

Cycling and Staying on Track: An Evaluation of Toronto's Cycling Initiatives  
through a Social Practice Theory Framework

**Jeanny Do**

University of Toronto Mississauga  
Master of Science, Sustainability Management  
SSM1100

Course Instructor: Soo Min Toh (soomin.toh@utoronto.ca)

Research Supervisor: John Robinson (johnb.robinson@utoronto.ca)

April 04, 2022

Word Count: 11,650

## Table of Contents

<i>Abstract</i> .....	3
<i>Introduction</i> .....	4
<i>Methodology and Research Approach</i> .....	5
Literature Analysis.....	5
Toronto Related Cycling Interventions and Initiatives Analysis.....	6
<i>Understanding Social Practice Theory (SPT) and Cycling</i> .....	6
<i>Literature Review</i> .....	7
“Materials” .....	8
“Competences” .....	11
“Meanings” .....	13
<i>Research Findings and Results</i> .....	14
“Materials” of Cycling in Toronto .....	15
Cycling Infrastructure – Bicycle Lanes .....	15
Cycling Network Plan .....	15
Cycling Infrastructure - Parking .....	16
BikeShare Toronto .....	16
“Competences” of Cycling in Toronto.....	16
Cycling Safety Tips and Security .....	17
Streetcars and Tracks.....	17
Other Safety Tips.....	17
Cycling Handbooks.....	17
Additional Education.....	18
StreetSmartsTO .....	18
CAN-BIKE .....	18
Cycling Laws .....	18
“Meanings” of Cycling in Toronto .....	19
Cycling Events and Programs .....	19
Bike Month .....	19
ActiveTO .....	19
Cycling Public Consultations.....	20

Cycling Advocacy Groups, Organizations and Clubs .....	20
<i>Discussion</i> .....	20
<i>Materials</i> in Toronto .....	20
<i>Competences</i> in Toronto .....	23
<i>Meanings</i> in Toronto .....	25
<i>Conclusion</i> .....	26
<i>Recommendations</i> .....	27
Recommendations in <i>Materials</i> .....	27
Recommendations in <i>Competences</i> .....	28
Recommendations in <i>Meanings</i> .....	29
<i>References</i> .....	30

## Abstract

The City of Toronto released the “*TransformTO: Net Zero Strategy*”, a climate action plan that outlines strategies to reduce its greenhouse gas emissions, including the 36% of emissions generated by the transportation sector, in Dec 2021. Acknowledging that personal vehicles account for 73% of the transportation emissions, the use of personal vehicles needs to be dramatically reduced and active modes of transportation, such as cycling, need to be supported and promoted. As part of their transportation climate goals, Toronto aims to have “75% of school / work trips under 5 km be walked, biked or by transit by 2030” and this paper is an examination, using a social practice theory approach, of whether Toronto is on track to meet that goal. Toronto’s cycling interventions and initiatives are examined against the three elements of social practice theory (*materials*, *competences*, and *meanings*) to determine why and how these interventions and initiatives contribute to increasing cycling rates. The study finds that Toronto does have the cycling initiatives in place that align with the elements of social practice theory to ignite behavioural changes that normalizes cycling as an everyday mode of transportation. Areas of improvement and recommendations are provided for future consideration to increase cycling rates, such as focusing cycling infrastructure investment in the suburbs of Scarborough, rapidly expanding secured parking facilities, building a cycling economy, and reducing known financial barriers.

## Introduction

Cities all around the world have released climate action pledges to combat the effects of global warming. Cities and urban centres are key contributors to climate change, as their local economies, activities and highly dense populations are a major source of greenhouse gas (GHG) emissions. According to some estimates, cities are responsible for nearly 75% of all global CO<sub>2</sub> emissions, with the transportation sector and buildings being the top contributors (UNEP, n.d.). Given their impact, some cities have begun adopting initiatives to reduce their local emissions and set actionable targets to become a net-zero city within the next few decades. In July 2017 the City of Toronto released its climate action strategy plan, called “*TransformTO*” which includes setting low-carbon and net zero strategies to reduce local GHG emissions and improve the City’s health, grow the economy, and improve social equity (City of Toronto, 2019). With the release of the new climate TransformTO Net Zero Strategy, in December 2021, the City has since adopted an even more ambitious strategy to reduce community-wide GHGs to become net zero by 2040 instead of 2050, making it one of the most ambitious climate strategy in North America.

According to the most recent community wide GHGs inventory report, buildings and transportation are the largest contributors of GHG emissions in Toronto, at 57% and 36%, respectively. Of the transportation emissions, 73% of the emissions comes from the use of gas and diesel fueled personal vehicles by individuals or households (i.e., cars, SUVs, vans, light trucks) (City of Toronto, 2020). As part of the TransformTO Net Zero Strategy transportation goal, Toronto’s goal is that “75% of school/work trips under 5km are walked, biked or by transit” by 2030. As of 2019, active transportation accounted for 37% of total trips taken (City of Toronto, 2020). It is clear then, to significantly reduce the overall transportation emissions, the use of personal vehicles must be reduced as much as possible and active modes of transportation must be supported and promoted.

Strategies to increase cycling in general are beneficial on multiple fronts. Cycling is arguably the most sustainable form of transportation, since it causes little to no environmental damages, promotes health through physical activity, takes up limited space and is economically sustainable (Pucher & Buehler, 2017). Cycling has become a main driver towards an environmentally friendly, healthy, space-saving and sustainable form of urban mobility (Marquart et al., 2020) that also helps reduce local GHG emissions. Across Canada, cycling rates have steadily increased in the last two decades in both small and large municipalities (Verlinden et al., 2019; Pucher et al., 2011; Assuncao-Denis & Tomalty, 2019). Cycling to work increased in many Canadian cities between 1996 and 2016; Vancouver’s rate increased from 3.3% to 6.1%, Victoria increased from 8.7% to 11.1%, Calgary increased from 1.1% to 1.6%, Winnipeg went from 1.5% to 1.8%, and Gatineau jumped from 1.5% to 2.5%. In the same period, Toronto and Montreal experienced the largest

percentage increase in cycling to work rate. Toronto increased from 1.1% to 2.8% (a 147% increase), while Montreal went from 1.4% to 3.9% (a 176% increase) (Verlinden et al., 2019). These overall increases suggests that cycling has become more popular and widely accepted as a mode of transportation and many cities are recognizing the value of increasing their cycling levels (Tumlin, 2012; Assuncao-Denis & Tomalty, 2019).

Using a qualitative approach and drawing upon social practice theory, this study will explore Toronto's cycling interventions and initiatives to examine why and how they are contributing to increasing cycling rates. Shove et al.'s (2012) version of social practice theory (SPT) provides a framework to analyze cycling as a social practice which illuminates how cycling rates are sustained, how cycling is chosen as the mode of transportation and what is likely required of the cycling environment and individuals to consider this mode. Shove et al.'s (2012) three elements of: *materials*, *competences* and *meanings* will be used throughout the study to guide the literature review, findings, and discussion. The literature review contains a review of social practice theory and its relevance for evaluating cycling policies, followed by a discussion of existing and widely accepted cycling interventions and initiatives that are intended to increase cycling rates, organized in terms of the three components of social practice theory. Exploring Toronto's cycling interventions and initiatives in this way will provide some insights for answering the question: is Toronto on track to meet their transportation goal of having 75% of school or work trips that are 5 km or less be walked, cycled or by transit by 2030? In other words, are the existing cycling interventions and initiatives in Toronto sufficient for it to reach the City's climate transportation goals? The author will reach some judgement about these questions and offer recommendations for consideration.

## Methodology and Research Approach

### Literature Analysis

A comprehensive literature review was conducted to examine peer-reviewed academic sources and materials related to cycling behavior and cycling interventions. The search syntax was limited to cycling interventions and policies that were intended to increase cycling rates within a general population. The peer reviewed academic sources and materials were searched and examined during June 2021 and January 2022 using online databases accessed directly through the University of Toronto Libraires website. The search terms used to filter the academic sources include: *cycling, bicycling, urban cycling, utility cycling, social practice theory, policies, interventions, programs, incentives, safety, infrastructure, city, cities, Toronto, pro-environmental, behavior, behavior change, culture and practice theory*. Peer reviewed articles came from the following academic journals: Transportation Research Part A and Part F; International Journal of Sustainable Transportation; Journal of Transport Geography; Urban, Planning & Transport

Research; Environment & Planning A; Preventive Medicine; Global Environmental Change; Transport Policy; Transport Reviews; Transportation; Social Science & Medicine; and Leisure Sciences. Due to limited research resources and time constraints, the researcher applied filter limitations to academic article search results, including: articles are peer-reviewed, available online, in article format, published between 2000 to 2021, and in the English language.

In addition to examining peer-reviewed academic articles, the researcher also sourced grey papers or grey literature (i.e., materials and research reports produced by organizations outside traditional academic institutions) related to cycling trends and cycling interventions produced by cycling advocacy groups, non-profit organizations, research laboratories and municipalities. The groups and organizations include: The Centre for Active Transportation, Transportation and Land Use Planning Research Laboratory at Ryerson University, the University of Toronto Scarborough Suburban Mobilities Research Cluster, and the City of Toronto.

### Toronto Related Cycling Interventions and Initiatives Analysis

Following the comprehensive literature review, the researcher referred to the City of Toronto's "Cycling in Toronto" website (City of Toronto, n.d.) to examine the cycling initiatives, policies and programs that have been implemented, developed and/ or planned for future development. The initiatives fall under the following categories as listed by the City: *Toronto Cycling Map*, *Toronto's Cycling Infrastructure*, *Cycling and the Law*, *Cycling Network Projects*, *Bicycle Parking*, *Cycling Events & Programs*, *Cycling Public Consultations*, *Safety*, *Education & Campaigns*, and *Cycling & Transit*.

### Understanding Social Practice Theory (SPT) and Cycling

Evaluating how certain cycling initiatives helps increase cycling rates within a general population is another form of evaluating how these initiatives can induce behavioural changes and normalize cycling as a practice at scale. In previous studies examining behavior change and cycling (i.e., Anable, 2005; Bamberg & Schmidt, 2003; Bamberg et al., 2011; Gardner, 2009), individualist approaches and theories such as the Theory of Planned Behavior (Ajzen, 1991), the Theory of Interpersonal Behavior (Triandis, 1977) and Norm-Activation Model (Schwartz, 1977) were applied under the premise that "social change is thought to depend upon values and attitudes... which are believed to drive the kinds of behavior that individual choose to adopt" (Shove, 2010, p. 1274; Spotswood et al., 2015). In these theories, the focus of behavior change is placed with the individual, where interventions seek to alter the conditions of decisions that are made to influence their preferred choices (Buck & Nurse, 2021). In other words, individualist behavior change theories focuses on changing attitudes or values, whereby individual choice, intentions, and subjective interest are the main objective of research.

In contrast, practice theories explore and understand practices (like the practice of cycling) as a 'routinized type of behavior' on a larger scale or societal level rather than an individual level (Reckwitz, 2002; Shove et al., 2012). They are concerned with how practices come into existence, how they endure, are sustained, or change over time, how they rise in popularity for a time or suddenly die out (Shove et al., 2012; Larsen, 2017). Social practice theory in particular, seeks to understand a practice by way of examining the surrounding social context and conventions embedded in that practice, instead of reviewing the attributes and intentions of the individual participants in a practice (Sersli et al., 2021; Spotswood et al., 2015). Where the study of individualist models and theories are interested in understanding an individual's intentions and behaviors, practice theory on the other hand is concerned with how and why practices come into existence, how they are sustained or change over time (Larsen, 2017). It is concerned with the tangible and intangible variables that compel or reject participation in a practice, acknowledging that practices are made up of interdependent components for analysis (Reckwitz, 2002; Larsen, 2017). The version of social practice theory that appears to be most applicable for the study of cycling and changing a social behavior is Shove et al.'s (2012) three element model, whereby practices are defined by the interdependent and dynamic relations between the "*materials*", "*competences*" and "*meanings*."

"*Materials*" encompasses tangible objects, infrastructure, tools, hardware, and physical resources (Shove et al., 2012; Sersli et al., 2021; Spotswood et al., 2015). "*Competences*" refers to skills, know-how, technique, and knowledge and "*meanings*" entails values, ideas, aspirations, sociocultural significance, and embodied understanding of the practice (Shove et al., 2012; Sersli et al., 2021; Larsen, 2017). For example, the practice of cycling could include the materials of bicycles, cycling paths, repair shops, and signals; competences of training, skills and navigation abilities in the local area; and meanings of participating in cycling culture and valuing it as a sustainable mode of transportation. Shove et al. (2012) suggests that the three elements have to be routinely, consistently and actively engaged with, and complement each other to normalize and sustain a practice or behavior in an effective way. By examining cycling as a practice that needs to become normalized to increase cycling rates, Shove et al.'s (2012) SPT provides an analytic framework to evaluate cycling interventions and initiatives that are designed to fulfill one or more of the three elements.

## Literature Review

The application of social practice theory to examine cycling as a normalized practice has become common in examining cycling culture in different cities around the world. Spotswood et al. (2015) found that in the UK, the lack of '*materials*' (i.e., lack of access to bicycles and cycling infrastructures) were responsible for low cycling rates amongst the research group. The

perception associated with cycling as non-mainstream and seen as a niche activity deterred would-be cyclist. By applying a SPT framework, Spotswood et al. (2015) demonstrate how understanding the negative perception of cycling may help implement future interventions to increase cycling rates in the UK. Contrasting the findings of Spotswood et al. (2015), Larsen (2017) applies the Shove et al.'s (2012) SPT framework to examine how bicycling practices in Copenhagen are continually re-produced, sustained and consistently attracts a significant number of cyclists. Larsen (2017) elaborates on the importance of needing all three elements of SPT to be aligned and complementing each other in order normalize cycling behaviors amongst the majority. Well-designed cycling infrastructure and facilities, significant access to cycling materials, positive perceptions of cycling and low skills or competence to participate are required to motivate and/or incentivize people to choose cycling

### “Materials”

The “materials” of cycling and their role in increasing cycling rates has been examined and studied by numerous transportation scholars. The overwhelming consensus is that cycling infrastructures and facilities are essential in attempting to increase cycling rates in a local area.

Pucher et al. (2009) conducted a comprehensive study to assess existing research on the effects of different cycling interventions ranging from infrastructure, integration with public transport, education, marketing programs, bicycle access programs and legal issues. When examining cycling infrastructure, the study reviewed the impacts of bike lanes, bike parking and storage (both indoor and outdoor), and transit integration (i.e., parking and storage at transit hubs). The overall conclusion was that well designed and thoughtful cycling infrastructure helped increase cycling rates. Cities that provided more access to bicycles, whether that was through public bike share programs and/or subsidizing purchases also experienced an increase in cycling rates. When examining the effects of bicycling programs (i.e., media campaigns, educational events) and legal issues (i.e., helmet laws, reduced speed limits), there appears to be limited impact on bicycling rates, noting that additional research would be required. Of the 14 case study cities that were assessed, Pucher et al. (2009) suggested that the cities who adopted a package of holistic and comprehensive cycling interventions generally experienced a significant increase in cycling rates.

In their examination of cycling culture in the Netherlands, Denmark and Germany, Pucher & Buehler (2008) demonstrated these countries are able to maintain high levels of cycling through a coordinated implementation of multi-faceted and mutually reinforcing set of pro-cycling policies. Specifically, provisions of separate cycling bike lanes along motor vehicle traffic, traffic calming in residential neighborhoods, ample bike parking, full integration with public transit, making driving



both expensive and highly inconvenient and employing strict mixed-land use development were all highlighted as key components in achieving high levels of cycling amongst these three countries.

Focusing on North American cities, Pucher et al. (2011) studied trends in cycling levels, safety and policies and found that in general, cycling rates have increased while fatalities have fallen. The study found a positive correlation between cycling levels and support of bike paths and lane, suggesting that cycling infrastructure is a significant component for increasing cycling levels, as it generates a perception of safety and encourages the most vulnerable groups to cycling. Portland, Oregon demonstrated the most impressive growth where bike mode share increased more than five times between 1990 and 2009, from 1.1% to 5.5%. The growth was attributed to Portland's adoption of integrated and comprehensive cycling policies and interventions. The success in Portland highlights how car-dependent North American cities can dramatically increase cycling rates by adopting and implementing the right combination of cycling infrastructure, programs and policies.

Major cities like New York, London and Paris, where historically cycling for daily travel was limited and considered niche, are experiencing stable growth of cycling rates (Pucher et al., 2021). Pucher et al. (2021) found that in the past few decades, these cities have seen notable increases in cycling levels primarily due to the implementation, improvements, and vast expansion of cycling facilities. They include various types of bicycle lanes (i.e., on and off streets, separate bike paths), increased bike parking facilities, improved intersection crossing designs, integration with public transport and providing public bike share programs.

Cycling infrastructure is a critical step in municipalities efforts in increasing cycling rates. Frank et al. (2021) evaluated changes in cycling trips before and after the construction of a 2 km urban greenway in Vancouver, BC. The greenway was fitted out with cycling facilities (i.e., one-way protected lanes, painted dotted lanes, one-way shared on-street with counterflow) and other streetscape improvements to accommodate people of all ages and abilities to walk and cycle. The construction of the urban greenway resulted in a 252% increase in cycling trips for residents who lived within 300 m, compared to residents who lived further away after a two year follow up period. Frank et al. (2021) was able to suggest a casual effect between cycling infrastructure investment and travel behavior while also demonstrating how greenways could be an effective strategy to boost cycling rates.

A similar study was conducted by Siemiatycki et al. (2014) where they examined the impacts of allocating and redesigning Vancouver's Burrard Street Bridge to accommodate cycling infrastructure. The study demonstrated how certain cycling infrastructure designs in existing motor vehicle routes can successfully encourage cycling rates. By converting a single southbound

traffic lane on the Burrard Street Bridge leaving the Vancouver downtown core to a “bikes only lane”, cycling trips over the bridge had risen by 70,000 trips or by 26% in the first three months of the pilot trial while general travel times for motor vehicles remained unchanged.

Furth (2021) examines different types of cycling facilities, their financial costs, and their impacts on cycling rates in certain cities. He concluded that for mass level cycling to occur, cycling infrastructure that separates cyclist from motor vehicle traffic and a dense connected network of cycling paths must exist. As more cycling infrastructure exist, cyclists’ perception of safety significantly increases which encourages more cycling.

Hull & O’Holleran (2014) compares the design of cycling infrastructure amongst six European cities with high cycling rates to explore if a specific cycling infrastructure design encourages or discourages cycling. They evaluated each city’s cycling infrastructure based on cyclists’ perception of the infrastructure’s coherence, directness, attractiveness, traffic safety comfort, spatial integration, experience, and social economic value. It was concluded that the design of cycling infrastructure significantly influences a cyclist’s perception of safety which has a significant impact on the choice to cycle or not. Cyclists’ perception of conflict and perceived possibilities of accidents can be more important than actual conflict in determining whether people will use a specific cycling route. In a related study, Agarwal & North (2012) found that the biggest deterrence and barriers to cycling amongst university students in London, Ontario was the severe lack of cycling infrastructure. Amongst the 103 Queen’s University students surveyed, the lack of designated cycling infrastructure, heavy vehicle traffic on main roads, and limited bicycle storage and parking options on campus and near residents were significant barriers to cycling.

In examining Toronto’s steadily increase of cycling rates, Young et al. (2020) argued that Toronto’s ability to form dedicated cycling departments in governance greatly helped prioritize the design and implementation of cycling infrastructure. The department’s responsibility for enacting new transportation policies and plans encourages the cycling rate momentum, while changes in the City’s economic sectors and socio-economic and demographic factors led the way to fostering a stronger cycling culture (i.e., increase in young millennial professionals hailing from technology and service industries settling and working in the downtown core).

The literature indicates that the ‘materials’ of cycling are seemingly fundamental to influence and encourage cycling uptake in a local area. Designated bike paths, indoor and outdoor parking facilities, expansive cycling networks, and integration with public transit all contribute to the ‘materials’ of cycling, whereby cyclist are provided with the physical space and tangible equipment to engage in the practice. The literature demonstrates that municipalities and cities who develop and implement well designed cycling infrastructure tend to see their cycling rates increase over

time (i.e., Pucher et al., 2009; Furth, 2021; Pucher et al., 2011; Pucher et al., 2021). Of the various types of cycling infrastructure, designated bike lanes and paths that are separated and protect cyclists from motor vehicles were frequently cited in the literature as the ‘material’ that helps increase cycling rates by way of increasing cyclists actual and perceived safety. The greater the sense of security and safety felt by cyclists, the more likely cyclists are encouraged to participate.

While the literature mentions other ‘materials’ of cycling, such as bicycle parking and storage facilities, public transit integration, bike share programs, bike repair facilities and crossroad designs, bike lanes and paths were the main focus of evaluating cycling infrastructure and their influence on cycling rates. Additional research is required to evaluate and review in more detail other specific cycling infrastructure and their impacts on overall cycling rates in a local area.

### “Competences”

Beyond the physical and tangible components required to cycle, an individual requires the skills, know-how, technique, and knowledge to cycle. The literature indicates that a mixture of policies and programs need to be implemented to encourage and develop all types of cyclists’ abilities to increase cycling rates. Policies that directly or indirectly foster cycling skills play a role in building confidence and abilities.

Sersli et al. (2021) examined the impact of cycling courses and programs on women in Vancouver, BC to investigate women’s perception and cycling behaviors. From the 32 interviews conducted, women who participated in cycling courses did so to overcome barriers (both physical and perceived) and to gain or improve their cycling competencies (i.e., develop stronger cycling skill, rules of the road, enhancing safety perception and mitigating sexual harassment). Sersli et al. (2012) shed light on how some barriers to cycling are gender specific and require cycling policies that overcome gender specific barriers to encourage underrepresented population (i.e., women) to start and continue cycling.

Heinen & Handy (2021) highlight the importance of non-infrastructure policies and programs in promoting and encouraging cycling, arguing that the most successful cities are the ones who use an integrated package of infrastructure investments, combined with policies and programs. The study builds upon previous research that evaluated the effectiveness of non-infrastructure or “soft” interventions. Heinen & Handy (2021) discover that a wide variety of programs and policies have potential to increase cycling, including policies that are bicycle-specific and policies that discourage or deter driving. To improve competence of cycling, Heinen & Handy (2021) concluded that policies and programs should be designed to focus on 1) encouraging non-cyclists to begin

cycling (i.e., focusing on developing basic cycling skills and knowledge) and 2) to encourage cyclists to cycle more (i.e., focusing on educating cyclist on alternative routes).

Yang et al. (2010) examined 25 cycling related intervention studies to evaluate the potential benefits on participants' physical health. Cycling interventions used in the 25 studies included intensive intervention with individuals, individualized marketing to households, improving cycling specific infrastructure and other multifaceted municipal level programmes. Overall, the available evidence suggests that changing the built environment has the potential to influence cycling behavior and that individualized marketing intervention to change behavior only appeared to be effective for people who were already interested in changing their behavior towards cycling. Yang et al. (2010) found that to induce substantial and sustained changes in travel behavior, changes to the built environment with the support of individual and institutional interventions would need to be utilized in tandem to increase cycling rates.

Previous studies that applied the SPT to cycling behavior have focused almost exclusively on cases where the objective is to replace an unsustainable mode of transportation (i.e., driving a gasoline vehicle) with a more sustainable mode of transportation (i.e., cycling). Bruno & Nikolaeva (2020) focuses on applying the SPT on ways to maintain cycling behaviors and cycling rates to combat the decline of cycling (i.e., defection). They examined two Dutch national bicycle policies that were intended to help increase cycling rates; the first policy applied a wide range of programs and broader approaches to existing cycling communities, while the second policy focused exclusively on a single approach with the objective of reducing highway congestion by providing cycling infrastructure. Overall, the first policy that employed a range of cycling intervention and programs maintained a stable cycling rate, but also had measurable impact on the support that Dutch cities provided to cyclist, whereas the second policy of installing bike paths along a congested highway saw less than 1% of drivers switching to cycling after 2 years. Bruno & Nikolaeva (2020) argue that investing in a maintenance-based approach could contribute to sustaining a sustainable practice such as cycling.

Policies and interventions focused on developing knowledge, skills or 'competences' of cycling are considered by the literature as vital for inducing and sustaining the practice of cycling. Without the knowledge or know-how on how to engage with the 'materials' of cycling, participants of the practice lack the "type of knowledge [that is] required for the carrier to 'succeed' at the performance of the practice" (Shove et al., 2012; Spotswood et al., 2015). In other words, without knowledge, training, or skills on how to use the 'materials' of cycling, the practice of cycling becomes difficult to adopt. A bicycle on its own is a handful of steel bars attached to two wheels. However, a person pedalling the bicycle in a forward motion; squeezing the handle breaks at intersections; reading traffic signals and signs and maintaining a space distance between

themselves and other cyclists is engaging in the practice of cycling. Policies and interventions focusing on developing 'competences' becomes crucial in transforming physical, tangible objects, or entities, into essential components needed to conduct a behavior or practice.

### "Meanings"

While building cycling infrastructure and implementing policies and programs to improve skills are vital components to engender cycling behavior, cycling culture or the symbolic meanings of cycling is equally valuable in cultivating and sustaining the behavior and attracting additional and potential cyclists.

Aldred & Jungnickel (2014) examined the cycling culture of four UK urban areas (i.e., Bristol, Cambridge, Hackney & Hull) and found a clear distinction between an 'established' and 'emerging' cycling culture. Areas that were considered to have an 'established' cycling culture had high, stable and/or increasing cycling rates, whereby cycling was normalized, considered ordinary, practiced by all levels of people of different socio-economic classes and cycling was not perceived as requiring high levels of skill or competences. Areas that had an 'emerging' cycling culture generally perceived cycling as a specialized, niche practice that required higher degree of knowledge and skills. These areas also perceived cycling as being associated with fashionable young professionals and the middle class.

Caldwell & Boyer (2018) discovered that cyclists who maintained a close-knit community with other cyclists were more likely to adopt and sustain their choice in cycling as a mode of transportation, despite residing in a "typical" American city where single-occupancy vehicles were the primary form of commute. Interviewed cyclists attributed their abilities to continue cycling to their relationships with other cyclists, the availability of cycle-friendly streets and the support of their employers and workplace.

Savan et al. (2017) explores how community-based application of cycling programs that adopts social psychological and social practice insights into behavior change can potentially increase cycling rates. They conduct a literature analysis examining studies and programs of social and civic infrastructure relevant to fostering cycling for daily transport. Specifically, they explore the use of social interventions intended to encourage the modal shift towards active transportation and cycling, thereby conditioning new norms of behaviour. Key findings were that a mixed approach works best whereby cities adopting multifaceted packages of measures are more effective than single interventions. The greatest impact in cycling adoption and behavior change is achieved by combining soft policies (i.e., promotion, education campaigns) with hard policies (i.e., building infrastructure).

Marquart et al. (2020) conducted interviews with cyclist and experts / decision-makers (13 and 6, respectively) in Leipzig, Germany to investigate to what extent decision makers were aware of the needs, motivations and everyday experiences of the cyclists. The study found that although cyclist and experts agreed cycling infrastructure was important for cycling, experts did not perceive other factors to be as important, compared to the cyclists (i.e., the environmental attributes & quality along cycle path networks, the mental health benefits, mitigation of motorized traffic, etc.). The study concludes that for future cycling planning efforts, experts and decision makers should incorporate and integrate cyclist needs more thoroughly.

Burk (2017) reviewed commuting by bicycle rates of 62 American cities between 2000 and 2014. The study found that cities that had large presence of environmental organizations who advocated and supported bicycling infrastructure and cycling practice experienced a greater increase in cycling rates between studied period. This finding helps support the notion that within the SPT framework, it is equally as important for cycling behavior to be cultivated and positively perceived to change cycling behavior as it is to have cycling infrastructure and interventions in place.

The literature suggests that how the general population perceives or comes to understand a practice can influence whether or not that practice is commonly adopted or not. The 'meanings' of cycling or its "embedded meanings takes the form of an in-built and unreflective sense of what behaviors are 'right' or 'fitting'" (Rettie, Burchell & Riley, 2012; Spotswood et al., 2015). Depending on the local context, the act or the practice of cycling can evoke different emotions and associations to it, which in turn could influence whether the practice is engaged with at scale. If cycling is a common practice, normalized and engaged with by many, the literature suggests that it more likely to induce greater participation, thereby highlighting the value of cultivating and fostering a positive cycling culture.

## Research Findings and Results

All information presented in this paper pertaining to the City of Toronto's cycling infrastructure, policies and programs were gathered directly from the City's official website at <https://www.toronto.ca/services-payments/streets-parking-transportation/cycling-in-toronto/> in January 2022. Findings and results have been loosely structured according to Shove et al.'s (2012) SPT elements: '*materials*', '*competences*' and '*meanings*' as a way to interpret and assess their contributions in influencing the behavioral changes needed to normalize a practice. Toronto's cycling initiatives have been evaluated and examined against the SPT framework to make a judgement on whether the initiatives adhere to the elements necessary for inducing the behavioral changes required to normalize cycling as a practice in Toronto.

Findings listed in the *'materials'* portion focuses on the City's physical cycling infrastructure and policies and strategies related to future development targets; findings listed in the *'competences'* portion primarily reviews initiatives and programs intended to educate and build upon cycling skills and knowledge; while findings listed in the *'meanings'* portion reviews initiatives and programs that advocates, encourages cycling and contributes to the fostering of a cycling culture.

## "Materials" of Cycling in Toronto

### Cycling Infrastructure – Bicycle Lanes

According to the City's official cycling website listed above, the City's cycling network includes various types of bicycle lane types and designs: cycle tracks, bicycle lanes, contra-flow lanes, off-street multi-use trails, quiet on-street routes and shared roadway routes. For each type of infrastructure, a description and visual is provided to inform the reader at <https://www.toronto.ca/services-payments/streets-parking-transportation/cycling-in-toronto/bike-lanes-contraflow-lanes-and-separated-cycle-tracks/>.

### Cycling Network Plan

The "Cycling Network Plan" (CNP) serves as a comprehensive road map and work plan outlining the Toronto's planned investment in the near-term and intentions for the long term. The CNP's mandate is to 1) connect the gaps in Toronto's existing cycling network, 2) grow the cycling network into new parts of the city, and 3) renew the existing cycling network and routes to improve their quality. The CNP contains three main components that structures short and long term infrastructure projects: the Long-Term Cycling Network Vision, the three year rolling Near-Term Implementation Program and the Major City-Wide Cycling Routes.

*The Long-Term Cycling Network Vision* adopts a future planning approach. Its main agenda is to have every street in Toronto considered for bikeways and other cycling upgrades through the use of development applications, area studies and potential capital projects. This component of the CNP acknowledges that not all streets are created equal, and that some streets provide greater value to the cycling network. To determine a street's value, various types of cycling impact analysis are performed which form the basis of a cycling service assessment.

*The Near-Term Implementation Program* is focused on a rolling three-year implementation and execution strategy, whereby it focuses on the realities of infrastructure planning and capital coordination of eligible streets. The latest near-term implementation program was adopted for 2022-2024 and currently has 119 km of cycling infrastructure projects underway with varying types of bike lanes and 40.78 km of projects renewed / fixed. 111.66 km of infrastructure projects are currently under pilot studies while 21.19 km projects have been approved for future implementation.

*The Major-City Wide Cycling Routes* document is focused on supporting a connected cycling system across the Greater Toronto Area by linking with other cycling routes in neighbouring municipalities. This component of the CNP complements cycling infrastructures identified by the broader Provincial and City Plans, including the Metrolinx Regional Cycling Network Plan TOcore. Since 2019 there has been notable progress within the Major City Wide Cycling routes, focusing on closing gaps, initiating new designs and enhancing the overall network. As of January 2022, the City has a total of 367 km of on-street cycling infrastructure (i.e., cycle tracks, bicycle lanes, contra-flow bicycle lanes, wayfinding and route connector “sharrows”, signed routes) and a total of 386 km of off-road trails.

### Cycling Infrastructure - Parking

Diverse bicycling parking facilities are provided to the public at locations near the cycling network that are regularly frequented by cyclist. The types of parking offered are: bicycle lockers (lockers designed to hold a bike and gear and is weather protected), bicycle stations (indoor video surveillance parking facilities), bicycle corrals (seasonal on-street racks), and lock-up rings on sidewalks. To locate parking facilities or options, cyclists can refer to BikeSpace, a community web application supported by the City and Cycle Toronto, via [www.bikespace.ca](http://www.bikespace.ca) or by downloading application on mobile devices.

As part of the CNP, bike parking strategy is incorporated to outline investment between private and public providers of bicycle parking. The strategy’s objective is to develop a shared vision for parking & security among user and providers, clarify responsibility for provision of bicycle parking, increase knowledge of priority areas for investment and plan the City’s efforts in building and managing its bicycle parking assets (City of Toronto, 2021). The strategy recognizes that bicycle parking is a fundamental component of bicycle trips, and the increase of cycling trips has also increased the demand for parking.

### BikeShare Toronto

BikeShare Toronto is managed and operated by the Toronto Parking Authority (an agency that operates on and off street parking facilities in Toronto) and provides convenient 24 hours, 7 days a week temporary access to bicycles and e-bikes. According to BikeShare Toronto, there are currently 6,850 bikes and 625 stations across the Toronto cycling network. The program offers a diverse range in pricing to suit the needs of diverse customers, including annual memberships (\$99.00 or \$115.00), 72 and 24 hour access (\$15.00 and \$7.00 respectively) and single trips (\$3.25 / trip).

### “Competences” of Cycling in Toronto



Toronto's cycling website offers information on cycling safety, education, and campaigns to help users gain knowledge and learn how to cycle safely, protect against theft and how to report stolen bicycles.

### [Cycling Safety Tips and Security](#)

Guides and tips related to cycling and security in Toronto are provided and categorized into six sub-groupings: 1) streetcars and tracks, 2) general safety tips, 3) security & theft prevention, 4) riding with children, 5) new cyclist and 6) winter cycling.

### [Streetcars and Tracks](#)

The Toronto Transit Commission (TTC) operates streetcars that run on tracks in the downtown core and therefore guidelines and tips on how to safely navigate railway tracks are vital to reduce and avoid injuries due to trapped wheels. For example, to cross streetcar tracks safely, the cyclist should always approach at a right angle and do so at a manageable speed. A diagram is provided to further demonstrate how to safely cross streetcar tracks. Additionally, the TTC also educates cyclist on the by-laws related to passing or stopping behind streetcars. For instance, cyclist must pass streetcars on the right side of the vehicle, however when a streetcar is stopped to allow passengers to board, cyclists must stop two metres behind the rear door.

### [Other Safety Tips](#)

General safety tips provide guides on the use of sidewalks, appropriate cycling attire, riding at night, in the summer and in the rain. It educates older cyclists on how to ride with infants, toddlers and young children, helmet requirements and possible fines for lack of helmets on young riders. For new cyclists, recommended cycling equipment is listed to enhance personal safety while also providing reminders such as being vigilant, visible and predictable, checking over one's shoulders before signalling intentions to change lanes or stopping, using correct signals, being aware of their positioning at intersections and being aware of large vehicles. In terms of safety and theft prevention, the city offers tips on how to reduce theft by using high quality bike locks, using secured parking facilities, and techniques on properly securing and locking bicycles.

Given Toronto's four seasons, tips and suggestions for winter cycling are provided to assist cyclists during the winter season. For example, tips are provided on bicycle and tire maintenance and how to prepare for cycling in snowy conditions.

### [Cycling Handbooks](#)

In partnership with CultureLink Settlement and Community Services, the City produced three cycling handbooks; the *Toronto Cycling Handbook*, the *Toronto Cycling Handbook: Family Education* and the *Ontario Cyclist Handbook*, which teach readers about bicycle parts, cycling

related traffic laws, how to develop safe cycling habits and more. They are available in fourteen different languages (including French, Portuguese, Spanish, Korean, Russian, Chinese, Farsi, Tagalog and Urdu) and are free for digital download or available at Toronto public libraires, civic centres and City Hall.

### [Additional Education](#)

The City's website provides detailed educational information on other components of cycling in Toronto. They include how to perform right turns at intersections when a vehicle is blocking the farthest right lane, how to activate, read and follow bicycle traffic signals, where to position oneself in green bike boxes, how to avoid car "dooring" (i.e., when someone opens parked car's door into path of a cyclist), how to cycle around transit vehicles, and how to safely pass another cyclist in a bicycle lane.

### [StreetSmartsTO](#)

The City created StreetSmartsTO, an initiative to help support Toronto's growing community of cyclists. StreetSmartsTO's goal is to help increase people's awareness, knowledge and improve upon cycling skills to empower people to start cycling or continue to cycle in Toronto. They offer a variety of workshops, produce numerous cycling training videos (offered in different languages), and provide additional information like how to plan cycling trips, how to continue riding in the winter months and how to shop and store items on the bicycle (i.e., types of racks or baskets to install, alternatives to racks, etc.).

### [CAN-BIKE](#)

The City offers information on CAN-BIKE, the only accredited program designed by Cycling Canada that teaches cycling rules and safety led by certified instructors. CAN-BIKE courses can be arranged for workplaces and organizations.

### [Cycling Laws](#)

The City provides a list of relevant rules and by-laws that govern cyclist and other vehicles to ensure all road users cooperate and travel safely when sharing the road. The *Highway Traffic Act* and the City municipal codes (or by-laws) together regulate the safe use of roads and dictate how cyclists are to use different cycling infrastructures. Monetary fines are listed for infractions of rules and laws, including a \$150.00 fine for parking a vehicle in a bicycle lane, \$60.00 fine if a cyclist under the age of 18 years is not wearing a bicycle helmet, \$110.00 fine for improper bicycle lighting, and a \$305.00 fine if a motorized vehicle (including some e-scooters) is caught riding along park paths or multi-use trails. Information on how to contact Toronto Law Enforcement is provided along with the types of collision scenarios in which police will attend (i.e., collision involving a pedestrian, cyclist or person in wheeled device).

Rules and by-laws governing drivers of motor vehicles include the prohibiting of stopping or parking in bicycle lanes or tracks, allowing sufficient space and keeping at least a one metre distance from the cyclist when passing them.

By-laws governing cyclists include the use of sidewalks, use of electric bicycles (e-bikes), e-scooters, and electric kick-scooters, requirements of bike lights and use of bike helmets, what types of bicycles (including all electric versions) are allowed on specific roads or bike lanes, and requirements for TTC's streetcars.

## “Meanings” of Cycling in Toronto

### Cycling Events and Programs

The City provides information on its partnerships that promote cycling initiatives and programs that raise awareness of cycling as an efficient mode of transportation. Starting in 2012 the City partnered with *Cycle Toronto* (a charity focused on advocacy, education and community building to improve the city's cycling culture) to engage in community-based cycling programs and events.

### Bike Month

Coordinated by Cycling Toronto and occurring during the early summer month (May 31st – June 30<sup>th</sup>), *Bike Month* is an annual community engagement initiative that hosts various events focused on empowering and encouraging the public to cycle. Bike Month is an opportunity for community members to cycle for the first time, gain new skills or connect with other cyclists. To incentivize participation, contests, and prizes for activities like “Bike Bingo” and total kilometres cycled during the month.

### ActiveTO

*ActiveTO* is a set of initiatives deployed by the City during the COVID-19 pandemic that focused on creating additional space for the public to commute and travel via bicycles while respecting physical distancing health guidelines. Initiatives include short-term, recurring road closures of major streets on weekends, rolling out the “quiet streets” program in some neighborhoods (i.e., erecting temporary barricades and signs to encourage slow, local vehicle access only), and additional pilot studies to expand the cycling network for potential future permanent development.

To understand the impacts that ActiveTO initiatives had on the community, the City in partnership with Park People and the Centre for Active Transportation undertook a public survey of people utilizing the major road closures. The surveys explored the impact of the road closure initiatives on respondents physical activity levels, mental health and cycling adoption. In general, the survey

found that the road closure helped respondents be more active, they felt safer while cycling and were able to comply with physical distancing guidelines. A majority of respondents (70%) lived 5 km or less from the closed road, and over a quarter of cyclist (29%) were new cyclist. New cyclists and those returning to cycling included more women, people identifying as Black, Indigenous or people of colour compared with long-time existing cyclists (typically white males). 92% of respondents reported a high degree of support for continuing the initiative both during and after the COVID-19 pandemic.

### Cycling Public Consultations

The City consistently engages with the public and local communities on upcoming cycling projects to gain insights and receive feedback either in person or online. Public consultations are an important step in the City's project development process and directly provides the public with an avenue to learn about future projects and gives them an opportunity to ask questions. The City also provides information and outcomes on previously held consultation sessions on other potential projects.

### Cycling Advocacy Groups, Organizations and Clubs

Within the City there are over a dozen cycling advocacy groups, organizations, and clubs focused on building and promoting cycling culture through advocacy, education, promotional events, campaigns, research and networking. Cycling organizations include: Advocacy for Respect for Cyclists, Culture Link, Cycle Toronto, High Park Bicycle Club, Toronto Bicycling Network, Toronto Centre for Active Transportation, Ontario by Bike and Waterfront Trust. Bicycle clubs available in the City include: Beaches Cycling Club, Dark Horse Flyers Cycling Club, D'Ornellas Cycling Club, LapDogs Cycling Club, Les Domestiques, Morning Glory Cycling Club, Outdoor Club of East York, Toronto Bicycle Club and Toronto Bicycling Network.

### Discussion

#### *Materials in Toronto*

The consensus within the cycling literature is that a well-designed and comprehensive cycling infrastructure is a critical component to encourage cycling behavior and increase cycling rates (Pucher et al, 2009; Pucher et al., 2011; Frank et al., 2021; Furth 2021). According to the City's online publications, Toronto appears to offer a diverse amount of cycling infrastructures, focusing on expanding and improving the cycling network on an annual basis. It prioritizes developing and investing in cycling infrastructure through the establishment of the Cycling Network Plan (CNP). The CNP's mandate which focuses on filling gaps, expanding, and improving the quality and quantity of the cycling network demonstrates the City's continuous commitment to designate and re-design public road spaces to accommodate the growing interest of cycling.

The value of providing ample amounts of cycling infrastructure (specifically bicycle lanes and paths) is to increase the sense of safety for all riders, whether it is perceived or actual safety and protection from serious injuries and fatalities (Assuncao-Denis & Tomalty, 2019; Bruno & Nikolaeva, 2020; Pucher & Buehler, 2006). The varying types of cycling infrastructure are important to consider as different types accommodates different cyclists' comfort and perception of safety. Women, young people, less experienced and risk adverse cyclists are partial to bicycle paths and lanes that are separate from motor vehicle traffic and have physical barriers or buffer zones as these increases the perception of safety (Pucher & Buehler, 2017). Misperception of safety can act as a serious barrier to cycling uptake (Savan et al., 2017). In general, safer cycling encourages more people to consider cycling which increases more investments in cycling infrastructure and facilities. Growth of cycling rate supports the prioritization of more infrastructure, more cycle training, more consideration by motorist of cyclists, amounting to making cycling safer for all (Pucher & Buehler, 2006). This domino effect exemplifies Shove et al.'s (2012) social practice theory, whereby the types of cycling infrastructure (the 'materials') can represent protection and safety for a cyclist (the 'meanings') and therefore allowing cyclist to feel more comfortable and able bodied to take up cycling (the 'competences'). The value of well-designed cycling infrastructure is not just in allocating road space for cyclists, but also in what they represent and how easily they can be used by all.

Municipalities with higher rates of cycling have higher percentage of safe cycling, whereas municipalities with low cycling rate have lower rates of safe cycling. The inference is that there is a likely causation that runs in both direction regarding cycling rates and safety; safer cycling environments induces more cycling and more cycling fosters greater sense of safety (Pucher & Buehler, 2008; Pucher et al., 2011). The City has 119 km of cycling infrastructure projects underway, 40.78 km of projects renewed or fixed, 111.66 km of projects under pilot study and another 21.19 km approved for future implementation, for a total of 292.63 km worth of improvements and investments, in addition to the existing 367 km of on-street and 386 km of off-street cycling lanes. The assumption is that as the City increases its cycling infrastructure, cycling fatality and serious injury will decrease, thereby increasing cycling rates (Young et al., 2020).

New York, London and Paris experienced a similar outcome. All three cities saw a steep decline in their cyclist fatality rates between 2000 and 2017 of 57%, 63% and 84% respectively, attributing the reduction to the theory of "safety in numbers" and vast expansion and improvements of their cycling infrastructure over the same period (Pucher et al., 2021). New York City expanded their network of on and off-street bike lanes by sevenfold between 2000 and 2019, increasing from 284 km to 2,103 km; London increased its cycling network by five times between 2001 and 2017 from 435 km to 2,179 km; and Paris increased its cycling network by six times between 1999 and 2019,

going from 151 km to 941 km (Pucher et al., 2021). Without quantitative data on Toronto's current cyclist fatality and serious injuries rates to measure against the City's total number of kilometres of bike lanes, this paper is unable to examine whether the two variables had any impact on Toronto's cycling rates. Notwithstanding the lack of data, the City appears to have the potential to improve the perception of cycling safety through additional development of cycling infrastructure.

While the CNP provides up-to-date information on the amount of kilometres cycling paths being developed, it does not provide details on newly constructed or improvements of bicycle parking facilities. A lack of ample parking facilities and options can present significant barriers to cycling and/or the consideration of cycling (Agarwal & North, 2012; Pucher et al., 2021), making them an equally vital component of the overall cycling infrastructure. Despite the City's acknowledgment that bicycle parking is a fundamental component of bicycle trips, the City has not published information on total number of bicycle parking spaces available nor information related to pilot projects or potential plans for development. As a 'material' element of the practice of cycling, insufficient bicycle parking could deter a cyclist from engaging in the practice all together and/or limit their ability to engage in the practice. Additional information on bicycle parking and improvements would be an important measurement to evaluate how it encourages cycling (Pucher et al., 2011).

Public bike share programs like BikeShare Toronto have help legitimizes a cycling culture (Savan et al., 2017) and democratize cycling (Assuncao-Denis & Tomalty, 2019) by way of providing temporary access (i.e., access to 'materials' of cycling) and equal opportunity to the public. The more widely available and ubiquitous the bicycle becomes, the more likely it is to be used (Pucher & Buehler, 2017). Studies have shown that cities that adopt similar public bike sharing programs experienced a notable increase in bicycle trips. For example, in Barcelona the proportion of trips by bicycle increased from 0.75% to 1.75% after the roll out of *Spicycles* (now called *bicing*) and from 1.0% to 2.5% in Paris (Romero, 2008; Nadal, 2007; Pucher et al., 2010). With its 6,850 bikes located at 625 stations along the City's cycling network, BikeShare Toronto helps reduce financial barriers to cycling, provides alternative modes of transportation for short-distance trips, (i.e., less than 5 km), and reinforces the perception and image that Toronto is a cycling city by locals, visitors, and tourists alike. Although this paper is unable to explicitly measure the number of public bikes against proportion of trips taken by bicycles or its impact on cycling rates, the literature would suggest that the availability of a public bike sharing program at the very least encourages cycling as a practice rather than discourages it.

## *Competences in Toronto*

Policies and programs that are intended to increase cycling or indirectly increase cycling can complement cycling infrastructure investments, ensuring that investments are fully utilized (Pucher, Dill, & Handy, 2010; Heinen & Handy, 2021). In other words, “soft” interventions or non-infrastructure initiatives are needed to cultivate cycling practices at scale and in turn, improve cycling rates. Policies and programs can either promote, encourage, or incentivize cycling or they can denounce and discourage other behaviors that lean towards cycling as an alternative option (Heinen & Handy, 2021). Within the context of Toronto, certain skills and knowledge are emphasised over other general cycling tips and education, suggesting that a set of specific level of competence is required to cycle in Toronto.

To overcome these potential competence barriers, interactive and noninteractive initiatives were used to disseminate cycling competences. The City has published free information related to cycling tips, guides, and education unique to the City on their website. For example, information is provided on the City’s website on how to cycle around TTC streetcars and railway tracks to avoid injuries from trapped wheels, while also educating and highlighting specific city by-laws related to the streetcars. The cycling handbooks which have been published in fourteen languages and is available for free in both print and digital copy can be lauded as an inclusive strategy in its attempt to encourage the non-English speaking population of Toronto to consider cycling. However, without data on how the free information is being used or engaged with, it is difficult to evaluate whether the consumption of free information converts an individual from a reader to a practitioner of cycling. Additional research and study is required to assess the usefulness of the published information; what is the percentage of people accessing the information and handbooks; what percentage started cycling after engaging with the information; how effective has the translated material been in encouraging non-English speaking population to cycle?

StreetSmartsTO and CAN-BIKE both employ an interactive and hands-on approach of developing ‘competences’ of cycling through workshops, training courses and training videos, to increase knowledge, training, skills and generate greater awareness of cycling culture. They have the ability to build a cyclist’s confidence, comfort levels, perceived safety and awareness of local traffic laws (Sersli et al., 2021), making education and training a critical component in engendering cycling uptake. StreetSmartsTO in partnership with Cycle Toronto offers workshops and host events throughout the year that focuses on a variety of cycling related topics unique to Toronto. According to the “Past Events” listed on the Cycle Toronto website, 80 workshops and events were held between January 2021 and January 2022 on topics such as winter route planning, bike safety,

safe cycling, road rules, commuting by bike and family biking. Information on total number of participants in these workshops and events are unavailable, making it challenging to measure their impacts on improving 'competences' of cycling and influencing cycling rates. Notwithstanding the limited data mentioned herein, programs designed to encourage and build cycling competences remain valuable in inducing behavioral changes.

These workshops and training courses adopt commitment strategies or foot-in-the-door strategies, which are "critically important in moving people from intention to action" (Savan et al., 2017, p. 242). In general, the strategies requiring small initial commitments have proven to successfully encourage new and occasional cyclists to try cycling while simultaneously lowering preconceived barriers and inducing positive attitudes and perceptions about cycling (Savan et al., 2017; Stokell, 2010). In some cases, multiple sessions, or a few hours worth of training can have lasting impact on the trainee. In Sydney, Australia for example, adults who participated in a six-hour bicycling proficiency training program felt more confident and comfortable with cycling after the training and maintained that feeling two months after completing the program (Telfer et al., 2006; Heinen & Handy, 2021). Despite their benefits, workshops and training programs are typically voluntary in nature and may only be effective in attracting people who already expressed interest or intentions to take action.

Alternatively, mandatory 'competence' or cycling training programs and initiatives could be adopted within an educational curriculum. Cities in the Netherlands, Germany and Denmark maintain cycling levels that are ten times higher than cities in the United Kingdom and the USA (Pucher & Buehler, 2008) and are often praised for their strong cycling culture. As part of their regular school curriculum, Dutch, Danish and German children receive extensive training in safe and effective cycling techniques and complete these courses by the fourth grade. Within the framework of SPT, developing the 'competences' for the practice of cycling at a young age helps ingrain the essential skillsets and knowledge while normalizing the practice as the rider ages.

The City has the available information and training programs that are helpful to individuals who have preconceived interests in either learning and/or improving their existing cycling competences. However, if the intentions and goals of these training programs are to instill greater cycling competence in the general public, the City will have to develop more strategies that incentivizes and encourages non-cyclists to participate in the programs. The City could also explore ways in which cycling training and education is mandatory (i.e., a part of primary school's physical education curriculum) or forms part of an existing licensing system (i.e., driver's licence process) to help disseminate cycling competences.



## Meanings in Toronto

The existence of a cycling culture is considered by some scholars a fundamental component to increasing cycling rates in a city (Assuncao-Denis & Tomalty, 2019; Savan et al., 2017; Caldwell & Boyer, 2019). Understanding what cycling and the bicycle itself symbolizes could have implications on policies, events, and programs that are developed and implemented in the City. Cycling culture can manifest in overt and subtle ways which the City has shown to cultivate in several initiatives.

The City's partnership with Cycle Toronto, which allows the latter to promote community-based cycling programs and events is a form of social reinforcement that promotes and sustains cycling behavior (Savan et al., 2017). Its partnership is a direct signal from the City that it too supports cycling advocacy and chooses to collaborate with the charity to develop policies and programs that support Cycle Toronto's mission of providing a *"safe, healthy and vibrant cycling city for all"* (Cycle Toronto, n.d.). Annual events like Bike Month can serve as a mass marketing tool, increase awareness of comfort and enjoyment of bicycling. The various types of events that occur throughout Bike Month are intended to build a sense of community around bicycling by providing people with opportunity to try cycling in a safe, engaging and fun environment.

The ActiveTO initiative saw short-term, recurring road closure of major streets on the weekends. The initiative gained overwhelmingly positive responses from new and current cyclists of all demographics, with a majority of them showing support to have ActiveTO become a permanent initiative. 92% of the 359 survey respondents support the continuation of temporary road closure during the COVID-19 pandemic; 95% support the continuation of the initiative after the pandemic; 96% felt comfortable and safe while walking and/or cycling on the closed roads; 29% were new cyclists or returning cyclists and of the 29%, 77% attributed the road closure in helping them discover or re-discover cycling again. These responses were expected given that "mass cycling events, often fun, community-based promotional activities are known to attract new and novice cyclist and get them interested in cycling and in the cycling community" (Bowles et al., 2006; Mason et al., 2011, Sloman et al., 2010; Savan et al., 2017, p. 243). These types of large-scale road closures have been recognized as a promising and effective approach in promoting cycling, physical activity, building social capital, enhancing social inclusion, and exposing cycling to nearby communities (Mason et al., 2011; Sarmiento et al., 2010; Savan et al., 2017). When Shove et al.'s (2012) SPT is applied, open street initiatives appear to have all three elements of 'materials', 'competences' and 'meanings' present and interacting. Open vehicle-free roads (the 'materials') lowers the perception of danger and increase perception of safety (the 'meanings'), which in turn provides an opportunity for all types of cyclists (experienced, returning, novices) and demographics to cycle (the 'competences').


When people can visibly see and are surrounded by cycling culture, cycling as a social practice is more likely to be adopted as a normalized behavior (Pucher et al., 2009). Advocacy organizations and clubs help sustain cycling visibility and culture through their advocacy campaigns, networking, and community-based events. Within the City, there are at least nine groups known and listed who provide year-round cycling support and events that act to sustain and encourage cycling behaviors, which in part helps embed cycling as an everyday routine. Their involvements are vital in creating an accessible, positive, and supportive environment which promotes and perpetuates cycling and pro-cycling behavior (Savan et al., 2017; Aldred & Jungnickel, 2012; Bauman et al., 2008). The literature suggests that the existence of these groups and clubs help sustain cycling culture; however additional research is required to study and evaluate their role in improving cycling rates and inducing the practice of cycling in the general population. At this time, this study is unable to assess if the number of club members can or has influenced cycling rates in Toronto.

Public consultations, surveys and feedback are important tools for City planners to gain valuable insights and engage directly with the local community on cycling related policies and infrastructure. In other words, mechanisms that allow for civic involvement, active collaborative participation and encourages two-way interactions provides greater opportunities for concerns, nuances, needs and interest to be raised between City planners and effected community members (Marquart et al., 2020). By incorporating a participatory and collaborative process, the City demonstrates that it values community members' suggestions and concerns when developing cycling interventions to ensure cycling projects and plans accurately meet the community's needs while mitigating any potential barriers of the local environment. Copenhagen, widely accepted as the world's most bicycle friendly city, routinely integrates suggestions from cyclists in their planning decisions to ensure decisions are inclusive of cyclists' emotional experiences, perception of the environment and possible areas of improvement (Marquart et al., 2020). However, it is unclear whether public consultations, surveys and feedback processes improves cycling rates in Toronto. Additional study is required to assess their contributions in inducing behavioural changes where cycling is adopted as a normalized practice.

## Conclusion

Toronto's cycling interventions, programs and initiatives have been examined and described in terms of Shove et al.'s (2012) three elements of the social practice theory; *materials*, *competences* and *meanings*. This theoretical framework was used to assess and evaluate what the City is doing and/or what it can do more of to influence large scale behavioral changes to induce cycling as a normalized practice to potentially meet their TransformTO goals. The available data found on the City's website indicates a comprehensive and holistic strategy that has been used to steadily improve cycling rates. This would suggest that Toronto's range of cycling initiatives and programs aligns with the elements required to ignite behavioural changes that positively perceives and

normalizes cycling as an everyday mode of transportation. Cities that are most successful in increasing and sustaining cycling rates have done so by deploying a fully integrated package of infrastructure investments, policies and programs (Pucher, Dill & Handy 2010; Pucher et al., 2011).

For “materials”, the City’s primary infrastructure focus and investments seems to be on re-designing major roads and residential streets to incorporate a wide variety of cycling lanes and paths. Public bike share program has been used to provide greater access and improve availability of bikes to the public, although there is a lack of information on the City’s progress on additional parking facilities. For “competences”, cycling guides, tips, education, related by-laws and rules, handbooks, training videos, training courses and workshops are all made available for voluntary access. However additional research is required to evaluate how effective these educational and training initiatives have been on improving cycling rates. For “meanings”, the City regularly offers year-round small and large scale community-based events, programs, initiatives and public consultations that increases cycling visibility.

Through the lens of Shove et al.’s (2012) SPT, the City’s aggregate total of cycling initiatives demonstrate that it has the required elements to induce behavioural changes whereby the adoption of cycling becomes a normalized practice. That is to say, the City appears to be engaging in all the appropriate activities generally known to increase overall cycling rates, but nevertheless there are areas the City should focus on and concrete their efforts towards in the next eight years. The City should focus and give equal prioritization to other types of cycling infrastructure developments and improvements such as building additional bicycle parking facilities at schools, work places, and transit hubs; creating more bike repair shops; and integration cycling infrastructure with public transit systems. In tandem, the City should also focus on strategizing ways to significantly improve participation in cycling education and training programs to increase cycling competence in the general population. Given the City’s ambitious TransformTO goal of having “75% of school/work trips under 5 km be walked, biked or by transit by 2030”, significant efforts and investments in the areas of cycling “materials”, “competences”, and “meanings” are required to improve cycling rates in the next eight years.

## Recommendations

Below are some recommendations the City may wish to consider to inform their efforts and strategies in improving cycling rates.

### Recommendations in *Materials*

#### *Invest in Scarborough*

Distance between destinations is one of critical factors influencing an individual’s decision to cycle (Heinen & Handy, 2021), which suggest that cycling infrastructure investment need to be focused

in areas with high density development and mixed land uses to encourage cycling decisions. As suggested by Sorensen et al., (2021), the investments of cycling infrastructure should be extended beyond the City's downtown core and include the City's suburban area, Scarborough. Despite Scarborough being a post-war suburb dominated by motor vehicles, it manages to have characteristics and qualities that could allow cycling to thrive with proper investments and promotion. Scarborough has many areas of high-density neighborhoods with major mixed-use corridors, mostly located near arterial roads, where as much as 97% of residents, jobs and businesses are within 1 km of on-street or a major route (Sorensen et al., 2021). This means a majority of the trips in and around these clusters are less than 5 km, a distance that is considered feasible by bike (Young et al., 2020). Higher density land usage and mixed-use corridors with large numbers of short trips are ideal places to develop cycling infrastructure to encourage active transportation.

#### *Expand Secured Parking Facilities*

In addition to the expansion of the cycling network, the City should concurrently increase secured bicycle parking facilities. The City could consider adopting mechanisms in building codes and zoning by-laws that mandates land developers to include sufficient amount of secured bicycle parking facilities, either for public usage or private residence use. For example, neighborhoods with high concentration of nearby apartment buildings (i.e., CityPlace Toronto, Liberty Village, St. James Town, Yonge & Eglinton, the Gay Village) and employment hubs (i.e., the Financial District) be designed with widely accessible and secured bicycle parking facilities and cycling related amenities to encourage more people to commute by cycling. Beyond engaging private land developers to increase bicycle parking facilities, the TTC should also re-design their transit terminals and stations to expand and increase secured bicycle parking capacities. TTC subway stations and terminals, where space is available, should prioritize developing secured bicycle parking facilities instead car park spaces.

#### *Recommendations in Competences*

##### *Mandatory Cycling Training and Education*

To improve and embed greater cycling skills and training amongst the general population, the City could look into partnering with educational institutions and incorporate cycling into the curriculum (similar to those found in the Danish, German and Dutch school curriculum (Pucher & Buehler, 2008)). This would increase the likelihood of more children having equal opportunity to learn cycling education and improve their cycling skills, which they could retain into adulthood.

The City could also explore ways to incorporate cycling education and training into existing licensing procedures (i.e., form part of driver's license examination). This will likely require the City

to partner with the Ontario Ministry of Transportation who oversees vehicle licensing regulations and policies.

### *Recommendations in Meanings*

#### *Build Cycling Economy and Increase Access*

Local businesses and residents could stand to mutually benefit from a robust cycling economy. As cycling rates and cycling infrastructure increases, the associated net benefits to local businesses and resident also increase through increase in sales, commercial and residential property values and decreases in commercial vacancy rates (Arancibia, 2013; Ledsham & Savan, 2017). In order to capture the benefits, the City should begin broadly promoting the economic benefits of cycling to residents and business, creating advocacy group for businesses interested in environmentally friendly transportation for employee, and engage in promotional campaigns regarding positive economic impacts of cycling in neighborhood that are due for road construction or revitalization. As a demonstration of the economic value of a cycling economy, a study calculating the internal and external benefits of cycling in the EU estimated that the minimum annual economic benefit of cycling was between €205.2 – €217.3 billion (Küster & Blondel, 2013). There is strong evidence that suggest the positive relationship between commercial areas with cycling infrastructure and increased business activity (Arancibia, 2013), reinforcing the benefits of promoting cycling economy.

The City could consider using fiscal incentive programs and policies to induce greater cycling rates. “Costs are often assumed to be key determinant of a mode choice” (Heinen & Handy, 2021, p.124), which can be a deterrent or an encouragement. The City or City partners could offer tax rebates and/or financial support for the purchase of bicycles and bicycle equipment’s. Widely available and accessible bicycle service and repair shops should be created and supported throughout the City, especially in the underserved neighborhoods. Making the bicycle and related services as universally accessible and ubiquitous as possible through subsidized programs for high needs populations will encourage more people of varying socioeconomic levels to try cycling at a low cost (Ledsham & Savan, 2017).

Overall, the City of Toronto is engaging in cycling initiatives and interventions that are understood to improve cycling rates. The City maintains the components required by social practice theory to help induce the cycling behaviors that would improve cycling rates. However, all three areas of cycling “materials”, “competences” and “meanings” require some improvements and additional efforts if the City remains dedicated on achieving its ambitious TransformTO goals. Recommendations are to focus on developing a comprehensive cycling infrastructure that includes areas of Scarborough; more parking facilities, bike repair shops and having greater integration with public transit systems; developing strategies to increase mandatory participation

in cycling education and training, either through schools or licensing systems; promoting the benefits of a cycle economy and increasing access to bicycle materials through government subsidies and/or financial incentives.

## References

- Agarwal, A., & North, A. (2012). Encouraging Bicycling among University Students. *Canadian Journal of Urban Research*, 19.
- Aldred, R., & Jungnickel, K. (2014). Why culture matters for transport policy: The case of cycling in the UK. *Journal of Transport Geography*, 34, 78–87. <https://doi.org/10.1016/j.jtrangeo.2013.11.004>
- Arancibia, D. (2013). *Cyclists, Bike Lanes and On-Street Parking: Economic Impacts*. Toronto Cycling Think & Do Tank. [http://www.torontocycling.org/uploads/1/3/1/3/13138411/daniel\\_arancibia\\_ce\\_report\\_bike\\_lanes\\_december\\_10.pdf](http://www.torontocycling.org/uploads/1/3/1/3/13138411/daniel_arancibia_ce_report_bike_lanes_december_10.pdf)
- Assunção-Denis, M.-È., & Tomalty, R. (2019). Increasing cycling for transportation in Canadian communities: Understanding what works. *Transportation Research Part A: Policy and Practice*, 123, 288–304. <https://doi.org/10.1016/j.tr.a.2018.11.010>
- Bruno, M., & Nikolaeva, A. (2020). Towards a maintenance-based approach to mode shift: Comparing two cases of Dutch cycling policy using social practice theory. *Journal of Transport Geography*, 86, 102772. <https://doi.org/10.1016/j.jtrangeo.2020.102772>
- Burk, D. (2017). Infrastructure, Social Practice, and Environmentalism: The Case of Bicycle-Commuting. *Social Forces*, 95(3), 1209-1236. <https://doi.org/10.1093/sf/sow100>
- Caldwell, K. B., & Boyer, R. H. W. (2019). Bicycle commuting in an automobile-dominated city: How individuals become and remain bike commuters in Charlotte, North Carolina. *Transportation*, 46(5), 1785–1806. <https://doi.org/10.1007/s11116-018-9883-6>
- City of Toronto. (2020). *TransformTO 2019 Implementation Update*. Environment and Energy Division. <https://www.toronto.ca/wp-content/uploads/2020/11/96aa-TTO-2019-Update-June2020-FINAL-AODA.pdf>
- City of Toronto. (2021). *TransformTO Net Zero Strategy: A climate action pathway to 2030 and beyond*. <https://www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-173758.pdf>
- City of Toronto. (n.d.). *About Toronto*. <https://www.toronto.ca/community-people/moving-to-toronto/about-toronto/>
- City of Toronto. (n.d.). *Cycling in Toronto*. <https://www.toronto.ca/services-payments/streets-parking-transportation/cycling-in-toronto/>
- Cycle Toronto. (n.d.). *The Organization*. <https://www.cycleto.ca/about-cycle-toronto>
- Frank, L. D., Hong, A., & Ngo, V. D. (2021). Build it and they will cycle: Causal evidence from the downtown Vancouver Comox Greenway. *Transport Policy*, 105, 1–11. <https://doi.org/10.1016/j.tranpol.2021.02.003>
- Furth, P. G. (2021). Bicycling Infrastructure for All. In R. Buehler & J. Pucher (Eds.), *Cycling for Sustainable Cities* (pp. 81–102). The MIT Press. <https://doi.org/10.7551/mitpress/11963.003.0009>

- Heinen, E., & Handy, S. (2021). Programs and Policies Promoting Cycling. In R. Buehler & J. Pucher (Eds.), *Cycling for Sustainable Cities* (pp. 119–136). The MIT Press. <https://doi.org/10.7551/mitpress/11963.003.0011>
- Hull, A., & O'Holleran, C. (2014). Bicycle infrastructure: Can good design encourage cycling? *Urban, Planning and Transport Research*, 2(1), 369–406. <https://doi.org/10.1080/21650020.2014.955210>
- Küster, F. and Blondel, B. (2013). *Calculating the economic benefits of cycling in EU-27*. European Cyclists' Federation. <https://ecf.com/groups/calculating-economic-benefits-cycling-eu-27>
- Larsen, J. (2017). The making of a pro-cycling city: Social practices and bicycle mobilities. *Environment and Planning A: Economy and Space*, 49(4), 876–892. <https://doi.org/10.1177/0308518X16682732>
- Ledsham, T. & Savan, B. (2017). *Building a 21<sup>st</sup> Century Cycling City: Strategies for Action in Toronto*. Metcalf Foundation. <https://metcalfoundation.com/publication/building-a-21st-century-cycling-city/>
- Marquart, H., Schlink, U., & Ueberham, M. (2020). The planned and the perceived city: A comparison of cyclists' and decision-makers' views on cycling quality. *Journal of Transport Geography*, 82, 102602. <https://doi.org/10.1016/j.jtrangeo.2019.102602>
- Pucher, J., & Buehler, R. (2006). Why Canadians cycle more than Americans: A comparative analysis of bicycling trends and policies. *Transport Policy*, 13(3), 265–279. <https://doi.org/10.1016/j.tranpol.2005.11.001>
- Pucher, J., & Buehler, R. (2008). Making Cycling Irresistible: Lessons from The Netherlands, Denmark and Germany. *Transport Reviews*, 28(4), 495–528. <https://doi.org/10.1080/01441640701806612>
- Pucher, J., & Buehler, R. (2017). Cycling towards a more sustainable transport future. *Transport Reviews*, 37(6), 689–694. <https://doi.org/10.1080/01441647.2017.1340234>
- Pucher, J., Buehler, R., & Seinen, M. (2011). Bicycling renaissance in North America? An update and re-appraisal of cycling trends and policies. *Transportation Research Part A: Policy and Practice*, 45(6), 451–475. <https://doi.org/10.1016/j.tra.2011.03.001>
- Pucher, J., Dill, J., & Handy, S. (2010). Infrastructure, programs, and policies to increase bicycling: An international review. *Preventive Medicine*, 50, S106–S125. <https://doi.org/10.1016/j.ypmed.2009.07.028>
- Pucher, J., Parkin, J., & de Lanversin, E. (2021). Cycling in New York, London, and Paris. In R. Buehler & J. Pucher (Eds.), *Cycling for Sustainable Cities* (pp. 321–346). The MIT Press. <https://doi.org/10.7551/mitpress/11963.003.0021>
- Savan, B., Cohlmeier, E., & Ledsham, T. (2017). Integrated strategies to accelerate the adoption of cycling for transportation. *Transportation Research Part F: Traffic Psychology and Behaviour*, 46, 236–249. <https://doi.org/10.1016/j.trf.2017.03.002>
- Sersli, S., Gislason, M., Scott, N., & Winters, M. (2022). Easy as riding a bike? Bicycling competence as (re)learning to negotiate space. *Qualitative Research in Sport, Exercise and Health*, 14(2), 268–288. <https://doi.org/10.1080/2159676X.2021.1888153>
- Shove, E., Pantzar, M., and Watson, M. (2012). *The Dynamics of Social Practice: Everyday Life and How it Changes*. SAGE Publications.

Siemiatycki, M., Smith, M., & Walks, A. (2016). The politics of bicycle lane implementation: The case of Vancouver's Burrard Street Bridge. *International Journal of Sustainable Transportation*, 10(3), 225–235. <https://doi.org/10.1080/15568318.2014.890767>

Sorensen, A., Bortolussi, I., Chong, I., Gowie, J., Shankar, N., and Vigayan, K. A. (2021). *The Scarborough Opportunity: A comprehensive walking and cycling network*. University of Toronto Scarborough Suburban Mobilities Research Cluster. <https://www.utscc.utoronto.ca/suburban-mobilities/sites/utscc.utoronto.ca/suburban-mobilities/files/docs/Scarborough%20Opportunity%20October%202021%20%281%29.pdf>

Spotswood, F., Chatterton, T., Tapp, A., & Williams, D. (2015). Analysing cycling as a social practice: An empirical grounding for behaviour change. *Transportation Research Part F: Traffic Psychology and Behaviour*, 29, 22–33. <https://doi.org/10.1016/j.trf.2014.12.001>

UN Environment Programme. (n.d.). *Cities and climate change*. <https://www.unep.org/explore-topics/resource-efficiency/what-we-do/cities/cities-and-climate-change>

Verlinden, Y., Manaugh, K., Savan, B., Smith Lea, N., Tomalty, R., and Winters, M. (2019). *Increasing Cycling in Canada: A guide to what works*. The Centre for Active Transportation, Clear Air Partnership. <https://www.tcat.ca/wp-content/uploads/2019/09/Increasing-Cycling-in-Canada-A-Guide-to-What-Works-2019-09-25.pdf>

Yang, L., Sahlqvist, S., McMinn, A., Griffin, S. J., & Ogilvie, D. (2010). Interventions to promote cycling: Systematic review. *BMJ*, 341, c5293–c5293. <https://doi.org/10.1136/bmj.c5293>

Young, M., Savan, B., Manaugh, K., & Scott, J. (2021). Mapping the demand and potential for cycling in Toronto. *International Journal of Sustainable Transportation*, 15(4), 285–293. <https://doi.org/10.1080/15568318.2020.1746871>