Automobility realism: How the auto-dominated present constrains our imagined futures

Paris Marx

Department of Geography
McGill University, Montreal
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ABSTRACT

In the twentieth century, the buildout of an auto-oriented transportation system fundamentally altered the social and economic systems of Western countries. The new system of mobility fuelled unsustainable land uses, environmental destruction, and an increase in transportation-related deaths and injuries which disproportionately affect low-income, racialized, elderly, young, and other vulnerable groups. As such, visions for a future of transportation which address these problems are urgently needed. Some of the most widely popularized ideas are those promoted by executives in the technology industry, but there has been little critical analysis of whether these ideas will actually address the harms and inequities of the existing system. Using a mix of interviews, corporate documents, and conceptual images, along with books, peer-reviewed research, independent studies, and journalism, I interrogate the claims made by leaders in the technology industry about the prospects of electric vehicles, ride-hailing services, autonomous vehicles, flying cars, and a series of tunnels for cars; and compare them to the actual impacts of those solutions that have already been implemented, and the likely impacts for those which remain theoretical. I argue that the system of automobility has constrained people's ability to imagine an alternative to an auto-dominated transportation system, which I term 'automobility realism', and that the ideas presented by tech executives fail to truly address the harms and inequities of the existing transportation system. Rather, the integration of technologies allows for narrow benefits which primarily accrue to well-off individuals, while potentially creating new harms for vulnerable groups. I conclude that the problems of automobility will only be solved when people are empowered to imagine futures beyond the dominance of automobiles in urban space.

RÉSUMÉ

Au 20e siècle, la création d'un réseau de transport axé sur l'automobile a fondamentalement transformé les systèmes social et économique des pays occidentaux. Le nouveau système de mobilité a donné lieu à une utilisation non viable du territoire, à une destruction environnementale, ainsi qu'à une augmentation des décès et des blessures liés au transport qui touchent de manière disproportionnée les personnes à faible revenu, les personnes racisées, les aînés, les jeunes et d'autres groupes vulnérables. Il devient donc urgent d'imaginer, pour le transport, un avenir exempt de ces problèmes. Certaines des idées les plus largement popularisées sont celles que préconisent les dirigeants du secteur des technologies, mais peu d'analyses critiques s'intéressent à l'effet réel de ces idées sur les inconvénients et les inégalités du réseau actuel. En m'appuyant sur des entrevues, des documents d'entreprises et des images conceptuelles, ainsi que sur des livres, des travaux de recherche évalués par les pairs, des études indépendantes et des articles de journaux, je remets en question les affirmations exprimées par les chefs de file du secteur des technologies à propos des perspectives qu'offrent les véhicules électriques, les services de voiturage, les véhicules autonomes, les automobiles volantes et les tunnels pour automobiles. Je les compare ensuite aux répercussions réelles des solutions déjà en place et aux répercussions probables des solutions qui sont pour l'instant théoriques. J'affirme qu'un réseau de transport favorisant l'automobile a limité la capacité des gens à imaginer une solution de rechange à un réseau dominé par l'automobile, un phénomène que j'appelle « réalisme dominé par l'automobile ». Je soutiens également que les idées proposées par les dirigeants du secteur des technologies ne feront pas disparaître les inconvénients et les inégalités

créés par le réseau de transport actuel. Au contraire, l'intégration des technologies présente de minces avantages qui profitent principalement aux personnes bien nanties et pourrait causer davantage de préjudices aux groupes vulnérables. J'en conclus que les problèmes causés par la prépondérance de l'automobile ne seront réglés que lorsqu'on nous donnera les moyens d'imaginer un avenir sans domination de l'automobile en milieu urbain.

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NOTE ON THE TEXT

This thesis is prepared according to the guidelines for a manuscript-based thesis. Chapter 2 contains a review of the relevant contextual, conceptual, and methodological information for the research presented in the manuscripts. However, there will be some repetition of that information as aspects of it are also present in Chapters 3 and 4, which are the two manuscripts in this thesis. Further, Chapters 3 and 4 have their own reference lists for the individual manuscripts, while the reference list in Chapter 6 encompasses the references in Chapters 1, 2, and 5.

The manuscripts which make up Chapters 3 and 4 are in preparation for submission to academic journals. The first manuscript is co-authored between my supervisor and I, while the second manuscript is single-authored. In the first manuscript, I was responsible for conceptualization, writing, and reviewing and editing drafts, while my supervisor, Dr. Kevin Manaugh, is listed as the second author and provided assistance with conceptualization, supervision, and reviewing and editing drafts.

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1.0 INTRODUCTION

André Gorz (1973) observed that the automobile "cannot be democratized" (para. 1) because "when everyone claims the right to drive at the privileged speed of the bourgeoisie, everything comes to a halt, and the speed of city traffic plummets" (para. 11). Almost a half century later, the contradictions of automobility seem to finally be coming to a head with accelerating climate change, over a million people continuing to die every year from automobiles (World Health Organization, 2018), and the time lost to drivers waiting in traffic reaching a point where many are looking for change. This has resulted in a push for alternatives to automobiles in cities around the world, with increased investments in pedestrianization, cycling infrastructure, and the expansion of transit services. However, not all urban stakeholders agree that the role automobile needs to be reduced. Understanding the origins of these visions, the power structures which popularize them, and how they are covered by the media is critically explored in this thesis.

These proposals range from electric vehicles and ride-hailing services to autonomous vehicles. While the former are already present on urban streets, the latter are only being tested on public roads in small numbers since they remain under development. These ideas go further to include longer-term visions such as fleets of flying cars and extensive tunnel networks for the exclusive use of autonomous, electric vehicles. The companies and executives promoting these ideas promise they will address the problems inherent in the existing system of automobility, but existing research has already begun to challenge many of these notions. Ride-hailing services have made traffic congestion worse, not better (Erhardt et al., 2019; San Francisco County Transportation Authority, 2017), and primarily serve a relatively privileged urban group (Clewlow & Mishra, 2017; Young & Farber, 2019), while the benefits of electric vehicles, from subsidies to environmental improvements, are accruing to higher income individuals (Holland et

al., 2019; Sovacool et al., 2019). These findings naturally call into question whether technological enhancements to automobiles can truly address their inherent contradictions.

I focus on the purported transportation solutions coming from the tech industry — specifically, the five listed in the previous paragraph — and critically examine them in Chapters 3 and 4. I argue that the solutions presented by powerful individuals in major industries, but particularly in tech, are constrained by the dominant system of automobility, which I term 'automobility realism'. Despite claiming to address a broader range of harms and inequities which result from the dominance of automobiles in cities, I argue that their solutions are instead driven by addressing traffic congestion as experienced by wealthy people with very privileged experiences of the world, while failing to seriously contend with, if not exacerbating, the other problems inherent to the system. I extend the scholarship on the tech industry's transportation solutions by critically assessing some ideas which have had little academic study, while refocusing the discussion on the outcomes as they are likely to be experienced by poor, marginalized, and vulnerable urban groups.

1.1 Goals and research questions

In the chapters of this thesis, I critically analyze the transportation solutions put forward by powerful individuals in the tech industry through the lenses of automobility realism, mobility justice, and critical future studies. The goals of this research are to arrive at a better critical understanding of these solutions; contrast the promises made by executives with the observed and expected outcomes, depending on whether it has reached implementation; and to consider the solutions and outcomes through the lens of automobility realism to understand the degree to which the system of automobility and the social positions of the people proposing these ideas

limited their ability to seriously arrive at the root causes of the flaws in the existing transportation system. These goals are the basis of the following research questions:

1. How do executives and companies describe the transportation solutions they propose, and to what degree have their promises been realized or are likely to be realized?
2. To what degree does the dominance of automobiles affect the proposals put forward by tech executives, and what role do automobiles play in their visions of the future?
3. How would the implementation of these proposals affect different socioeconomic groups, with particular focus on the groups advocating these solutions and the vulnerable groups which have the least power to influence decision-making processes?
4. Do the representations of the futures proposed by tech executives and companies accurately reflect how they describe them? What do those representations suggest about who would benefit from the proposed futures?

The tech industry's impact on transportation systems is an area that is gaining increasing research interest, but some of their proposals are quite new and remain understudied. This research contributes to the growing literatures on electric vehicles, ride-hailing services, and autonomous vehicles, while making a novel contribution to the study of longer-term futures such as flying vehicles and auto-oriented underground tunnel systems.

In Chapter 2, I analyze the literature on the role of elites in crafting transportation systems and urban forms through history, including the key role they played in enforcing and entrenching the system of automobility in the early twentieth century. I also analyze the literature on the approach of the tech industry to problem-solving, which is best explained by the term "technological solutionism" as outlined by Morozov (2013), and the existing research on ride-hailing services and autonomous vehicles. I follow up this contextualization with an elucidation

of the conceptual frameworks I use in the course of this thesis: automobility realism, which brings together the concept of capitalist realism with the critical literature on automobility; mobility justice, which is essential to refocus transportation solutions from the concerns of executives to their implications for vulnerable populations; and critical future studies, which aids in the analysis of the longer-term visions discussed in Chapter 4. Finally, I describe the materials and methodological approaches I used to conduct this research, including the use of critical discourse analysis for textual elements and visual representations.

In Chapter 3, I turn my attention to three of the near-term technological solutions to transportation, which are often considered collectively as the 'three revolutions' in transportation: electric vehicles, ride-hailing services, and autonomous vehicles. I use automobility realism and mobility justice to critically examine the claims of executives and companies, taken from published interviews, news articles, and corporate documents; and contrast them with the real and expected impacts of their proposals as determined by peer-reviewed research, reports, and news articles. I argue that despite their claims, these solutions do little to solve the broader problems which arise from a transportation system dominated by automobiles, but are rather designed to narrowly address specific problems whose benefits will overwhelmingly accrue to the most privileged group of urban residents.

In Chapter 4, I extend that analysis to two longer-term transportation solutions put forward by tech executives: a service of on-demand flying cars and a tunnel system for use by autonomous electric vehicles. In addition to automobility realism and mobility justice, this analysis makes use of critical future studies to critically examine the broader futures being imagined in such ideas. I also draw from the science-fictional work of Ursula K. Le Guin to illustrate how visions of the future must consider the harms that have been normalized in existing

social, economic, and political arrangements; and how futures can be imagined in a way that seeks to critically interrogate and imagine alternatives to those problems. In addition to statements derived from published interviews, keynote presentations, news articles, corporate documents, and social media posts, this analysis also includes visual representations of tech's proposed transportation modes and what those representations suggest about the futures imagined by the powerful people in question. I argue that the bold statements of tech executives with regard the transformative potential of these solutions are not reflected in the visuals that accompany their statements, nor do they hold up to critical examinations of their likely implementations. I argue that rather than serving a broad segment of the population, these solutions instead seem likely to do little to alter the dominance of automobiles and the harms and inequities that result from such a system, but will provide additional options for well-off individuals to evade the traffic congestion experience by everyone else.

Finally, the results of my research illustrate that the proposals of tech executives, at least in the field of transportation, deserve more critical attention before reaching the implementation stage. The transportation solutions proposed by the tech industry which have already been implemented have not delivered the benefits that executives and thought leaders initially claimed they would, and those which they are promoting for future implementation are likely to follow a similar pattern. My research demonstrates not only that there needs to be more research in this field, especially on proposals which have not yet been implemented, but also that journalists and policymakers need to be more critical in their assessments and how they present them to the public. There must also be greater emphasis placed on imagining and promoting futures which challenge the dominance of automobiles and the harms which arise from them if cities are ever going to move beyond the automobile and toward more sustainable transport futures.

2.0 CONTEXTUAL LITERATURE, CONCEPTUAL FRAMEWORKS, AND METHODOLOGY

Research on the tech industry's purported transportation solutions is a relatively new area of attention, given that they themselves have largely emerged in the past decade. The literature is growing, in particular, on the subject of ride-hailing services, given their impact in major urban areas. However, in order to properly understand the implications of these technologies and how they continue a pattern of elite influence on the transportation systems serving urban areas, a review of a broader literature is necessary. In this chapter, I review the contextual literature, conceptual frameworks, and methodological approaches relevant to this thesis. First, I outline the literature on how elite power is exerted on the urban form; how the tech industry formulates and responds to problems through a technologically deterministic lens; and some of the transportation solutions which are to be critically interrogated in Chapters 3 and 4. Second, I expand on the three conceptual frameworks used in my critical analyses: automobility realism, mobility justice, and critical future studies. Third, I outline how I collected the materials which serve as the basis for my analyses and how I used critical discourse analysis as a methodology.

2.1 Research context

The research on the tech industry's transportation proposals is varied. It should not be surprising that the ideas which have been around the longest and have reached some stage of implementation have a larger body of literature, in particular ride-hailing services and autonomous vehicles, while those which have emerged only in the past few years, such as flying cars and car tunnels, have received comparatively little academic attention. However, these solutions must also be placed in the broader history of elite influence on urban space and transportation systems, along with the specific technologically deterministic problem-solving

approach which is not only prevalent in the tech industry, but which its popular figures have legitimized throughout society with a range of social consequences.

In this section, I begin by outlining how powerful figures have privileged themselves in urban space and reconstructed the transportation system to suit their desires throughout history. I then specifically explain how that occurred in the case of the rollout of the automobile in the twentieth century. Next, I shift to looking at how the tech industry approaches social problems and frames their solutions to them. Finally, I outline previous research on the tech industry's purported solutions for the transportation system.

2.1.1 Elite power shaping the urban form

The ability of powerful people to exert their influence on urban space and privilege themselves in urban transportation is not solely the product of cities and transportation systems designed around the automobile, though they have helped to entrench their power. Rather, such a dynamic has existed for thousands of years. In the ancient cities of Rome and Babylon, populations of approximately half a million were densely packed into areas of just 14 square kilometres or less, and the rulers of Rome even chose to ban wagons from passing through the city during the night because of the noise pollution they created (S. Brown, 2012; Falcocchio & Levinson, 2015). There was traffic on the streets for wagons and pedestrians alike, yet the wealthy were carried through the streets in litters — couch beds surrounded by curtains to shield them from the masses — by slaves, taking up far more space than an individual pedestrian (S. Brown, 2012; Juvenal, 2004). As the pedestrians had to deal with being pushed and prodded from all sides and having their legs covered in mud, the wealthy man in his litter could read, write, or even sleep while being carried to his destination (Juvenal, 2004).

Following the Industrial Revolution, cities in Europe and North America became denser and more crowded as new building materials allowed for the construction of taller structures and people migrated from rural areas in search of work (Falcocchio & Levinson, 2015; Muller, 2017). However, while the working class walked, cycled, and took streetcars, the wealthy were driven to their appointments in personal horse-drawn carriages — reflecting the litters of old, except with a paid driver and animal labour instead of slaves (Muller, 2017; Norton, 2007). In early nineteenth-century Paris, the muddy streets could only be avoided by the wealthy in their carriages or by escaping into the arcades (Hazan, 2002/2010). The narrow streets, overcrowding, hygiene risks, and threat of social unrest justified Emperor Napoléon III to order Baron Georges-Eugène Haussmann to undertake a massive public works program that transformed the city with large boulevards and new social infrastructure, but largely ignored the disruption to the lives of the working class and made it easier for the military to respond to uprisings by the poor, given Paris' revolutionary history (Hazan, 2002/2010). Haussmann's work went on to inspire similar plans for London, Chicago, Washington, D.C., and other major cities, along with later visions for large-scale transformations of urban environments (P. Hall, 2014).

After the entrenchment of automobility (further detailed in Section 2.1.2), there were many reimaginings of what the city should be in era of the automobile, and one of the most influential of those visionaries was Le Corbusier. He believed that the future of the city depended on "the intervention of *grands seigneurs*" (P. Hall, 2014, p. 240). He sought to emulate the autocratic influence of kings, emperors, and Haussmann himself to alter Paris' urban form to ensure it conform to elite desires and priorities, deriding any potential influence of the working class on the cities and communities they inhabited (Scott, 1998). Le Corbusier's wish to see much of Paris razed and replaced with tall towers surrounded by green space and wide roads,

with special towers for elite occupations in “a completely class-segregated city,” conveniently ignored “the problem of garaging all these cars, or of the environmental problems that would result from their noise and emissions” (P. Hall, 2014, pp. 242–244; Scott, 1998). While he developed similar plans for many other cities, he was largely unsuccessful at having any of them implemented, and where governments built public housing along the lines of the ‘tower in a park’ model inspired by Le Corbusier, they were often failures which segregated low-income residents and increased crime in their vicinities (P. Hall, 2014).

In New York City, the latter form of public housing was a key piece of the urban renewal program undertaken by Robert Moses, which demolished the housing of poor and black residents to make way for expressways and more upscale housing, while moving poor residents to concentrated public housing developments (Caro, 1974; P. Hall, 2014). Moses also made sure that road projects were built in ways that further separated residents by class and race, including through the construction of bridges at a height that would stop buses from reaching areas frequented by higher income people with automobiles (Caro, 1974; Schindler, 2015). Planning has traditionally been a technocratic field with ideas of what would best serve the population driven by science and data as interpreted by experts (Forester, 1982; Southworth and Ben-Joseph, 1995). In recent decades, there has been a greater academic focus on the power that can be exerted by planners on urban space and their ability to use their position to challenge people in more powerful positions while structuring processes to better represent the groups which have less of an ability to have their perspectives considered in planning decisions (Battista and Manaugh, 2017; Forester, 1982). However, “advocacy” planning does not appear to be practiced by a majority of planners (Battista and Manaugh, 2017), and this is reflected in criticisms by grassroots advocacy organizations who do not feel that minorities and vulnerable populations

have a voice in planning decisions and are often made worse off by the actions of planning departments (Sheller, 2018; Untokening Collective, 2017).

Continuing the pattern of the litter and the wagon, the automobile encloses its driver and passengers from the world which surrounds them, making it a "moving, dangerous iron cage" (Urry, 2004, p. 30). Given how it allows them to take up far more space than the pedestrian or transit user, the automobile becomes an expression of "bourgeois privilege" (Gorz, 1973/2018, para. 11) which did not emerge from the normal workings of market capitalism, but whose dominance is the product of a coordinated campaign by powerful individuals in government and industry.

2.1.2 Powerful interests working to entrench automobility

Streets have not always been the exclusive domain of automobiles. Before the advent of the automobile, they were much narrower than they are today and houses were not set back nearly so far from the road (Southworth and Ben-Joseph, 1995). Streets were multimodal spaces shared by pedestrians and horse-drawn carriages for the wealthy, then horse-drawn streetcars beginning in the 1850s (Muller, 2017), bicycles in the late 1870s (Southworth and Ben-Joseph, 1995), and electric streetcars and subways near the end of the century (Falcocchio & Levinson, 2015; Muller, 2017). The shared nature of streets, the relatively low speeds of anything using them, and the lack of individual yards and playgrounds for many residents led city streets "to be seen as a public space, open to anyone who did not endanger or obstruct other users" (Norton, 2007, p. 331). However, when the automobile began to become more common in the early twentieth century, that began to change, though as an expression of power, not as natural development.

The physical reconstruction of the streets to serve automobiles in the early twentieth century was preceded by a social reconstruction that had to alter how people perceived the streets

and the uses that could take place on them (Norton, 2007). Instead of being a place for many different modes moving at low speeds, where children could even play without being at high risk, the street was recast as the exclusive domain of automobiles and those who opposed it as backward 'jaywalkers' — a campaign carried out by automotive industry groups in partnership with police departments, city planners, government officials, and newspapers which received significant advertising revenues from automakers (Culver, 2018; Norton, 2007). However, once that social reconstruction, led by very powerful groups, was complete, the physical reconstruction could move ahead, with government officials directing the effort in a way that would best serve industry profits (J. R. Brown et al., 2009; Falcocchio & Levinson, 2015; Merriman, 2009).

When urban highways were originally being planned by city officials, they had a strong multimodal orientation and there was an understanding that they had to be planned carefully because they would affect surrounding land uses (J. R. Brown et al., 2009). However, during the Great Depression, cities' funding mechanisms collapsed and the construction of highways had to be funded by state and federal governments, who changed the focus from facilitating intraurban trips to routing them "into city centers to attract enough traffic to justify constructing an intercity system primarily intended to serve rural areas" (p. 170), with substantial influence from engineers and the automotive industry, not the urban residents who would be affected. Through the Interstate Highway Act and Federal Housing Authority, the federal government subsidized the construction of a network of highways across the United States and the growth of the suburbs by ensuring access to low-cost mortgages designed to expand homeownership (Falcocchio & Levinson, 2015; Muller, 2017). In the decades that followed, a whole range of laws were rewritten, subsidies redirected, and tax structures altered in order to prioritize automobiles over

other modes of transportation, creating a significant social cost which is largely ignored today (Gössling et al., 2019; Shill, forthcoming).

The elite-led process of entrenching automobile dominance has come with many problems and created significant harm, to the degree that the existing transportation system is only deemed to 'work' "because its violence is denied" (Culver, 2018, p. 152). Around the world, 1.35 million people die every year as a result of automobiles, with the number of injuries being much higher, and those deaths are disproportionately among people in low-income countries, who die at three times the rate of those in high-income countries, and vulnerable groups which include "[t]he elderly, the young, the poor, people of color, and vulnerable road users (such as pedestrians and cyclists)" (Culver, 2018, pp. 153–154; World Health Organization, 2018). This is illustrated by recent crash figures in the United States which show a downward trend in the fatalities of vehicle occupants, but an increase in pedestrian and cyclist fatalities resulting from the increase in the number of trucks and sport-utility vehicles on roads (National Center for Statistics and Analysis, 2019). In addition to deaths, the local air pollution emitted by automobile traffic creates a wide range of health problems, including "brain damage, respiratory problems and infections, lung cancer, emphysema, headaches, aggravation in those with heart disease, low birth weights, leukemia and stress (from noise levels)" (Gartman, 2004; Paterson, 2000, p. 259), which disproportionately affect low-income people and communities of colour, while directly contributing to environmental degradation and the creation of a system of transnational capitalism which has fuelled the climate crisis (Culver, 2018). Finally, building a transport system that requires most people to rely on automobiles and promoting suburbanization has created a high infrastructure cost that governments have not been able to keep up with, resulting in most residents stuck in long traffic delays at peak times and the promotion of a

spatial distribution that forces low-income workers to move further from job-rich urban and suburban centres to sprawling exurbs without transit options, making it more difficult for them to access employment and services (Muller, 2017). However, while many of these harms disproportionately affect vulnerable groups, even the wealthy get stuck in traffic.

2.1.3 The rise of uncritical technological solutionism

Just as powerful commercial actors have sought to shape urban space and transportation systems in the past to serve their interests and profit margins, the technology industry, which has been ascendant over the past several decades, is now trying to make its mark, often in partnership with other powerful industries. Executives at a number of prominent tech companies have presented purported solutions to the problems of automobiles, as they perceive them from their distinct perspectives which are influenced by their class position and belief in the power of technology to solve problems. Their approach to social problems has been called 'technological solutionism', which involves

> Recasting all complex social situations either as neatly defined problems with definite, computable solutions or as transparent and self-evident processes that can be easily optimized—if only the right algorithms are in place!—this quest is likely to have unexpected consequences that could eventually cause more damage than the problems they seek to address. (Morozov, 2013, p. 5)

Rather than interrogating a problem to determine the best response, those who engage in solutionism often already have a solution they wish to implement and frame the problem to accommodate it, which results in "an unhealthy preoccupation with sexy, monumental, and narrow-minded solutions — the kind of stuff that wows audiences at TED Conferences — to problems that are extremely complex, fluid, and contentious" (Morozov, 2013, p. 6). Solutionism is a product of the Californian Ideology, a worldview with considerable influence among powerful individuals in the tech industry which combines neoliberal capitalism and counter-cultural ideals with a strong technological determinism that believes the future will be

determined outside the realm of politics by "only the cybernetic flows and chaotic eddies of free markets and global communications" (Barbrook & Cameron, 1995, para. 22). Given this perspective, it is essential to examine whether tech executives' proposed solutions to the harms and inequities of modern-day transportation systems actually respond to the problems as they exist, or the problems they choose for a framing which makes the case for their desired technological solutions.

2.1.4 The tech industry's transportation solutions

The body of research on the tech industry's ideas for the transportation system has been growing over the past decade, particularly on the subjects of electric vehicles, ride-hailing services (also called transportation network companies or TNCs), and autonomous vehicles. To conclude this contextual section, I will summarize some of the existing literature with a focus on the social impacts of these technologies, rather than engineering and technical assessments.

There are several aspects of the literature on electric vehicles which are important to the analyses undertaken in this thesis, particularly on the distribution of benefits and harms. Environmental factors beyond the reduction of tailpipe emissions (D. Hall & Lutsey, 2018) are an important aspect of the broader impact of electric vehicles, including the role of particulate matter produced by wear to brakes and tires in creating air pollution (Timmers & Achten, 2016) and how shifting emissions from tailpipe to production can lead to geographic inequities (Holland et al., 2019; Sovacool et al., 2019). The production of electric vehicles, in particular their batteries, also involves mineral supply chains that will have to be significantly expanded in order to meet growing demand (Arrobas et al., 2017; Dominish et al., 2019; Månberger & Johansson, 2019), and that will have implications for countries around the world, though predominantly in the Global South (Barandiarán, 2018; Dominish et al., 2019; Fitz, 2015;

Månberger & Johansson, 2019). These literatures suggest that the benefits of electric vehicles are likely to exacerbate existing class, racial, and geographic inequities, while not solving the environmental challenges to the degree that is often suggested in mainstream discussions.

Over the past decade, ride-hailing services have had an undeniable impact on urban transportation, and a range of studies published over the past several years have sought to understand what effects they have had and who has most benefited from them. Those impacts have included the effect on the use of other transportation modes (Clewlow and Mishra, 2017; Graehler et al., 2019; Malalgoda and Lim, 2019), traffic congestion (Schaller, 2017; San Francisco County Transportation Authority, 2017), road speeds (Erhardt et al., 2019), car ownership (Clewlow and Mishra, 2017), greenhouse gas emissions (Anair et al., 2020; San Francisco County Transportation Authority, 2017), road deaths (Barrios et al., 2020), and whether ride-hailing services reduce vehicle kilometres of travel (San Francisco County Transportation Authority, 2017; Schaller, 2018). Researchers have also studied the demographics of ride-hailing users (Clewlow & Mishra, 2017; Gehrke et al., 2018; Young & Farber, 2019) and the business model of market leader Uber (Horan, 2017), which continues to lose money over a decade after it was founded. Yet again, the literature contradicts how the services have been framed by their founders and much of the news media.

Finally, autonomous vehicles have also been the subject of great interest and scrutiny in the past ten years. While they remain in the testing phase, unlike ride-hailing services, there has still been significant academic interest in their potential to alter the transportation system and the urban form. Researchers have examined a range of potential implementation scenarios with implications for urban density and suburban sprawl (Gruel and Stanford, 2015; Larson and Zhao, 2020; Thomopoulos and Givoni, 2015); changes in transportation patterns (Kaplan et al., 2019;

Thomopoulos and Givoni, 2015; Gruel and Stanford, 2015); equity (Guerra, 2015); energy use and emissions scenarios (Gruel and Stanford, 2015; Thomopoulos and Givoni, 2015); parking needs (Millard-Ball, 2019); and cybersecurity vulnerabilities of connected vehicles (Lim & Taeihagh, 2018; Vassallo & Manaugh, 2018). They have also examined the potential human objections to large-scale rollouts (Fagnant and Kockelman, 2015) and the ethical implications associated with autonomous vehicles (Karnouskos, 2020). While the studies identify potential benefits to the technology, they also provide many reasons to be concerned about likely drawbacks of large-scale implementation.

2.1.5 Context and literature conclusion

The literatures reviewed in this section illustrate how privileged individuals have always been able to exert their power on urban space and the means of transportation, from ancient Rome to the present day. The system of automobility and resulting urban and suburban forms were not just the product of a concerted effort by powerful institutions to alter social, economic, and political systems; they have been particularly beneficial to particular industries and privileged social groups. However, while automobiles have benefited some people, they have also been responsible for creating a whole range of harms and inequities which did not previously exist, and which have become normalized among much of the population.

In response, the ascendant tech industry has taken notice of some of these problems, and has sought to present solutions, sometimes in partnership with other industry, which they promise will rectify these harms. However, their means of problem-solving privileges style over substance and technology over politics, and the existing literature on some of these solutions suggests that they often do not deliver the promised benefits or fail to consider the broader implications of their proposals. My research provides a deeper analysis of five of the most

prominent transportation solutions of the tech industry, with a particular focus on their relationship to automobility, how they would impact vulnerable and marginalized groups, and what they suggest for the longer-term future of transportation. This thesis not only builds on the research that has already been done on electric vehicles, ride-hailing services, and autonomous vehicles, but makes an important contribution on the topics of flying cars and underground vehicle tunnel systems, which have had little attention by researchers. My framework of automobility realism, in particular, helps to explain why so many of these solutions continue to centre the automobile instead of imagining alternative means of designing future transportation systems.

2.2 Conceptual framework

This section of the chapter will explain how the conceptual frameworks of automobility realism, mobility justice, and critical future studies will inform the critical analyses I perform in the following chapters. I begin by introducing automobility realism, the concepts which inspire it, and how it will be relevant to the analysis of the tech industry's transportation proposals. Next, I outline mobility justice and how it helps to centre the analyses on vulnerable people and how they are affected by the ideas in question. Following that, I present the concept of critical future studies, its importance to thinking critically about the futures being presented by tech executives, and how it has been applied in other contexts. Finally, I explain how these frameworks are specifically applied in the context of my analyses.

2.2.1 Automobility realism

Automobility realism is a product of insights from the literatures on capitalist realism and critical perspectives on automobility which, together, provide a new perspective on how the system of automobility limits the imaginative potential of those thinking about the future of transportation.

Urry (2004) describes automobility as "a self-organizing autopoietic, non-linear system that spreads world-wide, and includes cars, car-drivers, roads, petroleum supplies and many novel objects, technologies and signs. The system generates the preconditions for its own self-expansion" (p. 27). It is composed of six components which include the object of the automobile, the culture of individual consumption, the larger industrial complex that is intimately linked to the automotive industry, the private form of mobility associated with automobiles, discourses of the 'good life', and the global environmental and resource implications of such a system (Urry, 2004). Automobility becomes not just the "the literal 'iron cage' of modernity, motorized, moving and domestic" (Urry, 2004, p. 28), but one which "effects an absolute triumph of bourgeois ideology on the level of daily life" (Gorz, 1973/2018, para. 4) by extending and entrenching the ideology of individualism. This is despite the growth in the popularity of automobiles serving to devalue their own utility by creating traffic congestion that robs the owner of the initial promise to be able to go faster than other road users by slowing them all to the same speed (Gorz, 1973/2018).

The limitations of urban geometry create a fundamental contradiction in the ideological underpinnings of automobility, which is reflected in the frequent use of traffic congestion as the primary argument in favour of the tech industry's transportation proposals (Salesforce, 2015; Swisher, 2014; The Boring Company, 2018; Uber Technologies, 2019), despite the fact that "*technology never changes geometry*" (Walker, 2016, para. 7). In the same way that Fisher (2009) observes that capitalism acts as "as a kind of barrier constraining thought and action" (p. 16) that is so difficult to break through it is easier to imagine the end of the world than the replacement of the capitalist system with an alternative, the all-encompassing, path-dependent nature of automobility effects similar constraints on the transportation system. The system of

automobility is not only intimately tied into the global capitalist system and its structures of power (Paterson, 2000), but it is the product of a decades-long collaboration between capital and the state in service of corporate interests (Gorz, 1973/2018; Norton, 2007; Shill, forthcoming). As a result, the economic elite is unable to fundamentally break with a way of organizing transportation which reproduces capital and solidifies their power. At its core, the automobile remains a luxury product, despite how its democratization has robbed it of its initial promise (Gorz, 1973/2018), but that has not stopped the elite from projecting their preferences onto the broader society believing that "what those people find convenient or attractive is good for the society as a whole" (Walker, 2017, para. 1). The solution thus will not come from technological fixes which dismiss complexity and questions of politics in favour of aesthetics and media spectacle (Barbrook & Cameron, 1995; Morozov, 2013), but will rather require an "ideological ("cultural") revolution" which is "not to be expected from the ruling class (either right or left)" (Gorz, 1973/2018, para. 5).

2.2.2 Mobility justice

Under a system of automobility, the violence created by the proliferation of automobiles is denied and normalized (Culver, 2018), despite killing 1.35 million people annually around the world (World Health Organization, 2018). That violence is not equally distributed, presenting a disproportionate threat to people in the Global South and a number of social groups regardless of country which include children, the elderly, the poor, people of colour, and other road users who are not enclosed in their own 'iron cage' (Culver, 2018; Paterson, 2000; World Health Organization, 2018). As such, it is essential to consider whether changes to the transportation system would address the harms experienced by the most vulnerable groups in society, or simply alleviate the more minor concerns of well-off road users.

The perspective of mobility justice is provides an important lens through which to consider transportation systems and mobility patterns. According to Sheller (2018), mobilities are "always channeled, tracked, controlled, governed, under surveillance and unequal—striated by gender, race, ethnicity, class, caste, color, nationality, age, sexuality, disability, etc., which are all in fact experienced as effects of uneven mobilities" (p. 10). Transportation systems privilege certain groups over others, forcing researchers to consider the "unjust power relations of uneven mobility" (Sheller, 2018, p. 2) and how "we fully excavate, recognize, and reconcile the historical and current injustices experienced by communities" (Untokening Collective, 2017, p. 4). The Untokening Collective, which first developed the approach in November 2016, argues that this does not simply mean for planners, politicians, researchers, and other people in powerful positions to think of ways to better represent or consider the perspectives of vulnerable groups, but rather that power itself be redistributed to "impacted communities" so they can develop planning models that better suit them and meet their specific needs, while valuing their lived experiences instead of simply relying on data (Untokening Collective, 2017).

2.2.3 Critical future studies

Being able to imagine more emancipatory futures is a key aspect of actualizing them. For this reason, critical future studies builds on the observations made by Fisher (2009) with capitalist realism to analyze "the ways in which cultural texts not only *represent* the future, but also actively shape it by opening up or closing down imaginative possibilities" (Godhe & Goode, 2018, p. 151). Instead of simply seeing "the future only as an intensification of the present" (Vint, 2015, p. 7), the goal of critical future studies is "to broaden the field of possibility" (Goode & Godhe, 2017, p. 112) in recognition of the power of the imagination to "overturn and rewrite the rules of what the real actually is, or rather, how it is defined" (Dobraszczyk, 2019, p.

9). Critical analyses of future visions are guided by a number of key concerns, including the power relations embedded in them, how agency is enacted or denied, who is truly served by such a way of organizing society, and the broader network of ideas which inspired the vision or were inspired by it (Goode & Godhe, 2017). However, researchers are not expected to try to hide their values, but rather to use them to guide their analyses and to "engender a sense of urgency and excitement" (p. 127) for the future.

Previous applications of critical future studies have analyzed the narratives surrounding Tesla's electric vehicles (Taffel, 2018), discourses used to discuss artificial intelligence (Goode, 2018), and representations of post-scarcity in the "Thousand Cultures" tetraology (Godhe, 2018). Further critical engagement with future representations through the lens of capitalism realism, while not explicitly using critical future studies, have also examined cyberpunk as a reflection of the post-utopian 'end of history' (Gomel, 2018); *Snowpiercer* as a capitalist-realist anticipation of the future (Canavan, 2014); the presence of capitalist realism in *Gravity*, *Her*, and *Side Effects* (Freedman, 2014); recent left-wing attempts to present futures which transcend capitalist realism (Shaviro, 2015); and utopian-communist fiction to develop a framework for a different kind of communications infrastructure (Fuchs, 2020). Finally, some research has already been done to critically analyze the futures of tech billionaires (Murtola, 2018), and while there have been left-wing attempts to imagine emancipatory futures beyond the framing that emerges from the tech industry (Frase, 2016), they are not always successful at critically engaging with those ideas (Bastani, 2019).

2.2.4 Conceptual frameworks conclusion

The frameworks of automobility realism, mobility justice, and critical future studies provide important lenses through which to examine the transportation ideas put forward by powerful

individuals in the tech industry. In this thesis, I build on the work of Fisher (2009), Urry (2004), Gorz (1973/2018), and other critical automobility scholars to analyse how the dominant system of automobility affects five of the most prominent ideas promoted by the tech industry for how transportation should change in the future. I also utilize mobility justice to ensure those analyses focus on the most vulnerable and critical future studies to dissect the representations of their ideas for the future. As transportation has become an area of greater debate in recent years, there has been a focus on the uneven impacts of automobility and how it might change in future. Yet elite figures have a long history of making transportation and urban systems reflect their personal desires, and the beneficiaries of the past decade of growth in the tech industry have their own ideas for how it should be altered to suit them. Critical approaches to automobility, mobilities, and future studies allow not only for the tech industry's proposals to be assessed against the status quo, but also to consider them against alternatives which would better serve the majority of the population while addressing inequities that have become normalized.

2.3 Methodology

In this section, I outline the materials I used to complete my research and the methodological approaches which guided it. First, I explain how I gathered and assessed the sources that formed the basis of my critical analyses. Second, I describe the critical discourse analysis approach I used and how I applied it in my research. Third, I detail how the visual and multimodal approach to critical discourse analysis was important to the analyses performed in Chapter 4. Finally, I break down the ethical considerations of my research.

2.3.1 Materials collection

Given that I wanted to analyze the impacts of the tech industry's transportation solutions, I knew a variety of sources would be necessary to fully capture the extent of the promises made by

companies and executives; how they were communicated and represented; the observed impacts of the ideas; and the likely impacts of those which have not yet been implemented. After determining my research questions and the solutions which I wanted to analyze, I sought out the sources and materials which would form the basis of my analyses. I already had pre-existing knowledge of some of the solutions in question, as I have read about them in the news like many other people; done previous research on ride-hailing services and autonomous vehicles; and have written about them in news publications. This will be discussed further in Section 2.3.4.

I began by visiting the websites and social media accounts, particularly YouTube and Twitter, of the companies and executives in question. I was particularly interested in how they described and positioned the various transportation solutions that I analyzed as part of this research. In this stage, I identified website pages, company documents, images, videos of keynote presentations, and tweets which helped to illustrate how these solutions were being talked about and framed for the public. However, I did not constrain myself to the media produced by and for these companies and executives. After searching these sources, I expanded my search into the broader news media to find other interviews and news stories to provide additional context to the materials produced by the companies themselves. I occasionally found myself looking at the materials produced for the launch of a particular new plan, product, or solution for the future of transportation, then looking at how that was covered by news media to see whether media took a more critical approach, which potential issues they identified (if any), and which they did not include in their coverage.

Comparing the framings of tech companies and executives to the real or potential impacts of their solutions was also an essential part of my analyses. After identifying interviews, images, videos, documents, social media posts, and news stories about the various solutions, I then turned

to the academic literature to see what research had been done on these transportation modes. In some cases, such as with electric vehicles, ride-hailing services, and autonomous vehicles, there were sufficient academic sources to draw from for my analyses, but for flying cars and the proposed tunnel system, I had to look for more sources outside of academia because the work done on the specific iteration of these ideas has been limited.

2.3.2 Critical discourse analysis

In order to analyze the way tech companies and executives framed their transportation solutions against the real and potential outcomes of such ideas, critical discourse analysis (CDA) played an essential role in providing a framework through which to conduct a critical dissection. CDA falls within the broader field of discourse analysis, which examines the use of language or 'discourse' by highlighting its social setting and how it is organized to establish authority (Lees, 2004). What sets CDA apart is its distinct focus on social inequality, meaning that while it does not ignore the powerless or those with relatively little power to frame discourse — Fairclough (2001) calls them the 'losers' — it shines its light on the practices, discourses, and "discursive strategies for the maintenance of inequality" operationalized by the powerful (van Dijk, 1993, p. 250). CDA is not a consistent methodology, meaning it is applied in different ways by different scholars, and while some see this as a potential drawback (Lees, 2004), Weiss and Wodak (2003) present it as a feature which allows "for open discussion and debate, for changes in the aims and goals, and for innovation" (p. 13). However, CDA cannot simply examine inequality and discourse; practitioners of CDA still need to understand the social context in which this process is occurring.

Critical appraisal of power relations and their role in the achievement of dominance by elite groups is essential in CDA, making it the ideal method for my analyses of the tech

industry's efforts to influence the design of transportation systems. Practitioners of CDA must examine how social power is amassed based on "privileged *access* to socially valuable resources"; how power enables the groups that hold it to control others by limiting their freedom and influencing their minds; when power is abused to achieve dominance over other groups; and how that dominance allows the discourses of the powerful elite to gain hegemony over the minds of other groups, making them act in the interests of the powerful group rather than their own (van Dijk, 1993, pp. 254-5). Through this understanding of the broader social context and its role in determining the relative position of different discourses, a hierarchy can be developed to examine the interplay between discourses and the possibility for alternative discourses used by less powerful groups to challenge dominant framings (Fairclough, 2001; van Dijk, 1993). This consideration of alternative discourses plays a role in the analyses I undertake in Chapter 4, which examines how tech executives imagine the transportation system looking in the future.

While CDA focuses on the actions of the powerful, the acknowledgment that other discourses can challenge it comes from its critical perspective. CDA is critical of the dominant social order, including existing academic approaches, and was born out of the desire to understand how the marketization of society under capitalism was creating "new patterns of discourse" (Billig, 2003, p. 36). Western Marxist and feminist thought have a strong influence over the practice of CDA, and its approach borrows from critical social theory and critical linguistics (Carvalho, 2008; van Dijk, 1993). Researchers who use CDA are not expected to pretend they do not have beliefs of their own; rather, their research is designed to make a political statement and they are expected to bring an explicit sociopolitical stance (van Dijk, 1993), a feature it shares with critical future studies (Goode & Godhe, 2017).

The first step to performing CDA is the identification of a social problem (Carvalho, 2008). Fairclough (2001) further specified that the problem needed to have an aspect that related to communication so it could be assessed through the lens of discourse analysis. For my thesis, that problem is the transportation solutions of the tech industry, and their own communications about how those modes are supposed to work and the benefits they are claimed to deliver form the basis of my analyses. Following Fairclough's (2001) approach, I examined the broader social context in which the problem takes place to understand the network of social practices that are relevant to creating and addressing the problem; the way communicative practices relate to these social practices; and the discourse in question in relation to this broader knowledge. However, since my analyses also make use of audiovisual materials, I further considered how CDA could be applied to those sources and how they may present additional elements to take into consideration.

2.3.3 Multimodal discourse analysis

Traditional CDA is primarily, though not exclusively, focused on textual discourses and language, but the increasing use of images and video in the media that is consumed by the general public means there needs to be a greater focus on visual and multimodal discourses (O'Halloran, 2011). Multimodal discourse analysis has been applied in many ways, including to television programs and news websites (O'Halloran, 2011); visual corporate communications and newspaper frontpages (Jancsary et al., 2016); and children's programming (Norris, 2002). This is particularly important for my thesis because, in addition to text, I also examine audio interviews, videos, conceptual drawings, renderings, and photos. Given that I seek to unpack the way that tech executives use their power to promote their specific solutions for the future of transportation, and visual and multimodal forms of communications allow power to be disguised

and exerted in different ways than in text (Jancsary et al., 2016), the multimodal approach to discourse analysis will be important to ensuring a critical analysis which accounts for differential applications of power in through various means of communication.

2.3.4 Ethics and positionality

At its most basic, research ethics refers to the notion of 'do no harm', be it emotional, physical, or psychological. Since my research does not involve human participants, but rather the analysis of existing sources, the ethical risks are lessened. However, that does not mean there is no responsibility to the people who could potentially be affected by this research, and the use of mobility justice as one of the conceptual frameworks guiding my use of CDA and the broader analyses which I perform is designed to ensure that I remain focused on how the exertion of power by influential figures in the tech industry has the potential to negatively impact vulnerable and marginalized groups of people.

Being aware of my position with regard to the research is essential to ensuring I am aware of how my identities and perspectives could influence my research. That is not to say that understanding is then used to try to negate personal views in an attempt to present a false objectivity that is common in both academia and journalism, as both CFS and CDA emphasize the importance of the researcher using their politics in service of critical analysis (Goode & Godhe, 2017; van Dijk, 1993). Yet Billig (2003) writes that "if critical analysts fail to be self-reflexive then the critical enterprise can be compromised, to the extent that critical limits of critique become ignored and thereby hidden" (p. 37).

A researcher's positionality includes their "race, nationality, age, gender, social and economic status, sexuality," and other life experiences or aspects of their identity that could influence data collection and the creation of knowledge (Rose, 1997, p. 308). Determining one's

positionality is often understood through the process of reflexivity, which occurs when the researcher engages in scrutiny of themselves and their research project to comprehend how their privilege and power could influence the research they are attempting to conduct (Dowling, 2016). According to Rose (1997), "privilege is understood as entailing greater access both to material resources and to the power inherent in the production of knowledges about others" (p. 307). In the context of my research, my socialist politics and previous critical writing for news publications on tech executives and companies played an important role in my choice of research, the questions I chose to pursue, and the critical approach I chose to employ. Such a political orientation, influenced by Marxist political economy, does make it easier to pay close attention to the way power is used to serve particular interests and how it impacts those with far less, if any, power of their own. It also helps to offset the privilege I have of being a graduate student while undertaking this research, which could also be limited by my experience as a white person.

Finally, given that my focus in this thesis is to critically evaluate ideas and business ventures of powerful individuals and companies, this research is an instance of 'studying up', an asymmetrical relationship where the researched has more power than the researcher (Dowling, 2016). In effect, this means that the research is designed to challenge the power of the tech industry and to understand the degree to which their ideas and values fit within a broader history of elites exerting their power on urban systems in service of their own interests. It further seeks to understand how they use their power in service of their own interests, and how to ensure changes to the transportation system serve the needs of the most vulnerable social and economic groups rather than those with the most power.

3.0 POOR IMAGINATION/FLAWED IMPLEMENTATION: HOW TECH EXECUTIVES' TRANSPORTATION VISIONS FAIL TO ADDRESS THE HARMS OF AUTOMOBILITY

Paris Marx
McGill University

Kevin Manaugh
McGill University

ABSTRACT

In the twentieth century, advances in transport technology in the form of mass-produced automobiles led to enormous structural and social changes. These changes led to a system of mobility tied to environmental degradation, unsustainable resource use, safety issues, and costs and benefits that are widely skewed throughout society. While inequities in mobility have existed for millennia, the car-centric twentieth century intensified these discrepancies. In recent years, the technology industry has offered a multitude of ideas for the future of transportation, with some of the most notable being the 'three revolutions': electric vehicles, ride-hailing services, and autonomous vehicles. These ideas are promised to address the environmental and social impacts associated with auto-centric transport systems. However, using the lenses of automobility realism and mobility justice, this paper dissects these three proposed solutions by interrogating the degree to which they retain or challenge the system of automobility itself and how the tech-driven solutions could make the existing harms and inequities even worse. The importance of including voices, expertise, and perspectives from a variety of stakeholders and addressing questions such as whether these tech-driven visions can be socially just and benefit all members of society is addressed.

Keywords: automobility, electric vehicles, autonomous vehicles, transportation network companies, mobility justice

The planning of cities and transportation networks often involves trade-offs between competing groups and interests, but there is little denying the role that powerful individuals in business and government have played over a long history to impose their vision for urban space and how people should move around it on the rest of its inhabitants. These influential people range from the rulers of ancient Rome who rode in couch-like 'litters' carried by slaves through the streets of densely packed pedestrians to elite urbanists like Baron Georges-Eugène Haussmann and Robert Moses who razed the low-income areas of Paris and New York City to make way for boulevards and expressways to serve more well-off urban residents (S. Brown, 2012; Caro, 1974; Falcocchio & Levinson, 2015; P. Hall, 2014; Hazan, 2002/2010; Schindler, 2015). These men either did not consider how their visions would interact with urban reality and negatively affect the lives of many inhabitants or saw their plans as a way to explicitly entrench the power of one social group or class at the expense of others.

The history of the proliferation of the automobile provides an example of powerful interests imposing a transportation system on cities and residents against their collective will, using heavy handed propaganda and changing the urban form to force the population into acquiescence (P. Hall, 2014; Merriman, 2009). In the first half of the twentieth century, automotive executives, the media, police, engineers, and planners altered social perceptions of who could acceptably use the streets through campaigns to demonize carless road users as 'jaywalkers', which involved the creation of social and eventually legal punishments for those who challenged the new norms that gave the streets to automobiles, even as residents tried (and

ultimately failed) to fight back (Norton, 2007). Later, the state changed regulations and the tax code to incentivize auto-oriented suburban development and subsidized the construction of the highways, including the Interstate Highway System in the United States, which were used to raze poor and minority areas of major cities (J. R. Brown et al., 2009; Falcocchio & Levinson, 2015; Shill, forthcoming; Southworth & Ben-Joseph, 1995).

The imposition of automobility has created a range of social, economic, and environmental problems, including the deaths of approximately 3.7 million people in the United States since 1899 (Culver, 2018), annual deaths of 1.35 million people around the world (World Health Organization, 2018), health problems associated with air pollution and auto-oriented land-use patterns, and the greatest threat to life on Earth: the climate crisis (Paterson, 2000). Given these negative outcomes, planning processes that result in technocratic decision-makers implementing policies which directly and indirectly harm vulnerable populations while giving them little power to influence the decisions which affect their lives need to change (Untokening Collective, 2017). Not only do existing negative outcomes need to be addressed, but the social and environmental implications of any future transportation system must be critically assessed before implementation, with a specific focus on the needs of and outcomes for the groups who are typically excluded from decision-making processes.

The existing system of automobility is the source of many social harms and inequities, and the technology industry, whose economic power has expanded immensely over the past several decades, has presented innovations which its executives and thought leaders promise will address those problems without questioning the system of automobility itself. In this paper, I will utilize the critical lenses of automobility realism and mobility justice, which will be outlined in the following section, to examine several aspects of the technology industry's promised mobility

revolution, the popularity of which has also influenced executives in the automobile industry. These innovations are electric vehicles, ride-hailing services, and autonomous driving technologies, which have collectively been termed the 'three revolutions' necessary to address the problems created by automobiles in urban environments. By examining interviews with executives and documents released by the companies outlining these solutions, along with peer-reviewed articles and journalistic assessments of the solutions' outcomes, both real and projected, I will assess the extent to which these solutions reckon with the problems inherent an auto-dominated transportation system, consider the challenges they will meet or have met in the implementation phase, and whether their benefits will disproportionately accrue to well-off individuals in the pattern of historical auto-oriented development. I will not be able to fully interrogate every possible implication of these various transport solutions, but this analysis will address some of the key equity questions that must be considered in order to judge the broader outcomes produced by these modes, instead of the more narrow considerations that the companies producing them would have policymakers and the public focus on.

3.1 Critical perspectives on transport futures

When executives in the technology industry make pronouncements about their ideas for the future of transportation, it can be difficult to determine whether their big promises are accurate reflections of what the executives hope to achieve or exaggeration designed to capture the public's imagination. Regardless of the intention, they have proven adept at using the media to have their ideas amplified into the public consciousness and taken seriously as achievable mobility outcomes. However, since their proposed transport solutions appear to ignore many realities and limitations of the physical and social environments, the importance of critically

assessing them is paramount, and the critical perspectives offered by automobility realism and mobility justice will be essential in carrying out those analyses.

3.1.1 Automobility realism

Gorz (1973/2018) describes the automobile as a luxury object which creates "the illusion that each individual can seek his or her own benefit at the expense of everyone else" but whose ability to fulfill that promise is "devalued by its own spread" (paras. 4–5). Even as the spread of the automobile has made the experience of driving terrible, for "when everyone claims the right to drive at the privileged speed of the bourgeoisie, everything comes to a halt, and the speed of city traffic plummets […] to below that of the horsecar" (para. 11), Gorz (1973/2018) argues the ideological power of the automobile has not been diluted:

> The persistence of this myth is easily explained. The spread of the private car has displaced mass transportation and altered city planning and housing in such a way that it transfers to the car functions which its own spread has made necessary. An ideological ("cultural") revolution would be needed to break this circle. Obviously this is not to be expected from the ruling class (either right or left). (para. 5)

But the automobile is part of a larger system of automobility, which Urry (2004) defines as having six components, including the vehicle itself, the cultural ideas that exist around it, and the "extraordinarily powerful complex constituted through technical and social interlinkages with other industries" (p. 28). Automobility has been intimately tied to the capitalist system through the promotion of economic growth throughout the twentieth century, its integral role in the globalization of capital flows, and the reproduction of global power structures (Paterson, 2000). To cement the power of automobility, corporate interests worked to alter social norms and reorient the physical environment around its product (Gorz, 1973/2018; Norton, 2007); the state aided in that effort by altering regulatory and taxation environments (Merriman, 2009; Shill, forthcoming); and the industry remade itself throughout the twentieth century to conform with changes in the capitalist system, use automobile ownership to "overcome class tensions by

turning workers into ‘property owners’, thus giving them a stake in capitalism” (Gartman, 2004, p. 177), and integrate subversive parts of society perceived as a threat to bourgeois society into the mainstream. Fisher (2009) notes that this latter point is a key feature of the capitalist system as whole — rebranding opposition to the system as an ‘alternative’ or ‘independent’ culture that becomes part of the mainstream — but there is far more overlap between the effects of the system of automobility and the larger capitalist system.

In interrogating the psychological aspects of capitalism, Fisher (2009) describes “a pervasive *atmosphere*, conditioning not only the production of culture but also the regulation of work and education, and acting as a kind of barrier constraining thought and action” (p. 16). This produces an environment where “it is easier to imagine the end of the world than it is to imagine the end of capitalism” (p. 2), but given the all-consuming effect of automobility, which has transformed the physical environment and alienated road users from one another (Urry, 2004), it may have a similar effect on the imaginations of the elites who benefit most from automobility and have the most power to chart the future course of transportation.

Walker (2017) explicitly makes this connection, which he describes as a form of ‘elite projection’: “the belief, among relatively fortunate and influential people, that what those people find convenient or attractive is good for the society as a whole” (para. 1). The flaw comes in the belief that what works for a small, elite minority will produce results that work for everyone — an assertion very reminiscent of Gorz’s argument that turning a luxury product like the automobile into a mass product produces negative results for everyone. Walker (2017) argues that “[e]ven the elite minority won’t like the result in the end” (para. 2).

The flaw in the approach of tech executives to transportation is precisely their obsession with technology, which is the product of an ideology that combines market fundamentalism,

counter-cultural libertarianism, and a technological determinism to create a form of 'solutionism' where problems are framed to make the case for narrow, technological fixes which sound attractive in TED talks but fail to address the actual complexity of the problems they claim to solve (Barbrook & Cameron, 1995; Morozov, 2013). Their narrow focus on technology leads tech executives to ignore the spatial element in urban transportation, but, as Walker (2016) asserts, "[w]hen we are talking about space, we are talking about geometry, not engineering, and *technology never changes geometry*. You must solve a problem spatially before you have really solved it" (para. 7).

As this section argues, a perspective which accounts for automobility realism recognizes that the system of automobility makes it difficult for those within it to imagine an alternative way of organizing transportation systems, and that effect is exacerbated in the case of elite individuals since they were the original beneficiaries of automobility and have been most alienated from the lives and mobility patterns of ordinary people. Those individuals then present solutions based on their privileged experience of urban mobility, which fail to account for both physical and social realities of the broader mobility system. Just as automobility has distributed benefits in an uneven way, so too would the 'solutions' presented by tech elites.

3.1.2 Mobility justice

Properly coming to terms with the broader implications of new transportation technologies requires going beyond the visions of executives and planners, which is where the concept of mobility justice provides an essential framework through which to examine mobilities. First developed at The Untokening meeting in November 2016, mobility justice demands that

> we fully excavate, recognize, and reconcile the historical and current injustices experienced by communities — with impacted communities given space and resources to envision and implement planning models and political advocacy on streets and mobility

> that actively work to address historical and current injustices experienced by communities. (Untokening Collective, 2017, p. 4)

This perspective requires contending with the "unjust power relations of uneven mobility" not just on the level of urban, suburban, or rural transportation, but the larger mobility systems which include "the extended urban systems and infrastructural spaces that shape larger macro-mobilities at a planetary scale, such as access to water and food, and the circulations of energy and fossil fuels through pipelines and cables" (Sheller, 2018, p. 2).

Despite the often positive framing of the transport solutions offered by tech elites, Sheller (2018) asserts that

> Mobilities are always contingent, contested, and performative. Mobilities are never free but are in various ways always channeled, tracked, controlled, governed, under surveillance and unequal—striated by gender, race, ethnicity, class, caste, color, nationality, age, sexuality, disability, etc., which are all in fact experienced as effects of uneven mobilities. (p. 10)

The recognition of the contested nature of mobility and the inequities inherent in an auto-oriented transportation system does not align with the technologically deterministic transport visions which emerge from tech companies, leading it to be left out of their marketing materials, but that does not mean that policymakers, academics, and residents should not expect a full and independent assessment of the social, environmental, and economic outcomes that would accompany implementation. The Untokening Collective (2017) asserts that mobility justice must de-center Eurocentric solutions, value the lived experiences of marginalized communities instead of relying overwhelmingly on quantitative data, and require new decision-making processes be developed with marginalized communities instead of simply inviting them to decision-making 'tables' which put "them at an inherent disadvantage and reinforces white-centered constraints" (p. 15). It also goes beyond local considerations to think about broader power structures and systemic implications, including the supply chains necessary for the products being proposed and

their impacts on the climate system at a time when scientists warn significant change is necessary to avoid the worst possible effects of climate change.

As such, under a mobility justice approach any future transport solutions must be critically assessed to determine whether they ameliorate, perpetuate, or rectify existing inequities. That requires acknowledging the inequities of automobile dominance as a starting point. Automobility is only perceived to be a workable system "because its violence is denied" (Culver, 2018, p. 152), despite it being

> a special danger to the young and the elderly, to the poor, to people of color, and to pedestrians, cyclists and other vulnerable road users – all of whom being people who typically produce less potential for violence through their own mobility than drivers. (p. 160)

Not only are automobiles leading contributors to climate change, the impacts of which will be unevenly distributed on a global level with low-emitting countries experiencing the worst effects, but the shift toward automobility and associated suburbanization primarily benefited drivers while disadvantaging urban dwellers and transit users — and, as a result of historical factors and racist state policies, the former group are more likely to be white, while the latter two groups are more likely to be racialized (P. Hall, 2014; Paterson, 2000). Automobility is not a neutral system; it has created significant inequities, and future transport solutions must create a more equitable transport system, not further benefit those who are already benefiting from the existing arrangement. Mobility justice forces those essential implications to be considered.

3.2 Analyzing purported solutions to automobility's failures

Reflecting the continued auto-centred focus of transportation and dominance of solutionist thinking, a potential solution to the unbearable present has emerged in the form of a proposed 'three revolutions' in urban transportation. These revolutions comprise the electrification and automation of urban transportation, along with expanding the use of and incentives for 'shared'

mobility (Fulton et al., 2017). However, among technologists, this has been translated to mean electrification, ride-hailing services, and automation, as demonstrated by Waymo's (2018) in-development autonomous, electric taxi service and Tesla's (2019) promised 'robotaxi' feature that will allow owners to make their vehicles available through an autonomous ride-hailing service while they are not using them. In the framing of researchers behind the original concept of the three revolutions, shared mobility is presented as "shared vehicle trips or public transport," and the authors are explicit that "[r]ide hailing services do not help bring about this scenario if they are dominated by single-occupant trips" (Fulton et al., 2017, pp. 1–3). Even in making that assertion, however, the researchers continue to fall prey to solutionism by treating new technologies as the solution to the problems of automobility, rather than engaging in a more fundamental rethink of transportation systems. For example, their timeline for deployment of autonomous driving technology appears overoptimistic, which will be discussed further in the autonomous vehicle section, and the concept of shared mobility still details a heavy reliance on automobiles, including ride-hailing services, and suggests many transit services should also become on-demand shuttles, often called 'microtransit', even though they have struggled everywhere their implementation has been attempted (Fulton et al., 2017; Schmitt, 2018). Each of these supposed revolutions will be critically dissected in the following three sections to outline the issues that will constrain their ability to address the harms of automobility.

3.2.1 Electric vehicles

Electric vehicles are not a new innovation, but rather one that is receiving renewed attention in the face of climate change. The first electric vehicles were on roads in the late nineteenth century before being overtaken by the internal combustion engine (ICE) (Gartman, 2004). As such, electric vehicles are not solely an innovation of the modern tech industry, but they merit

inclusion in this critical assessment for two reasons. First, Elon Musk has played an undeniable role in reviving attention and interest in electric vehicles since joining Tesla in 2004 (Vance, 2015); and, second, electrification is an integral piece of the auto-oriented transport visions espoused by tech executives. Autonomous vehicles are often positioned as fleets that are to be hailed via a smartphone app (Tesla, 2019; Waymo, 2018), Musk has said that his proposed vehicle tunnels should only be open to electric vehicles (The Boring Company, 2018), and even Uber's proposed 'flying cars' are promised to use electric motors (Uber Technologies, 2019). However, there are legitimate concerns about the resource extraction necessary for a mass rollout of electric vehicles, whether they are being promoted in an equitable manner, and their contribution to local air pollution, despite eliminating tailpipe emissions.

Through the lens of mobility justice, Sheller (2018) argues that efforts to decarbonize need to consider the geopolitics of existing social, economic, and ecological arrangements, but that perspective is rarely considered in conversations about the need to replace ICE vehicles with electric vehicles. Beginning the conversation from the position of assuming the continuance of a system of automobility, such considerations may not be made because the damage and inequity of extractivism is already built in; all that would change is the quantities of various resources and the dependency of global supply chains on specific countries (Dominish et al., 2019; Scholten et al., forthcoming). Yet, if the Paris target of 2.0ºC of warming is to be met, "a radical (that is, to the root) restructuring of energy supply and transmission systems globally" will be required, and "the technologies assumed to populate the clean energy shift (wind, solar, hydrogen and electricity systems) are in fact significantly MORE material intensive in their composition than current traditional fossil-fuel-based energy supply systems" (Arrobas et al., 2017, p. 58).

The lithium-ion batteries that are common in electric vehicles require a number of metals for their production, including aluminium, cobalt, copper, lithium, nickel, manganese, platinum, steel, and the rare-earth elements neodymium and dysprosium (Arrobas et al., 2017; Dominish et al., 2019; Månberger & Johansson, 2019). In estimating the demand of some of these minerals relative to the existing economically viable reserves in a transition to renewable energies and electrification of transportation, Dominish et al. (2019) find that the total demand for cobalt, lithium, and nickel, all of which are key to batteries, would far exceed economically viable reserves, and that demand would only fall below reserves for lithium and nickel if there were very high rates of recycling, for which there are currently few facilities. Further, the majority of the extraction of those minerals occurs in the Global South, presenting additional concerns for the human and environmental cost of production.

Many of these key metals have a "geographical concentration that is as high or higher than oil," but their economic value to the countries where they are extracted is "significantly lower than for oil and for many individual oil exporting countries" and will remain so unless producers form cartels, which is most likely to occur with lithium (Månberger & Johansson, 2019, p. 8). However, the production of many of these metals can have very negative effects on countries and communities, including funding rebel groups in conflict areas, poisoning water supplies, making use of child labour, causing respiratory problems, and many other health and environmental impacts (Dominish et al., 2019; Månberger & Johansson, 2019). Resource extraction can be used to lift people out of poverty, as has been pursued in Bolivia under the left-wing government of Evo Morales, but far too often local resistance is criminalized and suppressed and the negative consequences are not addressed (Fitz, 2015).

The global implications of a transition to electric vehicles cannot be ignored as politicians, corporate leaders, community groups, and social movements present and assess ideas for the future of transportation, yet the mere utility of electric vehicles must also be considered. The Nordic region has the highest per-capita electric vehicle ownership numbers in the world, bolstered by the support given to the sector by the Norwegian government, but experts in those countries attest that the transition is not equitable. In particular, experts are concerned that the subsidies and benefits provided by governments to encourage electric vehicle purchases primarily benefits residents in higher income brackets, not poor residents, and they draw attention to the fact that if the energy to power electric vehicles is being generated from fossil fuels, the air pollution could be shifted from higher income to lower income areas depending on the location of power generation facilities, thus increasing geographic inequities (Sovacool et al., 2019). Further, while the lifecycle emissions of an electric vehicle can be lower than an ICE vehicle because the bulk of the emissions of the former come from the production of the battery and vehicle, while the emissions of the latter are primarily from the tailpipe (D. Hall & Lutsey, 2018), that depends on the owner using it the same way they would use the ICE vehicle theoretically being replaced. Yet the higher income people buying electric vehicles typically buy them as secondary vehicle and do not prioritize keeping their plug-in hybrids charged because many buy them for the rebate, not the environmental benefits (Sovacool et al., 2019). One of the experts explains that, "the typical, single Tesla Model X owner received subsidies in 2016 worth the same amount you can hand out to provide 30,000 trips on the buses and the subway system of Oslo" (Sovacool et al., 2019, p. 211), which leads the authors to conclude that electric vehicles "reflect a potential half-measure that fails to capture many of the additional benefits of public transportation" (p. 213).

Reflecting the concerns of the Nordic experts, an analysis of the local air pollution damages of electric vehicles compared to foregone ICE vehicles in the United States found that the environmental benefits of the shift disproportionately accrue to people earning more than $65,000 a year; Asian and Hispanic populations; and residents in urban areas and the Western part of the country, while negative environmental outcomes would affect people earning below $65,000 a year; White and Black populations; and residents in more rural areas, especially in the Eastern part of the country and some large cities such as Chicago and Atlanta (Holland et al., 2019). Notably, the study looked at contributions to local air pollution, not global climate change. Some of the particulate matter that creates this air pollution comes from the tailpipe, but "non-exhaust emissions currently account for more than 90% of PM_{10} and 85% of $PM_{2.5}$ emissions from traffic," which includes wear from tires, brake pads, the road surface, and the resuspension of dust on the road (Timmers & Achten, 2016, p. 14). Since electric vehicles are, on average, heavier than ICE vehicles, they are estimated to produce the same amount of PM_{10} and just 1-3% less $PM_{2.5}$, meaning that while they contribute to a reduction in tailpipe emissions, they continue to repliicate health risks through the creation of local air pollution (Timmers & Achten, 2016).

As this analysis demonstrates, the electrification of vehicle fleets will surely be one element of a transition to a more sustainable transportation system, but it cannot be undertaken without considering its broader impacts. A shift from ICE to electric vehicles without significantly reducing automobile use as a share of urban mobility has a very high likelihood of producing significant harm in communities in the Global South that will be affected by extractive industries that will need to rapidly expand to meet demand for the minerals and metals needed to produce billions of batteries to power the newly electrified transportation system. Further,

electrification addresses the tailpipe emissions of automobiles, but leaves the many other harms and inequities created by automobility unchallenged while the subsidies and benefits overwhelmingly accrue to high-income individuals. However, keeping with the theme of the 'three revolutions', tech-focused corporate executives promise that their other solutions will address additional problems with automobility. The most realized example of which are ride-hailing services, which currently use ICE vehicles almost exclusively, and have been on city streets for over a decade. Their prevalence has allowed their impacts to be studied, and the findings do not suggest they offer the benefits their executives once claimed they would.

3.2.2 Ride-hailing services

Ride-hailing services, also called transportation network companies (TNCs), have had the largest material effect on urban mobility of any of the transport ideas examined in this paper. Some of the most identifiable companies offering these on-demand services in various parts of the world are Uber, Lyft, DiDi, Ola, Yandex.Taxi, and Grab. The primary innovation they offer for urban residents is the ability to 'hail' a ride using a smartphone app, through which they can also track their journey and pay for their ride, and almost anyone can sign up to be a driver as long as they pass a background check process that has been criticized for a lack of robustness (Isaac, 2019). These services are often positioned as app-based taxi services, but some allow other transportation modes to be hailed or booked, such as ferries, rickshaws, motorcycle taxis, helicopters, bikes, scooters, and even public transit services (Khosrowshahi, 2019; Turner & Hanh, 2019; Uber Technologies, 2018). However, the original promised benefits of these services have largely failed to materialize, and where they have, they have often been captured by a disproportionately well-off segment of the population.

Uber co-founder and former CEO Travis Kalanick said the goal of the company was "about making Uber cheaper than owning a car" (Salesforce, 2015, 18:45) and offering "the cheapest reliable ride possible" in order to serve "everyone" (28:15). He asserted that an expansion of Uber would reduce congestion, pollution, and the amount of urban space that would have to allocated to parking, and went a step further to argue "the world would be a better place" if "ever car was Ubered," meaning to be available on the service, because "there would be no traffic" (Salesforce, 2015, 29:15; Kalanick, 2016). However, these arguments notably exclude transit and focus on meeting these goals with cars since Kalanick originally created Uber to provide black car services, illustrating the mobility experience emphasized by its founders, and argues a lack of taxis made San Francisco difficult to navigate before Uber launched without driving a personal vehicle (Salesforce, 2015). However, when Kalanick does mention transit, he appears to take the wrong lesson. Kalanick positions Uber as the successor to jitneys, a low-priced and unregulated taxi-like service which competed with streetcars in the early twentieth century, arguing that had they not been "regulated completely out of existence," they would have ushered in a future of shared automobility, instead of the personal auto ownership that came to dominate the second half of the twentieth century (Kalanick, 2016, 2:50). Yet Kalanick leaves out how jitneys arose in the aftermath of an economic crisis which left many people unemployed, similar to how Uber emerged in the aftermath of the 2008 financial crisis, and took advantage of the high number of people seeking work; took passengers from streetcar services and led them to have to lay off workers; and increased the number of accidents on city streets (Eckert & Hilton, 1972). Following Kalanick's logic, the regulation of jitneys should have further aided streetcars and public transportation, but automotive companies and the government officials they lobbied rewrote laws and redirected subsidies to promote automobility and personal automobile

ownership — it was not a market outcome (J. R. Brown et al., 2009; Norton, 2007; Shill, forthcoming). The research on ride-hailing services indicates Uber has repeated the unexpected consequences of jitneys, potentially to a greater degree, and that Kalanick's assertions about serving everyone, reducing congestion, and reducing pollution have not come to pass.

In their survey of ride-hailing users in seven major U.S. cities, Clewlow and Mishra (2017) find that ride-hailing users are disproportionately young, college-educated, urban, and have higher incomes, with more than half of users earning more than US$75,000. They find that 36% of people between the ages of 18 to 29 use ride-hailing services, compared to just 4% of those 65 years and older (Clewlow & Mishra, 2017), and a report by Gehrke et al. (2018) for the Metropolitan Area Planning Council in Boston found residents aged 22 to 34 years accounted for nearly two-thirds of users compared to just 1% of residents aged 65 and over, but the younger age group may have been oversampled. The situation is similar in Toronto, where users are disproportionately between the ages of 20 to 39, those aged 60 and over account for only 2% of trips, and more than half of users earn more than C$100,000 (Young & Farber, 2019). The demographics of ride-hailing users identified by these studies suggests that the people who most need better transportation options are unlikely to be the ones benefiting from these services, but even worse, it may be making the services of those with lower transport access worse.

In Toronto, 49% of ride-hail users have a transit pass compared to 35% of users in Boston, but each ride-hailing trip was estimated to cost the latter transit authority US$0.35 in lost revenue, which amounted to an estimated US$19.3 million in lost revenue in 2017 (Gehrke et al., 2018; Gehrke & Reardon, 2018; Young & Farber, 2019). While the ownership of transit passes by ride-hail users could suggest complementarily between transit and ride-hailing services, surveys show the latter are taking users from transit and adding more cars to the road. In Boston,

42% of users would have used transit for their trip if ride-hailing services were not available, 12% would have walked or biked, and 5% would not have taken the trip (Gehrke et al., 2018). The survey by Clewlow and Mishra (2017) covering seven U.S. cities found that between 49% to 61% of ride-hailing trips were adding cars to the road, as they would have been made by walking, biking, or transit or not taken at all had ride-hailing services not been available. Clewlow and Mishra suggest that "ride-hailing is pulling more people away from public transit in cities rather than adding riders" (pp. 24–25), to the tune of a 6% decrease in bus ridership and a 3% decline in light rail. But they are not the only ones to have found an effect on transit use as a result of the introduction of ride-hailing services.

In a study of 22 large U.S. cities, Graehler et al. (2019) found that the entry of ride-hailing services was associated with an annual decrease of 1.3% in heavy rail ridership and a 1.7% decrease in bus ridership, while the introduction of bike share was associated with a 6.9% increase in heavy rail ridership, a 4.2% increase in light rail ridership, and a 1.8% decrease in bus ridership. Meanwhile, Malalgoda and Lim (2019) deem the effect of ride-hailing services on transit ridership to be insignificant and assert that transit effectiveness better explains declines in transit ridership. Yet, their assessment fails to consider the effect that ride-hailing services have had on traffic congestion in cities, which makes bus and light-rail services less reliable. In San Francisco, ride-hailing services attract drivers from other parts of the Bay Area into the city's core, which adds more vehicle kilometres of travel (VKT) in areas of the city that are already congested and are the areas which are already most walkable and accessible by transit (San Francisco County Transportation Authority, 2017). This has the effect of increasing traffic congestion, conflicts with other road users, and greenhouse gas emissions. A further report has found that ride-hailing trips create an average of 69% more pollution than the trips they displace

(Anair et al., 2020). Erhardt et al. (2019) found that vehicle hours of delay increased 62% in San Francisco between 2010 and 2016, compared to an estimated 22% without ride-hailing services, and that average speeds decreased 13%, compared to an estimated 4% decrease without ride-hailing services, because of the increased number of vehicles on the road and the disruption caused by stopping to drop off and pick up passengers. This led them to conclude that, "TNCs are the biggest factor driving the rapid growth of congestion and deterioration of travel time reliability in San Francisco between 2010 and 2016, exceeding the combined effects of population growth, employment growth, and network changes" (p. 11). New York City has experienced a similar phenomenon of ride-hailing services increasing congestion with the number of combined taxi and ride-hail vehicles increasing by 59% from 2013 to 2017 and total mileage increasing by 36%, all of which was generated by ride-hailing services as taxi use declined over the same period (Schaller, 2017). Neither the private nor pooled services reduce congestion, as switching 1.6 kilometres (1 mile) of personal driving to a private ride-hailing trip adds, on average, 4.5 kilometres (2.8 miles), while switching to a pooled or sharing service adds 4.2 kilometres (2.6 miles), due to the additional driving while drivers wait for their next passenger and drive to their location (Schaller, 2018). Thus, the increase in congestion has the effect of slowing and delaying transit services, which makes them less reliable, and forces transit users to consider other means of transportation (Schaller, 2017).

However, that is not the only way ride-hailing services shift users from more efficient transport modes back into cars, or from cars into a less efficient on-demand service. Ride-hailing services are notoriously unprofitable, with Uber losing US$8.5 billion in the 2019 financial year, compared to a loss of US$2.6 billion for Lyft (Krisher, 2020; S. A. O'Brien, 2020), and they have been losing money for over a decade. These losses allow the companies to offer their

services below the actual cost of delivery, making taxi services appear artificially more expensive, even though Horan (2017) demonstrates that Uber does not actually have a more cost-effective business model than traditional taxi companies. For the year ending September 2015, Uber had a negative 143% profit margin and had recovered only 41% of its costs, representing a large subsidy for the actual cost of service delivery that placed traditional transportation providers at a significant disadvantage — a tactic which should be considered a form of predatory pricing (Horan, 2017; Khan, 2017).

When adding up the extent of the human impact of ride-hailing services, their direct impacts on people, particularly those without the power of the executives making the decisions, must also be considered. Culver (2018) established that vulnerable road users are more likely to die in vehicle crashes, which means that the 2% to 4% increase in fatal crashes as a result of ride-hailing services identified by Barrios et al. (2020) is likely to also disproportionately affect those groups. Further, Isaac (2019) explains that Uber developed a sexist corporate culture which was present in its offices around the world and left female employees subject to sexual harassment and abuse. The company's aggressive global rollout was also found to have had very negative human impacts by reducing the pay of taxi drivers and leading some to commit suicide in the United States and in emerging markets; leaving ride-hailing drivers unsafe as they were targeted by taxi drivers and criminal groups for robbery, violence, and even murder in markets such as Brazil, Mexico, and India; and failing to protect passengers, especially women, from sexual abuse and rape by implementing relaxed background check procedures, if any at all (Isaac, 2019). Black, female, and LGBTQ passengers have been subject to discrimination when using Uber and Lyft, either by having longer wait times, being cancelled on more frequently, or suffering verbal or physical abuse from drivers (Aviles, 2019; Ge et al., 2016; Mejia & Parker,

2019); and in the United States, Uber and Lyft claim not to have to abide by the Americans with Disabilities Act by arguing they are technology companies, not transportation companies, leading to significantly longer waits or lack of service for passengers requiring wheelchair-accessible vehicles (New York Lawyers For The Public Interest, 2018; Reed, 2017; Said, 2018).

Despite being promoted as a means to reduce traffic congestion, serve underserved communities, and reduce emissions, ride-hailing services have achieved none of these socially beneficial goals. Rather, young urban residents with higher than average incomes and college degrees — a group that shares many traits with workers in the technology industry — have been the primary beneficiaries, while the transit services that lower income and vulnerable populations are more likely to depend on have been made less reliable. The 'move fast and break things'[1] culture of these companies had the effect of harming women who worked in their head offices; the drivers providing their services and those they were displacing in the taxi industry,;and some of their passengers, particularly those from vulnerable groups, since the companies did not implement policies to effectively keep them safe. The executives of these companies argue that they would be able to negate some of those concerns, particularly for passengers, if they were able to automate the drivers currently providing the service, but again, it is likely the promises being made will not come to fruition.

3.2.3 Autonomous vehicles

Autonomous vehicles, also popularly known as self-driving cars, are a transportation technology that has attracted attention in the past decade with the promise of improving the transportation system by not by constraining the use of automobiles, but rather by using artificial intelligence to

[1] A motto attributed to Facebook CEO Mark Zuckerberg, which has inspired many Silicon Valley startups.

more efficiently organize their travel patterns. However, this technology has yet to begin transporting passengers on any significant scale and the initial predictions of its boosters in the tech industry have proven to have been overstated. In 2012, Google co-founder Sergey Brin predicted autonomous vehicles would be transporting passengers in less than five years, and Musk said in 2016 that Tesla's vehicles would be able to drive themselves across the United States by 2018 (Bartlett, 2019; C. O'Brien, 2012) — neither of which was realized, and predictions in the same vein have proven to have been overoptimistic, at best.

The promises made about the potential effects of autonomous vehicles have been similarly bold. In a 2014 interview at the Code Conference, Brin discussed how autonomous vehicles would free up parking spaces, since cars are parked 96% of the time; reduce congestion by being able to drive faster and closer together in a platoon; better serve those who are currently underserved by the transportation system; offer a fleet of vehicles instead of individual ownership; and, crucially, significantly reduce vehicle deaths, noting that Google's autonomous-vehicle project had not had any crashes to date (Swisher, 2014). Duhigg (2018) later uncovered the latter point was not true: there had been more than a dozen crashes in the early years of the project, at least three of which resulted in serious injuries, including a 2011 incident in which a high-ranking member of the project, Anthony Levandowksi, had modified the software to use it on roads it was not supposed to operate on. When Levandowski's vehicle could not navigate the route, it forced another vehicle off the road, after which Levandowski fled the scene and did not report to authorities that autonomous driving software was involved. However, Google is not the only company whose autonomous vehicles have been involved in crashes.

As of the end of 2019, the National Highway Traffic Safety Administration has ongoing or concluded investigations into fourteen crashes involving Tesla vehicles using or expected to

have been using its Autopilot assisted-driving software (Shepardson, 2020). The National Transportation Safety Board (NTSB) (2019a) concluded that a 2018 crash between a Tesla vehicle and a firetruck was caused by the driver's inattention and overreliance on the automated system, and Autopilot's design, which allowed the driver to disengage from driving, reflecting a previous finding from a 2016 Tesla crash. Uber's self-driving project has had its own troubles, most notably the death of Elaine Herzberg in Tempe, Arizona on March 18, 2018 after she was hit by one of Uber's autonomous vehicles as it was running a standard route on public roads. The NTSB's preliminary report found that the sensors detected Herzberg nearly six seconds before impact, but did not determine it needed to stop until 1.3 seconds before impact, and that its emergency braking was disabled to reduce 'erratic behavior' even though no sensor had been installed to alert the safety driver if an emergency stop was necessary (National Transportation Safety Board, 2018). Leaked documents also showed that the team developing Uber's autonomous driving system were under pressure from management to speed up development and had reduced the number of safety drivers in the vehicles from two to one (Wakabayashi, 2018). The final report determined that Uber had an "inadequate safety culture," which contributed to the crash in multiple ways, and found that the system had not been programmed to look for pedestrians outside of designated crossing areas, which was why the system was unable to identify Herzberg or determine whether to brake until it was too late (National Transportation Safety Board, 2019b, p. vi).

The growing number of crashes involving vehicles with autonomous driving systems naturally creates questions about the safety promises made by the executives in charge of the companies developing them, and whether they can be safe at all levels of autonomy, especially those where the driver is still expected to be paying attention, as that has proven difficult to

maintain if they do not need to be actively driving for long periods of time. In the aftermath of the Uber crash, numerous companies with autonomous-vehicle projects have admitted that developing the technology would take longer than they initially projected, and questioned whether level five autonomy — the level where the vehicle could theoretically handle any driving and road condition without the need for human oversight — will ever be possible. For example, Waymo CEO John Krafcik said that, "Autonomy always will have some constraints" (Tibken, 2018, para. 3); Ford's CEO Jim Hackett admitted the company had, "overestimated the arrival of autonomous vehicles," and that their "applications will be narrow, what we call geo-fenced, because the problem is so complex" (Khalid, 2019, para. 1); and Volkswagen's head of commercial vehicles said

> Level 5 will never happen globally. You need latest-generation mobile infrastructure everywhere, as well as high-definition digital maps that are constantly updated. And you still need near-perfect road markings. […] This will only be the case in very few cities. And even then, the technology will only work in ideal weather conditions. If there are large puddles on the road in heavy rain, that's already a factor forcing a driver to intervene (Taylor, 2019, paras. 7–8).

Promises about safety are not, however, the only claims made without evidence by the executives promoting autonomous vehicles. A model developed by Larson and Zhao (2020) predicts that the introduction of autonomous vehicles will increase suburban sprawl and energy consumption, but could also make city centres denser if there is significant use of shared autonomous vehicles and a reduction in space devoted to parking. However, Kaplan et al. (2019) estimate that private ownership of autonomous vehicles will be much more common than shared usage, with an increase in VKT and congestion, especially for those people who do not live in the urban core, reflecting how existing ride-hailing services have not significantly reduced car ownership (Clewlow & Mishra, 2017) and how automakers will be able to customize autonomous vehicles to better suit individual needs than a shared service — a repeat of a strategy

which automakers began to pursue in the 1960s which saw them increase the number of models available to target not "a broad income group but a small, more specific market niche, based on non-class characteristics like age, gender and family status" (Gartman, 2004, p. 185). Thomopoulos and Givoni (2015) also warn that the proliferation of autonomous vehicles could jeopardize cities' efforts to move away from cars, reintroducing car use for all age groups since they will no longer need a license, especially if they are given exclusive lanes and other benefits to encourage their use, reflecting the equity issues with the benefits for electric vehicles in the Nordic countries (Sovacool et al., 2019).

Planners in the United States have also reported being worried about the impacts of autonomous vehicles on truck and taxi drivers, which would create potential equity issues, especially given Kalanick's comments that Uber would eventually replace drivers with autonomous driving software (Guerra, 2015; Newman, 2014). The same study indicated that autonomous vehicles made planners uncertain about the long-term viability of investments in rail projects (Guerra, 2015). Campaigns against transit investments funded by the Koch Brothers and other groups supporting continued reliance on automobiles have already weaponized the prospect of autonomous vehicles to help defeat transit ballot measures in the United States (Tabuchi, 2018), and Musk has a history of presenting autonomous vehicles as preferable to transit investments (Marshall, 2017). There are also concerns that the amount of data collected by these vehicles could infringe on people's privacy and enable surveillance, while the transference of data and reliance on computer systems could create cybersecurity risks (Lim & Taeihagh, 2018; Vassallo & Manaugh, 2018). Vassallo and Manaugh (2018) write that vehicles may avoid malware-prone areas in planning their routes, but those perceptions could be based on human bias, not verifiable data, which could lead low-income and minority areas to be perceived

as more malware-ridden even though “there is no evidence that the wealthy could better protect themselves from malware by buying a more expensive [autonomous vehicle]” (p. 6).

Even though autonomous vehicles have received a lot of investment and media attention in recent years, they are not likely to transform urban mobility in the near future in the way that influential tech and automotive executives led many people to believe. The development of autonomous driving technology has not progressed at the speed that was promised, and the claim that the technology will eliminate deaths by vehicles has no evidential backing. Indeed, the evidence that does exist should call it into question. Further, by encouraging greater sprawl and energy use, they could further separate urban residents, make it more difficult to form community bonds, and solidify the need to use a car to reach necessities such as grocery stores, doctor’s appointments, workplaces, and more. Such a development could ultimately contribute to the climate crisis instead of helping to alleviate it, expand the demand for metals and minerals if the vehicles are electric, and entrench spatial inequities that are inherent to the system of automobility.

3.3 Conclusion

The critical dissection of the solutionist changes associated with the three revolutions in urban transportation as promoted by tech and automotive executives demonstrates that their purported solutions do not inherently challenge the system of automobility and its inequities, nor would they function to serve populations who have been underserved or even harmed by it. Rather, they further privilege urban elites whose primary problem with automobility is having to wait for a taxi or in traffic — a problem created by automobiles shifting from a luxury product to one sold to the mass market and which planners and engineers have failed to solve through a series of road and highway expansions for decades (Gorz, 1973/2018; Milam et al., 2017; Walker, 2012).

Electric cars only solve the problem of the tailpipe emissions of automobiles, while failing to address the other harms produced by automobility, requiring a rapid expansion of mining for key metals and minerals to build the batteries, and potentially creating new inequities through incentives which overwhelmingly benefit high-income individuals and a less equitable geographic distribution of production emissions. Ride-hailing services make it easier for young, college-educated urban dwellers with above-average incomes to move about the city, while increasing congestion, drawing passengers away from transit, and harming drivers, female employees, and some passengers from vulnerable groups. Autonomous vehicles have not actually been proven to make streets safer and the leading companies in the space are uncertain when the technology to achieve that will be perfected, if it ever will — and even then, it could have consequences that would further promote urban sprawl, increase cybersecurity risks, and increase energy consumption.

Gorz (1973/2018) remarked that after killing the city by remaking it into a sprawled "urban hell" where a car is needed to get anywhere, "the car is killing the car" because "the automobile industry ends up with the unrelentingly predictable result that everyone has to go as slowly as the very slowest, at a speed determined by the simple laws of fluid dynamics" (paras. 18–19). Tech executives are the latest privileged group to try to solve a problem created by automobility without addressing its root cause, and, as a result, their attempt to retain mass automobility without traffic congestion will fail just as has happened with every previous attempt. The only way to solve the problems created by automobility is to take on automobility itself, but that will require people who are not invested in the status quo and who can see beyond autotopia to a transportation system which dethrones the automobile once and for all.

3.4 References

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4.0 FLYING CARS AND BORING COMPANIES: INTERROGATING THE INFLUENCE OF AUTOMOBILITY REALISM ON THE TRANSPORT FUTURES OF TECH EXECUTIVES

Paris Marx
McGill University

ABSTRACT

Tech executives have become involved in the future of urban transportation, yet their proposed solutions do little to challenge the dominance of automobiles which created many of the problems in the first place. Using the perspectives of critical future studies, automobility realism, and mobility justice, this paper interrogates two longer-term, tech-driven transport futures: skies buzzing with helicopter-like flying cars and layers upon layers of automobile tunnels below city streets. The perspectives allow for a critical analysis which focuses on how executives describe their proposed solutions and how they are represented in documents and images released by the companies; the degree to which they challenge or exist within a transportation system built around automobiles; and whether the solutions proposed can realistically address the harms and inequities of a transportation system built around automobiles. In addition, this paper also refers to the work of science-fiction author Ursula K. Le Guin to consider the role of narrative and story in how people think about urban environments and transportation systems, and the potential for different kinds of stories to break the hold of an auto-dominated transportation system over the public imagination.

Keywords: automobility, technological solutionism, critical future studies, mobility justice, critical geographies

In 1973, American science-fiction author Ursula K. Le Guin (1973) wrote a short story about the city of Omelas, whose people are happy without "monarchy and slavery […] without the stock exchange, advertisement, the secret police, and the bomb," and which has "no cars or helicopters in and above the streets" with visitors arriving "on very fast little trains and double-decked trams" (pp. 2–3). Omelas seems like a place where life is good and there are no problems, but Le Guin introduces a moral dilemma: in a small, dirty room in the basement of a building somewhere in the city, there is a small child which "looks about six, but actually is nearly ten," and has developed a mental deficiency "through fear, malnutrition, and neglect" that is never allowed out (p. 5).

The door to the room is only opened to allow small groups to peer in as the child's food and water dishes are refilled, and residents are told that their joy and happiness depends on its continued misery. When young people are told of the suffering child, they "are always shocked and sickened. […] They feel anger, outrage, impotence, despite all the explanations" (Le Guin, 1973, p. 6). But over time, most of them "begin to realize that even if the child could be released, it would not get much good of its freedom" (p. 7) either because they think it has been corrupted by its suffering or would not be able to survive in regular society — any reason to justify the harm that makes their good life possible. However, there are some who cannot live with the justifications. "These people go out into the street, and walk down the street alone. They keep walking, and walk straight out of the city of Omelas, through the beautiful gates" (p. 7). They are "the ones who walk away from Omelas" (p. 8).

What is the point of retelling this parable in a paper about the future of transportation and the urban form that will accompany it? The story of Omelas does not simply exist as a moral challenge, but forces reflection on the state of real-world cities, how harm is distributed within

them, whether that harm should truly be accepted as an unchangeable reality, and whether visions of the future seek to ameliorate those harms or accept them as faits accomplis. The injustices in real-world urban environments are not so clear as in the case of Omelas — there is not a building in which all residents know a child is being tortured and for some unclear reason its torture is necessary — but they are also not as hidden as they are often made out to be. They simply come to be accepted as the norm; as the price of the good life for certain groups of urban residents who hold power and privilege over those who are most subject to these harms.

Early in the story of Omelas, Le Guin (1973) observes that "to embrace violence is to lose hold of everything else" (p. 3). The reality of auto-oriented urban environments is that they are built on violence, but so often it has been normalized as people know little else, the government downplays the threat, and the media is complicit in ignoring or misdirecting the blame for the harm (Goddard et al., 2019; Shill, forthcoming). As Culver (2018) writes, "considering both the magnitude of this violence and the relatively limited attention it receives, the violence of the car arguably constitutes something of a blind spot even within much of mobilities and transport scholarship" (p. 146). Automobiles are responsible for 1.35 million annual human deaths, along with being the leading cause of death of people five to 29 years of age and the rate of death being three times higher in low-income countries than high-income countries (World Health Organization, 2018). Beyond direct deaths, automobiles have altered land-use patterns in a way that reduces access to services and mobility for many people; creates pollution that harms health and contributes to the climate crisis; and creates a whole range of additional health problems (Culver, 2018; Paterson, 2000). Any changes made to the transportation system and urban environments should be directed at addressing its inequities and harms, which are primarily created by automobiles and auto-oriented development, not accepting

them as the price for modern society. Yet, too often, the futures popularized by powerful individuals do little to challenge the violence inherent in the system of automobility.

This paper will examine the transportation futures being put forward by some of the most powerful societal actors of the early twenty-first century: wealthy executives in the technology industry who use the billions of dollars they amassed through the monopolistic dominance of their companies over various sectors of the economy to extend their influence into domains where they have less expertise, but see the prospect of future profits and increased power. Keeping in mind the story of Omelas, this paper will make use of three frames of analysis — critical future studies, automobility realism, and mobility justice — to analyze two transport futures being presented by tech elites: fleets of 'flying' cars to escape the congested streets below, put forward by executives at Uber; and layers of underground tunnels to move cars through a congested city, as described by tech billionaire Elon Musk. In order to perform this analysis, I examined published interviews, promotional videos, social media posts, corporate documents and presentations, and media stories in which executives and stakeholders discuss these transportation and urban visions, along with books, peer-reviewed articles, and journalistic inquiries which assess the ideas and provide valuable context on how vulnerable groups could be affected. The analytic approach I took to these forms of media was informed by critical discourse analysis, with a focus on its multimodal form, which seeks to analyze how power is exerted through discourse and the larger social and power relations within which those discourses exist (Fairclough, 2001; Jancsary et al., 2016; O'Halloran, 2011). Finally, the specific aspects of power dynamics I chose to focus on were informed by the conceptual frame of the paper, which will be further detailed in following section, including the key questions of inquiry provided by

critical future studies which are applied to each of the future proposals in turn, before a final reflection on alternative ways to think about more inclusive and emancipatory futures.

4.1 Toward a critical approach to transport futures

The urban and transport futures elucidated by tech executives influence the way that many people, including executives in other industries, imagine the trajectory of urban development. In the present context of inadequate critical assessment and the lack of emancipatory alternatives to the status quo, the positive framing presented by those powerful individuals dominates the conversation, leaving the problems inherent in their visions largely unexplored. A critical analysis of tech executives' transport futures is essential to revealing the narrow, privileged perspectives which spawned them, having the effect of not addressing the harms that primarily affect low-income, racialized, and other vulnerable groups who lack the same privileges, the opportunities to critically imagine what their urban futures may look like, and access to media platforms on which to spread any such ideas to millions, if not billions, of people.

Often these visions of the future do not originate with the tech executives, but are rather inspired by science fiction they consumed throughout their lives. For example, Musk, who runs electric-car company Tesla and aerospace company SpaceX, read science fiction and fantasy novels throughout his life, with Douglas Adams' "The Hitchhiker's Guide to the Galaxy" being one of the most notable, and even tried to write his own in high school (Vance, 2015). Murtola (2018) writes that these wealthy individuals have "not only the wealth but also the technology and connections to singlehandedly make a significant impact on the world" (p. 1) meaning they can and do pursue their visions without government backing or democratic approval, but force them upon society without considering the full implications of their actions.

The power and narrow perspectives of these figures illustrate the need for a critical approach to their visions and the larger question of how people imagine the future, but the collective ability to imagine alternatives to the present has been constrained. Vint (2015) observes that

> We can imagine the future only as an intensification of the present: from one political orientation, a future of global capital and inequity continuing into infinity; from the other, a future of more and better shiny, technological products. Or we can imagine it as the site of apocalyptic collapse. (p. 7)

This is also a key observation of *capitalist realism*. Instead of holding infinite possibilities, Fisher (2009) argues that neoliberal capitalism and the collapse of the Soviet Union has effectively made Margaret Thatcher's assertion that 'there is no alternative' to the capitalist market economy a reality. Popular visions of the future involve an intensification of neoliberal capitalism and the expansion of technology into more areas of life, or complete societal collapse — no alternative where workers collectively determine their own destiny is considered realistic, or even broached as an option. "Corporations forcefully present visions of the future that serve themselves and their products," (Vint, 2015, p. 11) as is evident in the cases of tech executives whose futures conveniently also promote their own companies and products, but it is wrong to see their visions simply as propaganda or advertising. Rather, capitalist realism "is more like a pervasive atmosphere, conditioning not only the production of culture but also the regulation of work and education, and acting as a kind of invisible barrier constraining thought and action" (Fisher, 2009, p. 16). Tech executives promote futures which are premised on capitalist markets and technological progress, instead of political action, not solely because they seek to personally profit from them, but because their minds are subject to the same barriers — potentially even more than most because they benefit from the system— and the benefits they reap are a by-

product rather than a conscious effort (Barbrook & Cameron, 1995; Morozov, 2013). However, that does not mean that the futures they present do not merit critical assessment.

Taking inspiration from capitalist realism, *critical future studies* analyzes "the ways in which cultural texts not only *represent* the future, but also actively shape it by opening up or closing down imaginative possibilities" (Godhe & Goode, 2018, p. 151). It further "posits that the discourses we use to imagine the future are never neutral," but "are inextricably entwined with material forces (economics, institutions, violence, the biosphere and so forth)," which is why it is essential to "defamiliarize unquestioned, sedimented or 'common sense' discourses of the future, to shake them up in order to broaden the field of possibility" (Goode & Godhe, 2017, pp. 112–113). In order to facilitate that process, critical future studies offers a number of questions designed to aid in the deconstruction of visions of the future which centre questions of power, agency, implementation, the distribution of benefits, and the origins of the ideas within them (Goode & Godhe, 2017). This analysis will be guided, in particular, by considerations of the kind of futures that are evoked; who the futures are designed to benefit and who is imagined to be centred in them; the means through which the futures are to be implemented; an interrogation of the actors proposing and promoting the futures; and the potential impacts of the futures. In addition, critical future studies emphasizes the need to consider alternative futures which broaden the emancipatory possibilities of the future in a way that is not 'value-neutral' (Goode & Godhe, 2017), nor meant to simply be subsumed by capitalism to become little more than "styles, in fact *the* dominant styles, within the mainstream" (Fisher, 2009, p. 9). They must employ a "utopian impulse" to rekindle hope for the future within people who encounter such visions while equipping them with the tools to break free of the mental constraints that capitalist

realism places on their imaginations by "engender[ing] a sense of urgency and excitement" for a better world (Goode & Godhe, 2017, p. 127).

Critical future studies' relevance extends to visions for the future of the city, including those put forward by tech billionaires. Dobraszczyk (2019) criticizes the instrumentalism which dominates current thinking about the future of the city, "drawing on science-based predictions to map out possible scenarios and separating this empirical data from the rather more subjective predictions stemming from the creative imagination" (pp. 7–8), while Hall (2014) argues that the "the planning of cities merges almost imperceptibly into the problems of cities, and those into the economics and sociology and politics of cities, and those in turn into the entire socio-economic-political-cultural life of the time" (p. 5). As such, the empirical cannot be separated from the subjective; from the lived experience and the socio-economic effects of implemented 'solutions', but too often longer-term outcomes are not considered by elites dreaming up ideas for the future.

Dobraszczyk (2019) further asserts that the human imagination is a powerful tool, but to escape into the imaginary currently "carries a pejorative meaning of escape — of an unwillingness to accept the world as it is and a flight into fanciful worlds of make-believe; and with this, an association with immaturity and childishness," even though it "also carries with it a much more serious intent, namely to overturn and rewrite the rules of what the real actually is, or rather, how it is defined" (p. 9). It is the latter role that is key to breaking the mental shackles of capitalist realism and, as encouraged by critical future studies, to imagine alternative, emancipatory futures.

Capitalist realism restricts the ability of the working class to engage in the critical function of imagining alternative futures, instead producing future visions which are "only more of the present, more of the same capitalist values and sites of invisibility" (Vint, 2015, p. 12). As

such, the elite visions of the future which dominate the popular conversation do not challenge existing power structures and the inequities which result from them, but continue to reproduce them. Walker's (2017) concept of elite projection, which he defines as "the belief, among relatively fortunate and influential people, that what those people find convenient or attractive is good for the society as a whole" (para. 1), extends this reality into the realm of transportation. There is a long history of elites and innovators "regal[ing] us with exciting predictions of how life will be in the future," but their "predictions, even untestable ones or ones that nobody will care about later, are part of a cultural process for establishing authority," and the growth of the 'big data' industry "suffuses transportation debates as though it were a final authority, as though one could translate data into information without assumptions" (J. Walker, 2018, p. 119). Walker (2016, 2017) asserts that there are two problems with the approach of tech executives to transport futures: an overreliance on engineering and technology to solve problems that are inherently about geometry and limited space in dense urban centres, and a focus on solutions which serve powerful groups, but which they fail to realize will not work if utilized by a large segment of the urban population.

The problems identified by Walker are far from unique to the present moment. Hall (2014) observes that "twentieth-century city planning, as an intellectual and professional movement, essentially represents a reaction to the evils of the nineteenth-century city" (p. 7), with a focus on getting people out of dense urban environments through automobility, suburbanization, and other planning ideas which created their own problems. This had the effect of producing a system of automobility which "stemmed from the path-dependent pattern laid down from the end of the 19th century" (Urry, 2004, pp. 26–27) and revolved around the object of the automobile which contained within it discourses of individual consumption and the 'good

life', while tying into a larger industrial complex of social and technical relationships and having a profound effect on resource consumption. Gorz (1973/2018) called the automobile "a luxury good" (p. 1) which "effects an absolute triumph of bourgeois ideology on the level of daily life. It gives and supports in everyone the illusion that each individual can seek his or her own benefit at the expense of everyone else" (para. 4). The initial promise of the automobile for the wealthy individuals who could afford one was to be able to go faster than other road users, but when that privilege was democratized, allowing the working class to buy automobiles for themselves, the benefit was diluted, "[f]or when everyone claims the right to drive at the privileged speed of the bourgeoisie, everything comes to a halt, and the speed of city traffic plummets […] to below that of the horsecar" (para. 11).

The problems created by automobiles and cities designed around them go beyond getting stuck in traffic, as described in the introduction. Yet, while the solutions presented by executives in the tech industry can be seen as a response to the problems created by the planning initiatives of the twentieth century, they fail to effectively challenge automobility and respond only to the problems which affect them most directly, meaning they focus on traffic. Reflecting capitalist realism, the system of automobility serves to create its own "literal 'iron cage' of modernity, motorized, moving and domestic" (Urry, 2004, p. 28), which I have termed *automobility realism*. Elite visions of transportation are trapped within automobility and only produce futures which rely on tweaks of the auto-dominated present, failing to present a radical approach which gets to the root causes of its harms and inequities. In their futures, "[t]echnology's benefits are idealized, its applications are universalized, and it becomes detached from its constitutive social and power relations" (León & Rosen, 2020, p. 500). Critical perspectives are necessary to illuminate the

flaws in their futures and elevate alternative visions which take a more discerning approach and centre vulnerable groups, not those with the most privilege.

Mobility justice provides a crucial lens through which to reorient the perspective of mobilities research and think about who is served by ideas for the future of transportation. The Untokening Collective (2017), which originated the concept, explains that mobility justice

> demands that we fully excavate, recognize, and reconcile the historical and current injustices experienced by communities — with impacted communities given space and resources to envision and implement planning models and political advocacy on streets and mobility that actively work to address historical and current injustices experienced by communities. (p. 4)

Just as Dobraszczyk (2019) recognizes that the changes made to cities will affect everyone in the future, and the urban poor most of all, mobility justice is an effort to recentre the focus of urban development and change from those with the most power to the most vulnerable groups, who are so often excluded from decision-making processes or are forced to conform to processes which are not designed to accommodate or include them (Untokening Collective, 2017). Sheller (2018) is explicit about which groups often make decisions about mobility and what effect that has on the narrow range of experiences that are considered in planning decisions.

> White, able-bodied, middle-class, male experts and technicians dominate transport policy and urban transit agencies, hence policy, planning, and design often overlooks women's, children's, disabled people's, and poor people's perspectives, experiences, and needs, or see them as irrelevant to the sector. Likewise, there is little racial analysis of differential or uneven mobilities, and only a slight awareness of the impairment or exclusion of the differently abled, and almost no thought, until recently, to the mobility of queer and transgender people. And very seldom are these exclusions and impairments to mobility placed in the context of longer and often violent histories of patriarchy, racial domination, colonialism, sexism, and ableism as the foundations of "liberal" civil societies. (p. 46)

As this passage illustrates, most perspectives are excluded from determining the form and future of urban space and transport systems in cities, but that must change if cities are to become more just and rectify the harms that they not only depend on, but have normalized for much of the urban population.

The futures being considered in this paper have not been developed by vulnerable urban populations, but by privileged individuals who receive significant attention by media and policymakers. Their visions for cities which integrate flying cars and underground tunnels for cars into their transportation networks, along with their statements about the effects of those systems on the city and its residents, will be critically analyzed through the lenses of critical future studies and the questions it provides; automobility realism to determine the degree to which the futures are trapped within automobility; and mobility justice to examine who is expected to benefit and whether the harms of automobility are addressed.

4.2 The congested city of flying cars

The first design for a flying car dates to 1841, when William Samuel Henson and John Stringfellow patented their design for an aerial stream carriage that was never built (Patches, 2015). Their initial idea was followed by many more attempts over the following 179 years, most of which never made it off the ground (Bonsor, 2000), and with frequent predictions that humans would be flying in the not-so-distant future. The first *Popular Science* article about flying cars, published in July 1924, was headlined "Flying Autos in 20 Years" (Colburn, 2013), a prediction which clearly did not come to pass, but that has not stopped people from making similarly outlandish predictions in the present, including a 2018 article in *The Guardian* declaring, "[i]t's probably a matter of when, not if, road-based travel becomes obsolete" (D. Hall, 2018, para. 20). Dobraszczyk (2019) recalls how visionaries of the past imagined people not simply taking to the skies to get from place to place, but building entire cities among the clouds, yet after all these years humans remain quite firmly planted on the surface of planet Earth, with the exception of the occasional long-distance flight. These examples support Vint's (2015) assertion that visions of the future should not be seen as predictions, but as extensions of the present. In the realm of

flying cars, the best example of this may be *The Jetsons*, the Hanna-Barbera cartoon which premiered in 1962 depicting a futuristic world of flying cars and a city elevated on posts high into the sky, but where gender relations had not progressed beyond the 1960s, with Judy Jetson financially dependent on her husband George and a feminized android named Rosie doing the housework (Perea, 2018; Schwartzman, 1999). However, these realities have not stopped a new wave of executives at technology and aerospace companies from imagining a new future of ubiquitous flying cars poised to roll out in the very near future.

The new vision of the 'flying car' is not so much a car's body with wings or propulsion, as it has often appeared in visions from the past and science fiction, but more closely resembles a helicopter with horizontal propellers, along with the prospect of being powered by an electric motor and autonomously driven in the future (Uber Technologies, 2016). Many companies are working on these electric vertical takeoff and landing vehicles (eVTOL), among them Airbus, Boeing, EHang, and Volocopter (Aurora Flight Sciences, n.d.; Balakrishnan et al., 2018; Boelens, 2019; Xu, 2020), but the company that has arguably received the most attention for promoting the concept is Uber, best known for its ride-hailing service that has had an undeniable impact on global urban mobility since it began operating in 2009 and which envisions partnering with some of the aforementioned companies to provide the eVTOLs for its future service (Uber Technologies, 2019a). As such, this section will primarily focus on Uber's vision for a transportation system and urban environment making use of eVTOLs.

Uber has stated that it plans to begin operating Uber Air, its on-demand eVTOL service, in 2023 (Uber Technologies, n.d.-a). The primary argument made for Uber's 'flying cars' is the need to address traffic congestion on roads (Uber Technologies, 2016, 2019a), which its executives assert should be done by adding a 'third dimension' to transportation because "the

transportation grid […] is in two dimensions, its cities live in three dimensions, and when we live in three dimensions we have to take our transportation into three dimensions as well" (Uber Technologies, 2019a, 2:55), reflecting statements by Musk (2017), whose ideas will be discussed in the following section. Yet these statements about three-dimensionality ignore existing urban transportation which would fit in this category — underground subway, metro, and rail systems — and move far more people in a spatially efficient manner than automobiles or eVTOLs will ever manage to achieve (National Association of City Transportation Officials, 2016), despite the company's claim that it desires to make cities "smarter, better, more efficient places to live and to work" (Uber Technologies, 2019a, 0:15). It would seem that investment in more spatially efficient modes of transportation — public transit and cycling — would better meet that goal, but that is not what Uber is proposing.

In a promotional video released for the Uber Air service (Uber Technologies, 2017), a woman enters what appears to be an apartment building or office tower, then boards a vertical takeoff and landing vehicle (VTOL) — it is not clear whether it is electric — with three other passengers and a pilot. During her journey, she looks down on an urban intersection and highway with bumper-to-bumper traffic — the illustration of the congestion she has escaped by taking a flying car — before arriving at a low-rise, suburban hub where an autonomously driven Uber sport-utility vehicle is parked outside, ready to shuttle her to a suburban home where her child runs to greet her. Uber is presenting an appealing vision, but watching it through a critical lens reveals the problems and inequities within such a future.

As previously cited, addressing congestion is core to Uber's argument for the necessity of Uber Air and eVTOLs, and it takes a prominent place in the promotional video. Yet, the focus on congestion ignores the role that ride-hailing services, particularly those operated by Uber, have

played in making congestion worse in urban centres (Erhardt et al., 2019; San Francisco County Transportation Authority, 2017; Schaller, 2017, 2018) and taking rides from more efficient modes of transportation, most notably public transit (Clewlow & Mishra, 2017; Gehrke et al., 2018; Graehler et al., 2019). Uber is responding to a problem it helped to create, and even the video suggests flying cars will not solve it since it remains present; the service will just give some people the option of escape. Instead, restricting ride-hailing services may help to address the congestion problem without the need for eVTOLs.

Uber executives also claim its Uber Air service will be accessible to a wide variety of customers, including groups that are traditionally underserved by transportation services. Justin Erlich, the Head of Policy of Autonomous Vehicles and Urban Aviation at Uber, has stated that Uber Elevate, the division of the company developing Uber Air, will be "thinking about what this looks like for making things wheelchair accessible" and the need to be "thoughtful long-term about where the routings are to make sure that we're serving underserved communities in transit, and to make sure that this technology is made available to everybody" (Dickey, 2018, para. 29). The company has further claimed that eVTOLs "will be an *affordable* form of daily transportation for the masses, even less expensive than owning a car" (Uber Technologies, 2016, p. 3). These statements appear positive, but Uber's former CEO Travis Kalanick claimed the company's ride-hailing service would be similarly equitable (Salesforce, 2015), only to have its users be disproportionately young, college-educated, urban, and earning incomes of more than US$75,000 in major U.S. cities or C$100,000 in Toronto (Clewlow & Mishra, 2017; Gehrke et al., 2018; Young & Farber, 2019). Uber's ride-hailing service has also failed to equitably serve residents in wheelchairs, with its lawyers arguing it does not have to abide by the Americans with Disabilities Act, causing customers in wheelchairs to experience much longer waits than

users of its service for the general public, if they can find a driver at all (New York Lawyers For The Public Interest, 2018; Reed, 2017). Further, Uber's ride-hailing service is considered to be relatively affordable, despite its users being disproportionately higher income, but that is only possible because it severely restricts the wages of drivers and subsidizes the cost of the service with venture capital — neither of which are sustainable in the long term (Horan, 2017). Given these realities, it is difficult to accept Uber's claims that its eVTOL service will be equitable when its ride-hailing service has not proven to be, despite similar claims.

Based on the images and videos Uber has released to promote and demonstrate how Uber Air would work, it is abundantly clear that the concept is rooted in an auto-oriented transportation system, does not fundamentally challenge it, and instead offers an option to escape traffic congestion by flying above it — an option that will likely only be available to higher income residents, despite Uber executives' claims to the contrary. The Uber Air promotional video demonstrates this by depicting the transportation environment from which the featured woman is escaping — not a subway or bus, but car traffic on the roads and highways — and having her depart from what appears to be a suburban apartment building and arrive in an even lower density suburban area (Uber Technologies, 2017). The auto-oriented, suburban environment is repeated in the concept photos for Uber Air's proposed Skyports, the dedicated hubs from which eVTOLs would arrive and depart.

A series of sixteen Skyport concepts were featured on the Uber Air website (Uber Technologies, n.d.-b), with the original seven images were removed in early 2020 and replaced with a new set of nine images. Of the sixteen photos, there were only two which showed different angles of the same concept, leaving fifteen unique designs with two each designed by the Beck Group, BOKA Powell, Corgan, Humphreys & Partners Architects, and a partnership

between Pickard Chilton and ARUP; and one each designed by Gannett Fleming, Gensler, Mithun, SHoP Architects, and Uber itself. The fifteen concepts are clearly designed to stand out from the buildings around them as large structures with distinct forms, but only two of the concepts (from the Beck Group and Corgan) appear to be located in urban areas. Yet even then, the urban Skyports are surrounded by large roads with no visible transit, and the Corgan design even has an elevated highway running through it. There are three additional concepts (by the Beck Group, Mithun, and Uber) which clearly show an urban agglomeration of skyscrapers in the distance, but are themselves located in low- to medium-density areas and, again, show no indication of transit use.

Six of the fifteen concepts feature large highways, with the Skyports sitting directly on top of them in four of the images. Eight appear to be located in suburban office parks or low-rise suburban communities, while two others appear to be in medium-density, mixed-use areas. Another two are pictured at angles where their surroundings are not clear, with a final concept surrounded by large tracts of asphalt and possibly located near an airport. Ten of the concepts clearly show pedestrians arriving at the Skyports on foot, but in many cases it is not clear where the pedestrians would be arriving from unless they walked a long distance, as many of the Skyports have few buildings in their direct vicinity given their suburban surroundings. Only three of the concepts include public transportation: one by Gensler showing two buses, though it is not clear whether they are city or intercity buses, and two designed by Humphreys & Partners Architects. In the earlier of the two concepts, there are small buses in front of the Skyport (which may be from Uber Bus, rather than transit) and tubes for rail or Hyperloop coming out of the side, while the building itself sits astride a large highway with elevated roads on every side of it, making it seem infeasible to run so much transit in a low-density area. In the later concept, the

Skyport is still in a low-density area with buildings separated by some distance, but there are Uber-owned Jump bikes and scooters in front of the Skyport, along with a green cycle lane; a branded drop-off area for Uber Bus (but no public buses); and a light-rail or streetcar system on the opposite side of a four-lane street. Again, the urban form does not suggest the active or public transport services would see very much use. Four other concepts (by the Beck Group, Corgan, Gannett Fleming, and Uber) show Uber's Jump bikes and/or scooters. Finally, most of the concepts are designed to serve the dual purpose of Uber Air Skyport and parking garage, making the auto-orientation of these structures clear.

Uber ultimately controls the Uber Air project and defines what users and other companies are to expect from the service. It is for this reason that the analysis focuses on the Skyport concepts featured by Uber, not every possible concept that has ever been created: the goal is to understand how Uber is positioning the service, and it is clear the company is prioritizing automobiles, not seeking to displace them. This is clear even in earlier representations. The image on the cover of Uber Elevate's white paper is a concept drawing of a dedicated eVTOL area on the top of a parking garage which appears to be in another suburban office park (Uber Technologies, 2016), reflecting how many Silicon Valley companies have retained suburban campuses instead of moving into urban locations (Heathcote, 2017). Other companies working on eVTOLs and on-demand eVTOL services are not so focused on suburban environments. Airbus' conceptual photos for its eVTOLs are exclusively urban and tend to focus on the eVTOLs, not how they connect to street-level or underground mobility options (Airbus, 2019; Balakrishnan et al., 2018), and EHang's conceptual photos are also primarily urban, but there is a futuristic concept that features a large, elevated highway weaving between skyscrapers and some images with eVTOLs above natural areas to promote an application for tourism (Xu, 2020).

In 2019, Uber launched Uber Copter, a helicopter service between Manhattan and John F. Kennedy International Airport in New York City that was positioned as "the first step toward building the future of urban air mobility and transforming urban aviation" (Uber Technologies, 2019b, para. 1). The Manhattan side of the service is clearly urban, yet it is oriented around Uber's ride-hailing service, providing a vehicle to drive the user to the heliport or their final destination after they have arrived in Manhattan. Multimodality is also an aspect of its future Uber Air eVTOL service, but the mode will need to be available in the Uber app, and the company admits that even cities like Los Angeles will "see a larger share of multi-modal itineraries containing automobile legs, rather than walking" (Uber Technologies, 2016, p. 62). When journalists tested Uber Copter against New York City's transit system, one group found transit got them to the airport three minutes faster at a fraction of the price (Rosner et al., 2019), while another group found Uber Copter was 14 minutes faster, but given that it cost US$213.07 more than transit, it would not be worth it for the vast majority of travellers (Parisi, 2019).

There has been little focus on how the limited number of areas for takeoff and landing will restrict the service's operations and how an expansion of urban air travel would require a more robust system of air traffic control at lower altitudes (Kleinbekman et al., 2018), especially if there are drones having to navigate that space as well. Battery-powered eVTOLs also may not be able to feasibly provide frequent urban journeys of more than a few minutes, as the energy density of batteries is much lower than liquid hydrocarbons, significantly limiting their range (Rez, 2018). Finally, there is the very basic consideration of how residents will respond to having more air traffic at lower altitudes in the skies above their homes and workplaces, especially after an inevitable drone or VTOL crash. As Musk (2017) has stated, while defending tunnels as the superior form of three-dimensional transportation, "if there are a whole bunch of flying cars

going all over the place, that is not an anxiety-reducing situation. […] You're thinking, 'Did they service their hubcap, or is it going to come down and guillotine me?'" (6:20).

As this analysis demonstrates, when companies considering what the transportation system around eVTOLs looks like, there is a clear bias in favor of the auto-oriented status quo, extending it into the future instead of critically assessing whether continuing to depend so exclusively on automobiles is 'smart' or 'efficient', to restate Uber's own goals. These proposals for flying cars make use of language that is designed to make people believe they will serve *everyone*, but the reality is that they will perpetuate the system of automobility and expand it into the skies by 'going three-dimensional' while continuing to privilege the powerful individuals who dream up these kinds of projects, not the urban residents who are most financially stressed by transportation and have the least access to swift, efficient mobility. The eVTOL solution was developed in response to traffic congestion, yet fails to address the root of the problem — the proliferation of automobiles — and the existing ride-hailing solution that has exacerbated it. It is a demonstration of tech executives' inability to imagine a transportation system beyond automobility and develop solutions that truly address the problems of the existing system, which is further reflected in the industry's other 'three-dimensional transportation' idea: car tunnels.

4.3 The sprawling city of tunnels

Underground tunnels for transportation are not new; they have been used for rail since the opening of the Metropolitan Railway in London in 1863 (Transport for London, n.d.), and have also been built to serve pedestrians, cyclists, and automobiles (Port Authority of New York and New Jersey, n.d.; Van Mead, 2019). However, the latest vision of tunnels for transportation put forward by Musk amounts to a significant expansion in the scale of tunnels' role in urban transportation, with an initial desire for 10 to 30 layers of tunnels beneath the streets of Los

Angeles (Marshall, 2017a), which grew to up to 100 or even unlimited layers in later statements, for a system called the Loop to be used by automobiles and constructed by the Boring Company (Swisher, 2018; The Boring Company, 2018b). As with that of a city filled with flying cars, Musk displays a notable inability to think beyond automobile dominance and see the constraints that exist to serving the entire population, while presenting a potential exclusionary future when the tunnels are considered in conjunction with his broader vision of the future.

There are notable overlaps between the justifications used for Musk's car tunnels and Uber's flying cars. Musk similarly argues that transportation must be three-dimensional, saying,

> the inherent problem with the way cities are constructed is that you've got all these tall buildings that are in 3D and then a road network in 2D, and then everyone wants to go in and out of the 3D building at the same time. Necessarily, this will result in traffic. […] You have to make transport 3D. (The Boring Company, 2018b, 6:18)

Musk and the Boring Company go even further to make the point that tunnels are about solving traffic above all else, calling it "soul-destroying" in statements and on the company website, "acid on the soul," and expressing how traffic in Los Angeles, where Musk resides, has gone from "seventh level of hell to like eighth level of hell" (The Boring Company, n.d.-d, para. 1, 2018b, 5:15). These statements indicate that the focus on traffic congestion takes precedence over other problems with automobility because it is the one that affects Musk most as he drives around Los Angeles, in addition to an ignorance about urban space, which is best summed up by Walker (2018): "Cities, by definition, are places where space is scarce" (p. 121). It is accurate for Musk to say that a lot of people coming out of a 'three-dimensional' building into a 'two-dimensional' street will cause congestion, but it is not just congestion of automobiles, the least space-efficient transport mode; the sidewalks also become congested, as do buses which transport people much more efficiently, and even the existing three-dimensional transportation — subway and metro systems. However, in arguing for congestion-free tunnels, Musk repeats a

problem that has afflicted planning of roads and highways for decades, where projects are planned for usage at peak times, but have continually failed to reduce traffic congestion (J. Walker, 2012). Despite decades of road and highway expansions to alleviate peak-time congestion, a growing body of research has found that adding more lanes and road space simply induces more vehicle kilometres of travel which "often dampen the ability of capacity expansion projects to relieve congestion and thereby generate higher levels of emissions" (Milam et al., 2017, p. 15). Musk (2019b) disputes the existence of induced demand, calling it "one of the most irrational theories I've ever heard," but has provided no evidence to refute the academic research which proves its existence. Given that Musk's statements were made before Uber's, it is possible that his justification was adopted by Uber executives to argue for flying cars.

If Musk was trying to move *people* instead of *cars* more efficiently, he may instead focus on transit, but he has a confusing history of statements on non-automotive transport modes. In 2017, he stated that transit "sucks," is "painful," and "a pain in the ass" where "there's like a bunch of random strangers, one of who might be a serial killer" (Marshall, 2017b, paras. 5–6); and also later said the electric kick scooter, which was rising in popularity at the time, "lacks dignity" (Swisher, 2018, 1:15:00). Instead, Musk favors "individualized transport, that goes where you want, when you want" (Marshall, 2017b, para. 6), and says the Boring Company will "increase the happiness of both drivers and mass transit users by reducing traffic and creating an efficient and affordable public transportation system" (para. 9) — referring to the Boring Company's Loop system, not publicly owned underground trains. In 2018, Musk seemed to have changed his view, stating, "we're not opposed to mass transit; mass transit is fine. Let's try every solution possible, but the thing about tunnels is that you can go 3D underground" (The Boring Company, 2018b, 6:07) — a statement which seems to, again, ignore the existence of subway

and metro systems. The latter comments came after criticism of Musk's auto-oriented tunnel concept. In his initial vision, cars would enter the tunnels by driving onto elevators installed under on-street parking spots, from which they would be deposited on moving platforms called 'skates' that would accelerate to 200 kilometers (130 miles) per hour until arriving at their destination and sending the car back to the surface on another elevator (Musk, 2017, 2018b). The earliest conceptual video released by the Boring Company (2017) shows a Tesla Model S — a vehicle produced by another of Musk's companies — driving on a congested road with on-street parking on one side and a series of on-street elevators for the Boring Company's tunnels on the other side. The Tesla vehicle effortlessly drives onto one of the platforms, which descends into the network of tunnels below with no indication of how the hole in the street is covered to ensure another vehicle, cyclist, or pedestrian does not fall in or how the passenger pays for the ride.

As the Boring Company began to build a test tunnel and faced public criticism for its auto-orientation, Musk's statements about the project began to change. Notably, in response to criticism about priority being given to cars, Musk (2018a) placed greater emphasis on the skates that would hold up to eight to 16 pedestrians or cyclists, and promised they would be given priority over the skates transporting cars. In order to demonstrate this commitment, the Boring Company (2018a) released a new conceptual video which showed a dedicated boarding platform on a sidewalk at Los Angeles International Airport where pedestrians could board a skate that appears to have the base of the car covered in white plastic with a glass enclosure to protect the pedestrians while they are in the tunnels, and there is a mix of cars and pedestrian skates in the tunnels. However, in both videos (The Boring Company, 2017, 2018a) the tunnels are presented as highways on a black background — all of the earth, other underground infrastructure, and the tunnel itself is removed to make them appear as unobstructed roads moving cars and pedestrian

on skates which move swiftly and efficiently to their final destinations. The representation should be seen as an expression of automobility ideology and the achievement of the unachievable, as became evident when Musk's vision collided with reality.

Months after the release of the video and statements about pedestrian priority, Musk showed off a prototype tunnel and announced the plan had changed once again: no longer would there be skates, for cars or pedestrians; rather the tunnels would be for autonomous, electric vehicles requiring "deployable guidewheels so that it braces itself against the side of the tunnel" with ten to twenty times more stations than a subway, and exit ramps in addition to the on-street elevators (The Boring Company, 2018a, 17:48). Instead of pedestrian skates, there would be "continuous operating cars in the Loop for those that do not have a car," with the priority for pedestrians and cyclists continuing (The Boring Company, 2018a, 23:25). However, these changes and the tunnel that Musk showed off present further problems with his vision for a tunnel-based automobile transportation system. First, the prototype tunnel was described as "so uneven in places that it felt like riding on a dirt road" with a top speed of 85 kilometres (53 miles) per hour (Nelson, 2018, para. 5). Musk addressed these issues, saying the company needed to get a "better paver," after which the surface would be "smooth as glass," and that they had reached speeds of 177 kilometres (110 miles) per hour in tests, but it is "a little scary right now" because of the construction issues (The Boring Company, 2018a, 4:30). While Musk promises the paving problem will be fixed, it does lead one to wonder why he showed it off to media and held an event before that was done, generating bad press. Second, while Musk asserts the tunnels will be for any automakers producing autonomous, electric vehicles, that requirement is inherently limiting, especially when vehicles also need to have specially designed deployable guidewheels installed. Despite the assertions, such requirements make it seem as though vehicles

from Tesla will have privileged access, adding a further incentive to buy vehicles produced by another of Musk's companies, which presents an equity problem if the tunnels are supposed to serve everyone, as Musk has suggested. Third, the pedestrian skates were already very limited, holding up to 16 passengers, but using Tesla vehicles to transport pedestrians and cyclists further limits the system's capacity, making it even less space-efficient. These concerns are further supported by additional changes that were made in real-world projects the company is trying to build. In Las Vegas, where the Boring Company has been contracted to build a 1.3-kilometre (0.83-mile) tunnel, even the ledges and guidewheels are gone and the tunnels are nothing more than roads for autonomously driven Tesla vehicles (A. Walker, 2020). Meanwhile, a proposed Boring Company project to connect Washington, D.C. to Baltimore with a dedicated tunnel was found to have a potential ridership of only 1,000 vehicles per day in each direction (U.S. Department of Transportation, 2019). After these changes were made, the company began to emphasize photos and videos of a Tesla Model X sport-utility vehicle in its test tunnel with various colours of mood lighting instead of Tesla Model S cars or pedestrian skates (The Boring Company, n.d.-e, 2018c), further emphasizing the automotive orientation of the project.

Another of the primary issues with the Loop is how much it will cost both to build and to use, which has important implications for equity. Musk incorrectly stated that subway tunnels "can cost up to $1 billion per mile" (The Boring Company, 2018b, 9:00), including examples from Los Angeles and New York City which he states were more than $2 billion per mile, but those numbers seem to conflate the cost of tunnelling with the entire project cost. For example, Phase I of the Second Avenue Subway in New York City had a total project cost of US$4.6 billion, which included about 2.5 kilometres (1.6 miles) of tunnel, but the tunnelling only accounted for US$415 million of the project cost and laying the track, signals, power, and

communications systems was another US$373 million (Metropolitan Transportation Authority, 2019). New York City's East Side Access project has been more expensive, currently budgeted at US$11.1 billion with expected completion in 2022 (Metropolitan Transportation Authority, 2019), but its high costs are an exception, not the norm, with the cost of tunnels amounting to over US$800 million in Queens due in part to a lack of coordination between agencies (Metropolitan Transportation Authority, 2014, 2018) and just over $405 million in Manhattan (Metropolitan Transportation Authority, 2013). The total high cost of these projects is much more complicated than tunnelling, with expensive stations, the high cost of union labour, inefficient contracting, and excessive spending on preliminary design and planning work cited as factors (Gelinas, 2015; Levy, 2018; Rosenthal, 2017). American transport authorities are already trying to address some of cost factors, and jurisdictions around the world have already achieved per-mile tunnelling costs close to what Musk has promised his technological fixes can achieve (Levy, 2017; The Boring Company, 2018b). Musk has also provided no commitments to using union labour and has a history of fighting unionization by workers at Tesla (Campbell, 2019).

Further, the cost to the passenger is unclear. Musk has stated that his Los Angeles project would be able to cover its costs through the sale of bricks made with the soil from tunnel boring (The Boring Company, 2018b), yet other projects do have a price per use. The proposed "Dugout Loop" to connect Dodger Stadium in Los Angeles to the Metro Red Line subway is said to have a fare of around US$1, but is not finalized (The Boring Company, n.d.-c, para. 18); the "Chicago Express Loop" project to connect downtown Chicago to O'Hare Airport is to have a fare "less than half the typical price of taxi/ride-share services, though higher than the Blue Line" (The Boring Company, n.d.-a, para. 15), which media reports clarified would be an "estimated cost of $20 to $25 per ride" (Ruthhart & Byrne, 2018, para. 6); and the proposed tunnel linking

Washington, D.C. and Baltimore would have a fare "comparable to or lower than current public transportation fares" (The Boring Company, n.d.-b, para. 38). However, it can be difficult to trust Musk's figures, as he has a history of overpromising and underdelivering (Rapier et al., 2019). For example, experts were critical of the projected construction costs for the Chicago Loop project, arguing they were far too low, particularly for the non-tunnel aspects such as vehicles and stations, which were shown in concept art to be quite large (and presumably costly to build) with all the vehicles in a single room with very high ceilings (Bliss, 2018; Hawkins, 2018; The Boring Company, n.d.-a). The potential ridership was also low at "nearly 2,000 passengers per direction per hour, with cars leaving every 30 seconds to two minutes" (Ruthhart & Byrne, 2018, para. 30), which is 60% of the existing Blue Line's under-capacity subway line (Bliss, 2018), but that was while Musk was still promising 16-person skates, not five-passenger Tesla vehicles, which would presumably have decreased ridership had the project not been cancelled.

Critical analyses of the Loop's constitutive parts and various permutations illustrate a range of problems and equity concerns, but it must also be considered as a cohesive whole fitting within a particular vision of the future put forward by Musk. One of the most telling statements Musk has made about the Loop system is that,

> you can weave the Boring system tunnel network into the fabric of the city without changing the character of the city. The city will still feel the same; you're not going to get in anyone's way; you're not going to obstruct anyone's view […] You will have this revolutionary transport system and your city will still feel like your city. (The Boring Company, 2018b, 8:15)

These arguments closely mirror the language used by groups opposing denser urban development in California, often referred to as not-in-my-backyard or NIMBY organizations (Badger, 2018), which aligns with Musk's larger vision for a green future: not one of dense, walkable communities, but a continuation of suburban sprawl where gas- and diesel-powered vehicles are replaced with battery-powered alternatives, ideally built by Tesla, and where

suburban homes add solar roofs and battery storage (Tesla, n.d.-b). However, the potential future could be even more exclusionary. Musk's first planned tunnel in Los Angeles would run from a location near his five Bel-Air mansions to another location close to SpaceX headquarters (Anzilotti, 2017) — the fact it runs from Musk's home to his place of work likely not being a coincidence, given his motivation for the project is to personally escape traffic. This reflects an argument by Sheller (2018) that the ability of some people to 'speed' past in automobiles while others are forced to wait for infrequent buses that take much longer to get to the same destination is, in itself, an expression of power, which is made worse by policies and infrastructures, such as rush-hour road pricing, which provide privileged access to the city centre for 'kinetic elites'. Despite Musk's claims of pedestrian priority, his auto-oriented Loop system seems likely to overwhelmingly, if not exclusively, serve drivers, and the unclear price of use could easily rise to a level that makes it an underground road system exclusively for those 'kinetic elites', who Sheller (2018) notes are often white and male, to use to evade the traffic that the majority of residents are subject to. There is also a more dystopian future scenario where, due to a popular revolt over inequality or the growing effects of climate change, wealthy individuals try to further seal themselves off from the rest of society, using the tunnels to minimize their time on the surface when travelling between their gated enclaves, which could be powered by renewable energies in a form of "resource-intensive solar separatism for the rich and the geographically lucky" (Aronoff et al., 2019, p. 108). Such a pessimistic interpretation of Musk's may appear extreme, but considered alongside the most recent vehicle announced by Tesla, the Cybertruck inspired by the dystopian, cyberpunk world of *Blade Runner* with bulletproof glass and a body that is unable to be dented by a sledgehammer (Musk, 2019a; Tesla, n.d.-a), the dystopian

possibility seems more probable. The Cybertruck would be the ideal vehicle for periods of driving beyond the elites' gated communities and before arriving at their exclusive tunnels.

As this analysis should make clear, Musk's vision of ubiquitous urban tunnels is not designed to address the harms and problems of automobility, outside the issue of congestion which affects him personally. His vision does not comprise denser urban environments oriented around people and more efficient transport modes than automobiles, but rather perpetuates a sprawled urban form dominated by automobiles with new underground roads to allow some residents to evade congestion. Despite Musk's assertions to the contrary, his Loop system does not truly appear to be designed for *everyone*, but rather privileges owners of Tesla vehicles, who are disproportionately old, male homeowners with high incomes (Hedges & Company, 2018). As illustrated, his vision presents the potential for an even more dystopian urban environment in a longer-term future because it allows high-income members of society to further separate themselves from low- and middle-income residents and the harms created by the existing transportation system and urban form which afflict vulnerable populations.

4.4 The need for alternative future perspectives

In the same year as Le Guin wrote the parable of Omelas, Gorz (1973/2018) wrote a polemic against the 'social ideology of the motorcar', in which he made a prescient observation that remains relevant nearly 50 years later.

> The car has made the big city uninhabitable. It has made it stinking, noisy, suffocating, dusty, so congested that nobody wants to go out in the evening anymore. Thus, since cars have killed the city, we need faster cars to escape on superhighways to suburbs that are even farther away. What an impeccable circular argument: give us more cars so that we can escape the destruction caused by cars (para. 17).

It is impossible not to see how the purportedly futuristic visions of Uber executives and Musk fit within the narrow, path-dependent frame of thought outlined and criticized by Gorz. These elite executives from the tech industry are not uncomfortable with the harms produced by

automobiles, as their focus on one of the least socially harmful aspects of automobility — traffic congestion — does not go so far as to address the root of issue — automobiles themselves — but rather treats the problem as though it can be solved with more automobiles, either underground or in the sky, demonstrating the outcome of a thought process constrained by automobility realism. There is no future of democratized automobility that does not produce harmful spatial environments; such impacts are an integral part of an auto-dependent transport system. Even though Uber's executives and Musk have made assertions to the contrary, flying cars and car tunnels are not solutions for everyone; as Gorz (1973/2018) argued about automobiles, they are "luxury goods invented for the exclusive pleasure of a very rich minority, and which in conception and nature were never intended for the people" and are "only desirable and useful insofar as the masses don't have one" (para. 1) — or, in this case, access to them.

Reflecting the science-fiction aspect of critical future studies, the fiction consumed by these executives has not allowed them to see beyond their privileged perspectives and the system of automobility whose harms they are disproportionately less vulnerable to. Recalling what Hall (2014) has written about the connection between the social and the material and Dobraszczyk's (2019) argument about the power of the imagination to break the mental chains of existing socioeconomic systems to imagine more emancipatory alternatives that address their harms and inequities, Le Guin (2004) furthers these arguments in writing that "[t]he exercise of imagination is dangerous to those who profit from the way things are because it has the power to show that the way things are is not permanent, not universal, not necessary" (p. 219). Emancipatory fiction must challenge structures of power, since "[w]e cannot demand that anyone try to attain justice and freedom who has not had a chance to imagine them as attainable" (p. 220).

Considering Le Guin's (2004) argument, it becomes clear how constraining the imaginations of the masses through capitalist and automobility realism serves the powerful, and how the transport futures that they imagine do not question the "ubiquity and necessity of extant institutions" (pp. 219–220) like automobility, but rather seek to extend them, along with their own power and dominance. Thinking through this lens, it can be observed how the children of Omelas, despite being repulsed at the initial thought of the child in the basement, slowly become accustomed to its suffering and accept the ruling ideology that says the good life of Omelas' residents not just depends on it, but that the child, even if freed, would desire a return to its suffering and exclusion. It can be compared to how the harms of automobility become normalized within auto-oriented societies, and that normalization is evident in the ideas presented by powerful individuals which do not to address the harms and inequities of the system, and could even make them worse. These executives accept the 'child in the basement' of automobility because they personally benefit from its perpetuation, both because of the profit they derive from it and the privileged place they have within such a system of mobility. But executives are not the only ones who struggle to imagine an alternative, given that automobiles have become a mass product and the urban form has been altered (Falcocchio & Levinson, 2015; Gartman, 2004), over the course of decades, to make people rely on automobiles and have a difficult time conceiving of different ways of getting around and constructing communities. Yet critical imagining of the future of transportation, and the kind of societies that those transport systems will both enable and be part of, must prioritize justice and freedom for the whole of the urban population and wider society (Sheller, 2018; Untokening Collective, 2017; J. Walker, 2018), not just preserving what Gorz (1973/2018) called "bourgeois privilege" (para. 11). Le

Guin's writings and fiction provide a starting point to consider the moral implications of modern societies and built environments, and what that emancipatory future might look like.

In arguing for a 'carrier bag theory of fiction', Le Guin (1986/1989) explains that shaping narratives around a singular forceful hero rather than the more complex reality of human societies leads to a misunderstanding of human nature which privileges masculine traits over feminine and focuses on dominance and conflict rather than collaboration and sharing. This problem is not only found in history and stories, but in cities. Western cities were built by and for able-bodied men, privileging the speed of the individual in their automobile over the well-being and freedom of the many with communal solutions to mobility and other aspects of urban life (Sheller, 2018). It should come as no surprise that Le Guin's fiction makes a similar observation.

In "Omelas," people are imagined as using high-quality trains and trams for longer travel distances, not automobiles, in what is positioned as a perfect society with the exception of the child in the basement (Le Guin, 1973). In science-fiction novel "The Dispossessed," a scientist from an anarchist society where transportation is handled by trains and dirigibles observes, during a visit to a hyper-capitalist urban centre, that access to cars was limited because "[a]ll such luxuries which if freely allowed to the public would tend to drain irreplaceable natural resources or to foul the environment with waste products were strictly controlled by regulation and taxation" (Le Guin, 1974/2011, pp. 81-82). Even in the hyper-capitalist environment, it was clear that democratizing automobility was environmentally and spatially unsustainable, but their restrictions also ensured that only a wealthy elite could use them, reflecting the observations made by Gorz (1973/2018) about the automobile as luxury product.

In a third story, coming-of-age novel "Very Far From Anywhere Else," Le Guin (1976/2004) writes of a teenage boy in American suburbia who struggles with the identity being

foisted upon him by his parents, explaining in an internal monologue, “I didn’t know who I was, but I knew one thing: I wasn’t the seat-fixture of an automobile,” rather preferring to walk and see “[t]he sidewalks, the buildings, the people you pass. Not the brake lights on the back of the car in front of yours” (p. 14). His negative internal response to being gifted a car by his father, the next step in the narrow idea of masculinity being foisted upon him after only being given ‘male jobs’ around the house, is not simply teenage rebellion, but a realization that the “normal car-loving American teenager” (p. 28) that his father was trying to make him was “what I wasn’t, and was never going to be, and I needed help finding out what I was instead” (p. 29).

All three of these stories do what the tech billionaires currently trying to define mobility futures do not: challenge the dominance of automobility and provide different ways to imagine mobility and the social structures which surround and are produced by it, not simply how to extend automobility in a way that works for the most powerful and wealthy people in society, as the capitalists did in “The Dispossessed.” Rather, Le Guin’s fiction clearly illustrates how a future of mobility that is just and emancipatory must centre pedestrians and transit, reinforcing a growing trend in Western cities, including in North America, where cities are taking steps to restrict the dominance of automobiles, invest in transit, and change the way they build communities to prioritize pedestrians. However, many of these changes are slow and timid, but stories and futures that open the minds of residents to the possibility of a post-auto city and identity, instead of misguidedly trying to solve problems created by the automobile through retrenchment, could empower them to begin imagining those futures for themselves. The harm of automobility will not be solved by walking away, but rather by demanding change to the urban form that empowers residents to walk within their communities and developing new narratives so people can imagine where they fit within a less auto-oriented future.

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5.0 CONCLUSION

The composition of urban transportation systems has become the subject of vigorous debate over the past decade as the harms and inequities of the auto-dominated status quo have come into greater focus and executives from the technology industry have begun presenting their visions for what transportation might look like in the future. These debates centre on what role automobiles should play in the future and the degree to which any transformation must depend on the development of new technologies, reflecting the worldview of technological solutionism (Morozov, 2013). As illustrated in the Chapter 2, the system of automobility was an outcome of common goals and motivations held by powerful constituencies in government institutions and business, and the ideas put forward by tech executives often perpetuate this system, while integrating new technologies which are purported to address at least some of the harms resulting from such a system.

The goal of Chapters 3 and 4 was to interrogate some of these ideas for the future of urban transportation systems, recognizing the imperative of critical analysis when the power of tech executives gives their ideas unearned legitimacy. This has led to the media featuring their ideas prominently, often without asking the hard questions; executives in the automotive and aerospace industries adopting these purported solutions as part of their own businesses; and politicians, seeking to appear forward-thinking and as though they embrace innovation, publicly embracing the hyped imaginings of tech executives without performing assessments of their feasibility or potential impacts. As such, the analysis undertaken in this thesis was sorely needed and could help to inform the public discussion about these modes moving forward.

In Chapter 3, I analyzed near-term transportation solutions which have been called the ‘three revolutions’ in urban transportation: vehicle electrification, ride-hailing services, and

autonomous driving technologies. The analysis was informed by the perspectives of automobility realism and mobility justice to interrogate whether the proposed solutions challenge the dominance of automobiles and the harms and inequities which result from such a transportation system. While vehicle electrification would reduce tailpipe emissions, it would generate significant market pressures to increase mining activities primarily in countries in the Global South that could create social and environmental harm; produce new spatial inequities with an uneven distribution of benefits; and do little to reduce the local air pollution produced by automobiles. Further, ride-hailing services have not lived up to early promises made by company executives, and have instead increased road congestion, increased vehicle emissions, and have disproportionately served well-off individuals instead of underserved communities. Finally, the speed at which autonomous vehicles could be developed was vastly overestimated, along with their capabilities, while their potential to expand suburban sprawl, increase energy use, and add new cybersecurity vulnerabilities to the transportation system have not received enough consideration. Thus, these three purported revolutions actually do little to alter the flaws with the existing auto-dominated transportation system, since they do not challenge the supremacy of automobiles and do not seriously seek to rectify the harms and inequities that it creates.

In Chapter 4, I pushed the analysis further into the future to examine two long-term transportation visions which tech executives describe as making transportation 'three dimensional': a system of flying cars and a network of underground car tunnels. In addition to automobility realism and mobility justice, I also made use of critical future studies to examine the way tech executives and companies spoke about and visually represented their proposals, and what those statements and images suggest about the way they think about the future of transportation systems. Under a critical lens, the flaws in these proposals also become apparent.

The claims of Uber executives that flying cars will solve congestion, serve 'everyone', and have an affordable price do not stand up under scrutiny, and their representations of the transportation system and urban form that flying cars will exist within remains predominantly sprawling and oriented around automobiles. Further, the system of tunnels for autonomous, electric automobiles promoted by tech billionaire Elon Musk appears more likely to create exclusive roads for wealthy drivers of vehicles produced by another of his companies, Tesla, than to seriously reduce surface road congestion, reduce the costs of tunnelling projects, or serve the most vulnerable and underserved urban residents. These solutions seek to address the primary transportation problem experienced by well-off urban residents — the traffic congestion they experience on public roads and highways — rather than seriously contending with the automobile dominance that creates that problem in the first place or the most serious harms and inequities created by the system of automobility. Making use of critical future studies, this analysis goes a step further in illustrating the need for fiction and stories which help people to imagine a transportation system beyond automobile dominance by examining the works of science-fiction author Ursula K. Le Guin and her approach to storytelling, since such fictional visions could serve to challenge those of tech executives whose imaginations are stuck in an auto-oriented mode of thought.

The analyses I have undertaken demonstrate the need for a more critical approach to the ideas presented by tech executives in the realm of transportation, if not also their broader visions for a greater integration of technology into more aspects of society and human life. Instead of truly challenging the harms and inequities in modern cities, they place the emphasis on technology alone to solve problems which go far behind processing power and data analytics, ignoring more serious questions about political priorities, power relations, and the distribution of scarce resources. These are political, not technological, questions. On the specific topic of

transportation, adding more technology to automobiles does not resolve the fundamental harms and inequities which are created by a transportation system and urban form designed and built around the swift, efficient movement of automobiles instead of people. Rather, addressing those problems will require placing people, specifically the most vulnerable urban residents, at the centre of the design of urban spaces and transportation systems. That requires the development of participatory processes to involve those vulnerable groups who have comparatively little access to the halls of power in planning and decision-making; undertaking a process of redesign and renovation to make urban and suburban spaces more friendly to pedestrians, taking into account the specific needs of children, parents, the elderly, and people with disabilities; and reorienting transportation systems around modes which efficiently move people and promote interaction between them, instead of moving automobiles and closing people in their personal 'iron cages'.

For policymakers, the findings of these critical analyses of tech executives' transportation proposals should make them more wary of embracing what are, in most cases, untested and unproven solutions whose promises of widespread benefits to urban residents and transportation systems are driven by ego and unfounded assertions, not an evidential foundation, as demonstrated by Chapters 3 and 4 of this thesis. Instead of being caught up in the narratives spun by these powerful individuals, policymakers must focus on the real harms and inequities created by an auto-dominated transportation system and seek solutions which can actually address them. That will mean not being distracted by technology and the 'innovation' buzzword, but designing communities so services are within walking or cycling distances of residential areas; investing in transit services and cycling facilities, while taking road space from automobiles to induce a change in transportation behaviours; and ensuring a right to the city that gives residents power

and guarantees access to urban space, housing, and the other amenities that are necessary to a truly good life for everyone. These are not solutionist approaches to transportation, but ways of designing transportation systems and building communities that have been proven to deliver social, economic, and environmental benefits where they are implemented — instead of simply focusing on what is best for the bottom lines of automakers, real-estate firms, and companies whose businesses are based on mass consumption of low-quality, disposable goods.

However, in addition to policymakers, the analyses in this thesis are also relevant to media publications and the journalists who work for them. The reputations of tech executives and the interest in their purported solutions is, in part, constructed by uncritical, fawning coverage they receive in technology and business publications, as well as larger, mainstream outlets. The case of ride-hailing services, in particular, demonstrates that the positive coverage heaped on Uber over the course of the past decade served its business interests, while failing to serious interrogate its claims about improving urban transportation and serving everyone. The media needs to do more than simply repackaging press releases and the statements of executives in a way that lets them use publications to launder ideas for the future that have not been fully thought through; rather, journalists need to serve as one of the stages at which their ideas receive critical analysis. If that were the case, tech executives likely would not be able to continue promoting the fantasy benefits of their ideas as long as they often do and would have to face difficult questions about what they are proposing at a much earlier stage. This is not to say there no journalists performing this crucial work, but rather that they remain in the minority. Such a critical focus from media could then open up the space to spend more time discussing the changes to the urban form and transportation systems which will truly address the worst harms and inequities of a system built for automobiles instead of for people.

The final group for which this thesis is relevant is researchers. Previous critical research set the foundation for the analyses in this thesis, but the findings in Chapters 3 and 4 are certainly not the end of this research. Critical academics should continue to explore the impacts, real and potential, of the various proposals made by tech companies for transportation systems, home automation, and urban space. While there is clearly a need to continue understanding the effects of technologies that are already on public roads, such as ride-hailing services, there also needs to more critical attention given to those proposals which could be rolled out in the future in an attempt to illustrate the misleading claims made by companies and executives about them, along with the potential inequitable outcomes they would have for urban residents. Researchers are also invited to consider the implications of automobility realism on other tech solutions for transportation or on broader transportation topics. Ultimately, critical scholars should serve as one of the checks on the solutionism of the tech industry, to the extent of even trying to stop projects that do not serve the public good.

Given the period during which this thesis is being submitted, I would be remiss not to briefly comment on the exceptional situation the human species now finds itself in. The spread of COVID-19 and attempts to "flatten the curve" of infections has transformed the way people live in a very short period of time; forced governments to take policy measures that would have been considered ideologically impossible just weeks before; and while many await a return to 'normal', it seems very unlikely that socioeconomic systems will simply resume as they existed before the pandemic. Rather, such a moment may present an opportunity for an "ideological ('cultural') revolution" (Gorz, 1973/2018, para. 5) in the way transportation systems are designed, cities are organized, and possibly in whose interest the larger system is organized. Thus, rather than waiting for the resumption of an inequitable, capitalist 'normal', this could be a

time to present ideas for the future which "engender a sense of urgency and excitement" (Goode & Godhe, 2017, p. 127), as instructed by critical future studies. In the realm of transportation, governments are already taking measures to reduce street space for cars to add more bike lanes and ensure pedestrians can social distance while going outside to walk in urban areas. Paris accelerated its cycling plans with 650 kilometres (403 miles) (Reid, 2020) of cycleways readied for May 11, Milan announced intentions to preserve air quality improvements by transforming 35 kilometres (21 miles) of streets to provide priority to pedestrians and cyclists (Laker, 2020), and New York City Mayor Bill de Blasio was even forced to backtrack and agree to close 160 kilometres (100 miles) of streets for pedestrians (Roos, 2020) — just a few examples of a much larger trend. With residents taking notice of the air quality improvements arising from decreased vehicle use (Ellis-Petersen et al., 2020) and both money and lives being saved from having fewer cars on the road (Kerlin, 2020), there is a rare opportunity to present an alternative vision for a city that brings people closer together in the aftermath of this crisis and provides them with the social connection they have so desperately been craving not just while containment measures were in place, but for much longer as a result of the isolation and loneliness built into a suburban, car-oriented development model. The crisis presents an opportunity to abandon auto-oriented planning practices and solutionist problem-solving approaches to really dig into the root of social, economic, and political problems to create real solutions to the problems faced collectively in cities, countries, and the wider world.

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