possible. And then, you know, it'll probably just be continued car dependency, because that's the trajectory that they've already kind of laid out." (Interview with Chris Zegras, Digital Interview, October 21, 2020)

Zegras's argument aligns with the statistics in the previous paragraph as well – cars are responsible for the most GHG emissions of any mode of transportation. Any transportation climate policy in Chile needs to focus on cars primarily. The current focus on the electrification of buses and trains is misleading when cars, taxis, trucks, ships, and airplanes account for 89 percent of transportation emissions, compared to 11 percent for public transportation. Instead of focusing on greening buses and trains, the priority should be creating incentives for increasing electric car ownership in Chile.

This greenwashing intersects with income inequality in Chile in a critical way. The poor and working classes historically have a much lower environmental impact than the upper classes, yet they tend to face the majority of the burdens of environmental damage and climate change. Focusing on greening public transportation then places the burden for reducing emissions on the lower and working classes when they were not even the main problem in the first place. This inequity will be further discussed in the conclusion in the policy implications section using the TEJF, as this issue is a perfect example of where the framework can show the tensions between transportation and environmental justice goals.

7. Conclusion

This research aimed to investigate the intersections between inequality and transportation in the context of the recent events of the changes to Transantiago since its implementation in 2007, the protests that began in October of 2019 with a metro fare hike, and the greening of public transportation through the introduction of electric buses and renewable powering of the Metro. Since it has been over a decade since the redesign of public transportation through the implementation of Transantiago, I wanted to look at what has changed, if anything since 2007 when this project was widely perceived to be a complete failed policy. It was clear from the protests that began over a raise in the Metro fare that tensions continue to be present in regards to public transportation, so this begged the question if any lessons had been learned in policy making and planning since Transantiago's initial failure. Additionally, since the protests were broadly about inequality, yet began with a transportation policy, this framed the broad research aim, which was to understand the links between transportation and inequality in Santiago. Amongst the media coverage for the protests, I also saw articles released during the same time frame that praised Santiago for 'greening' public transportation through the renewable powering of the Metro and the introduction of the largest electric bus fleet in the world outside of China. These overlapping stories led me to investigate the ways in which inequality and environmental goals were connected in public transportation decision making.

In response to the questions posed in this thesis, I have presented three main arguments. The first is that the initial failure of Transantiago set a foreground prior to 2019 of both years of frustration over public transportation in Santiago and established a sentiment that inequality is closely related to the exclusion of the voices and needs of the lower classes in government policy making processes. Given this context of years of frustration over Transantiago and a growing sense that the Chilean government only caters to those who have money or political power, the stage was well set for the protests that erupted over the metro fare hike.

The second argument I have made is that transportation has become a symbol of inequality in Santiago and that through the everyday experience of interacting with transportation and the inequalities embedded in it, transportation becomes uniquely capable of sparking off protests compared to other spheres of policy making. Third, through looking at the recent 'greening' of public transportation in Santiago, I argue that these updates can be viewed as a form of greenwashing that is intrinsically connected to inequality in Santiago because the government has chosen to focus on greening the transportation mode of the lower classes rather than greening the tool of the middle and upper classes – the car.

In the remainder of this chapter, I will discuss the policy implications of this research. The policy implications will first review the connections between social unrest and transportation in this thesis, and then look at the intersections between transportation and the environment utilizing the TEJF proposed by Mattioli that was discussed in Chapter 3. This will be followed by a brief discussion of the contributions to literature, the limitations of this study, and recommendations for future research.

7.1 Policy implications

7.1.1. Transportation and social unrest

Part of this thesis tried to understand how transportation sparked the most consequential social movement Chile has seen since the ends of the Pinochet dictatorship over 30 years ago. Understanding the importance of transportation to those who live in cities should not be overlooked by policy makers, yet current ways of understanding the relative importance of policy areas may not be accurately detected by current methods. Transportation often does not come up as a top policy concern for citizens not just in Chile, but in most countries in current polling methods. When governments gather poll data to understand which policy areas are most important to them, it is likely accurate that transportation is relatively less important compared to areas like health care and education. However, it could be that the ranked nature of these areas gives the false impression that people are not sensitive to policy changes in areas that rank lower like transportation. Based on the protests in Chile, it is obvious that people are actually very sensitive to transportation policy changes. This does not just apply to Chile; transportation related protests have occurred in many countries recently, some of the most notable in Brazil, France, and Ecuador. Lake Sagaris, a transportation and social science scholar in Santiago, explained to me in an interview that:

> "[Transportation is] touching off major, major social movements and program protests, not just in Chile, but also in France, and in Brazil, and in Ecuador. So, yes, and I would say, as a social scientist, and I'm sure we'll be vindicated when the jury is in, I don't know, a decade from now or whatever. Is that yes, transportation, it while it's not the central issue in people's minds, when it comes to inequality, it's the day to day inequity of transport experiences that builds up frustration. And that touches, that that sets off the sparks that really can bring… really major protest movements as we've had. So it was it was very much the straw that broke the camel's back, was this raise and this increase." (Interview with Lake Sagaris, Digital Interview, October 23, 2020)

Transportation being at the center of many recent social movements, yet never being flagged as a top policy concern for populations indicates that the current methods for governments to determine what matters most to their populations may be flawed. For the case of Chile, it could be that polls asking residents to rank which policy issues are most important to them gives the false impression that an area that ranks, for example, as tenth on the list is not important. The truth, however, may just be that the first 10 issues are all relatively important and the rankings are almost arbitrary. Rodrigo Quijada, who has a background in transportation engineering and has worked in activism for over 20 years, explained to me how "people complain all of the time about transportation and transport in general, congestion, and public transport in particular. But the polls, the usual polls you get every once in a while - when people express what's important for them in the public sphere - usually transportation is way down" (Quijada 2020; CEP 2020). However, this thesis shows that transportation is very important for people in Chile. Moving forward, policy makers may need to reconsider how they gauge the most important areas for public policy improvements from the general public to better reflect what is important.

7.1.2. Transportation and environmental justice tensions

The TEJ Framework discussed in Chapter 3 provides a useful structure to understand the policy implications from the arguments made in Chapter 6. Chapter 6 discussed how the greening of public transportation seemed to be a misplaced policy aim since the focus of making transportation more environmentally friendly should be focused on the source of the most emissions by far – cars. Chapter 3 described the TEJF, and specifically provided a model for car dependence within the framework, which is shown in Table 4 below.

Chains of need satisfiers including transport and car.

Need		Subsistence (Max-Neef et al., 1992); economic security (Doyal & Gough, 1991)	Subsistence (Max-Neef et al., 1992); adequate food (Doyal & Gough, 1991)	Protection (Max-Neef et al., 1992); adequate healthcare (Doyal & Gough, 1991)
Need satisfiers	1st order (societal level)	System of employment at the societal level including division of labour, distribution of workplaces across space, etc.	System of food production and distribution at the societal level including e.g. distribution of retailers across space, etc.	Health system at the societal level including distribution of health care services across space, etc.
	2nd order	Paid employment	Food shopping	Visits to the doctor and hospital
	3rd order		Travel	
	4th order		Car	

Table 4 - Chains of need satisfiers from Mattioli, 2016 page 123

Within the TEJF, transportation can often be seen as a 3rd order need satisfier, and in the model of car dependence, cars are a 4th order need satisfier. Recall that tension between transportation and environmental justice goals arise when a basic need can only be met through energy-demanding need satisfiers, like in the model of car dependence. In addition, there is more flexibility in policy making with lower order need satisfiers, like transportation and car use.

In the case of Santiago, there is not strict car dependence because a car is not necessary for the satisfaction of basic needs. Cars have become a more important 4th order need satisfier though because of want satisfaction – cars have become a status of class and a more convenient mode of transportation because of the priority of infrastructure for cars in Santiago. Though infrastructure has favored cars and the social pressures to purchase cars as a status symbol has begun to shift cars from want- to need-satisfiers, there is not true car dependence in Santiago yet.

This framing is useful because lower order need satisfiers in Santiago are not set to be energy-intensive modes yet. Therefore, there is room for flexibility in the 3rd order need satisfiers for transportation and 4th order need satisfiers for specific modes of transportation. First, transportation is currently seen as a need satisfier to access opportunities for work, healthcare, and buying essential goods. Policy flexibility in this area would look like deprioritizing the need for transportation to access these essential services via making cities more local. The poor spatial distribution of these essential services outside of central Santiago currently makes transportation necessary, but shifting these services to the outskirts can reduce the need for transportation.

Second, continuing to pursue a path where cars become increasingly necessary to meet transportation needs will continue to put transportation goals and environmental goals in tension. Car usage in Santiago stands in a middle ground between want-satisfaction and need-satisfaction, which Mattioli describes as structuration (Mattioli 2016). Policy makers should work to shift the balance away from cars becoming a need-satisfier before it is too late. Policy makers can reduce and reverse this tension by disincentivizing car usage and encouraging modal shifts to public transportation, cycling, and walking. Because there tends to be more flexibility in lower order need satisfiers, there is a lot of room for policy makers to avoid the tension between environmental and transportation goals in the 4th order need satisfier that is mode of transportation in this case. By focusing on making policy changes in 3rd and 4th order need satisfiers where flexibility is available to avoid unjust trade-offs, policy makers can then focus future attention on higher order needs, where there is little flexibility which makes the policy challenges much greater.

7.2. Literature contributions

This research aimed to look at a collection of recent events related to transportation in Santiago. Since these events had happened so recently within the time span of this research, there has been very little literature available thus far on much of the content of this thesis. In this way, this thesis aimed to make an initial contribution to the scholarship on these events. Additionally, as discussed in the literature review in Chapter 3, there exists a small body of research on transportation in Santiago, but most of it comes from a technical engineering perspective using quantitative methodologies. This thesis aimed to contribute a new perspective within this body of work by analyzing Santiago's transportation system from the perspective of the social sciences and using qualitative methodologies. Finally, there are many papers that have investigated the failure of Transantiago in the first few years following its implementation. However, there is a lack of literature looking at Transantiago from a longer time scale to understand if and how anything has changed in the policy or planning aspects related to transportation in Santiago and Chile more broadly. This thesis aimed to provide a brief account of the recent changes in the system and what can be continually improved going forward.

7.3. Limitations and future research

A major limitation for this thesis was the remote nature of the research process, as it limited the types of claims I felt comfortable making. Without having personal experience with using public transportation in Santiago, I had no baseline to compare the opinions about the system with. If I had the opportunity to be in Santiago to conduct this research, it would have added a level of depth and detail that I could not achieve with remote research. Additionally, this thesis focused on the perspective of elites, but the perspective of the general public would have added a richness to this research to bring in the lived experiences of using public transportation in Santiago and facing inequalities daily. Incorporating interviews with people involved in the protests of 2019 would have also added another layer of perspective to the parts of this research that looked at the protests. In addition, an analysis of spatial inequality using GIS mapping to investigate low-income neighborhoods and transportation access would have provided more depth to the claims made in this research.

Future research in this area would benefit from drawing from the perspectives of a variety of people who use public transportation and depend upon it, as well as the perspectives of those involved with the protests. Looking at these same issues from a non-elite perspective would be necessary to understand the full perspective of these recent events in Santiago. Additionally, it would be interesting to investigate the applicability of the argument that

transportation is more able to spark protests across different contexts. Conducting a similar study in other countries that have experienced transportation based protests, such as France or Brazil, could serve to further validate or complicate the arguments presented in this research.

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Appendices

Appendix 1: List of interview participants

Below is a list of interview participants providing details on the sectors they are involved with and their affiliation to organizations or roles they have held

Interview Participant	**Sector**	**Affiliation/Roles**
Ricardo Hurtubia	Engineering/ Academia	Professor at Pontifical Catholic University of Chile
Rodrigo Quijada	Engineering/ Activism	Member of the Coalition for Fair Transportation & transportation engineer
Alan Thomas	Engineering/ Government	Worked at SECTRA and civil engineer from the University of Chile
Louis De Grange	Engineering/ Government	Current President/Chairman of the Board of the Santiago Metro
Abby Moy	Social Science/ Activism	Past Fulbright Scholar studying community participation in Transantiago development
Héctor Moya	Business	Current Director of METBUS, previous Director of SUBUS
Daniel Schwarz	Engineering/ Government	Engineer at SECTRA for many years
Guillermo Muñoz	Government/ Engineering	Former Director of Metropolitan Public Transport (Head of Transantiago) 2014-2018
Juan Carlos Muñoz	Engineering/ Academia	Professor in the Department of Transport Engineering at the Catholic University
Carlos Melo	Government/ Academia	Undersecretary of Transportation 2016-2018 and currently working at San Sebastián University
Chris Zegras	Social Science/ Academia	Urban studies professor at MIT, has worked in Santiago and done research there
Lake Sagaris	Social Science/ Academia	Professor at the Catholic University of Chile, founded Living City in Santiago, former journalist

Appendix 2: Sample scope of semi-structured interview questions

Specific to Interview Participant:

1. Can you tell me about what you do right now/are working on at the moment?
    a. What is your educational background?
    b. Were you a part of any organizations dealing with public transit? Can you tell me more about them?
2. Can you tell me about how you have studied public transit in Santiago? In what ways have you been involved with public transportation in Santiago?
3. Have you been involved at the government level with advising on public transportation in Santiago?
        a. If yes, can you tell me more about your role(s)?
        b. What would you say were the main goals of your project?
        c. Was your involvement/role technical or non-technical?
        d. Were there major bottlenecks in the project/process?
        e. Who were the major stakeholders involved in this project? Were international actors or organizations involved?
        f. In your opinion, what were the most successful and least successful elements of this project?
        g. Were there notable compromises that needed to be made? Can you describe the dynamics of these situations?
        h. Can you describe any particularly challenging ethical issues involved?
4. What is the role of those with engineering backgrounds in studying and planning public transit in Santiago?
        a. What is the background of most people involved at academic and government levels?
5. How should public transit be improved from your perspective?
        a. Should planning processes be changed? If so how?
        b. What actors have the most influence in decision making?
6. Can you tell me more about the tender process that was initiated during your time as head of Transantiago?
        a. How does the tender process usually work?
        b. What were some improvements you were hoping to make through this tender process?
        c. Do you have a sense of why it did not succeed?

    d. How do you feel about the current/new tender process?

More general questions:

7. If and how is the community involved in public transit today?
    a. Do you know much about community organizations involved in public transit?
    b. Do you know about proposals created by community actors/organizations?
    c. Role of municipalities in the planning process?
8. What were the original goals and visions for Transantiago?
    a. How have these changed in the 13 years since its implementation? If at all
    b. How do you perceive the long term goals for public transit in Santiago?
9. In your opinion, what are the most successful and least successful elements of public transit in Santiago? (particular focus on current day)
10. What is your impression of the public perception of this public transit? (particular focus on current day)
11. Can you describe any particularly challenging ethical issues involved with the planning or implementation of public transit? How were they addressed? (focus on more recent progress)
12. Do you have thoughts about the civil unrest that began in October 2019? What is your impression of it? How do you perceive the role of public transit in this? Was it an important factor or not so much?
13. There seems to be a push for green transit with electric buses, and renewable powered metro. From your perspective, what are the reasons for pursuing green transportation in Santiago? Could you describe some common motivations around creating sustainable transportation?
14. How does this project or sustainable transportation generally contribute to climate policy goals in Chile?
15. Do you have any recommendations for people to reach out to - looking for government actors, community organizers, interested/affected citizens, etc? Any organizations I should connect with or reach out to? Particularly community orgs?
16. Is there anything you wish we would have discussed?