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Do neighbourhood environmental perceptions affect practices?

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Abstract
In this paper, we examine how environmental practices related to public transit and urban green space use are influenced by perceptions of local level environmental change, neighbourhood inhabitation, and socio-demographic factors. The analysis shows that perceptions of change and neighbourhood inhabitation offer better explanations for changing local environmental practices than socio-demographic orientations. We contribute to social practice theory by drawing attention to the interplay of environmental perceptions and neighbourhood inhabitation as factors that facilitate changing environmental practices. By gaining insight into the relationship between perceptions of change and environmental practices, we thereby learn how sustainability goals, such as those embodied by SDG11, can be translated into social practices at the community level.

Keywords: neighbourhood; Sustainable Development Goals; urban green space; public transit; Atlantic Canada; social practice theory

Résumé
Dans cet article, nous examinons comment les pratiques environnementales liées au transport en commun et à l'utilisation des espaces verts urbains sont influencées par les perceptions du changement environnemental au niveau local, l'habitation des quartiers et les facteurs sociodémographiques. L'analyse montre que les perceptions du changement et de l'habitat du quartier offrent de meilleures explications pour l'évolution des pratiques environnementales locales que les orientations sociodémographiques. Nous contribuons è la théorie de la pratique sociale en attirant l'attention sur l'interaction des perceptions environnementales et de l'habitation du quartier en tant que facteurs qui facilitent l'évolution des pratiques environnementales. En acquérant un aperçu de la relation entre les perceptions du changement et les pratiques environnementales, nous apprenons ainsi comment les objectifs de durabilité, tels que ceux incarnées par ODD (Agenda 2030 du développement durable), peuvent être traduits en pratiques sociales au niveau communautaire.

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Introduction

A problem with umbrella terms, such as 'sustainable development,' is that they are too easily connected to a broad range of social practices and often hold little substance to people and their experiences on the ground. The United Nations Sustainable Development Goals (SDGs) attempt to bridge this gap by articulating a range of concrete actions that can be implemented across social and political settings (Whitmee et al. 2015). The 11th Sustainable Development Goal (SDG11), Make Cities Inclusive, Safe, Resilient and Sustainable, advocates for access to affordable and public transport systems, protecting urban cultural and natural heritage, addressing municipal air quality, increasing access to green spaces, and increasing municipal climate change mitigation and adaptation (United Nations 2018). This vision of sustainable cities informs local sustainability plans by cities around the world (Barnett and Parnell 2016; McGranahan, Schensul, and Singh 2016; Schmidt et al. 2021). This vision is also echoed in the work of the C40 Cities Climate Leadership Group, which represents 96 cities worldwide (C40 Cities 2020). As Schmidt et al. (2021) note, localizing the global agenda is "crucial" to connect the SDGs more effectively with community needs and action, while municipalities have a vital role to play in ensuring progress towards these global goals. However, to successfully translate the SDGs at the municipal level, we need a better understanding of how they are taken up as social practices.

Using survey data of subjective perceptions of social-ecological change in four small-to-medium sized cities in Atlantic Canada (Charlottetown, Prince Edward Island; Halifax, Nova Scotia; Moncton, New Brunswick; and St. John's, Newfoundland and Labrador) we ask if people act on their understandings of environmental change in ways that help advance urban sustainability goals. More specifically we assess how they affect public transit use and use of green spaces because both are key dimensions of sustainable cities as envisioned in SDG11. These practices align with the sustainability plans of these Atlantic Canadian cities and reflect models of sustainability that emphasize environmental and human health co-benefits (Whitmee et al. 2015). We draw on social practice theory to assess whether and how subjective perceptions of change in urban environments are converted into greater engagement with pro-environmental practices. Our analysis is guided by three questions. First, do subjective perceptions of change in local environment correlate with increasing pro-environmental practices? Second, does length of time living in a community correlate with increasing pro-environmental practices? Third, do sociodemographic factors like gender, race, or class, correlate with increasing pro-environmental practices?

If cities want to make meaningful progress on environmental change, then planners and researchers need to better understand what makes people change their environmental practices. Understanding these relationships in more detail allows us to identify possible points of intervention for cities to achieve sustainability goals, such as those embodied by SDG11.

From perception to practice

Environmental issues like climate change, biodiversity loss, and declining ocean health are international concerns that impact communities around the world. The UN SDGs evolved to create actionable goals to address these issues at the national and subnational levels. However, environmental change is experienced at the local community level and this means that it is at that level that change will be achieved. As such, global environmental governance tools like the SDGs need to be implemented with an eye to local perceptions of environmental change and success can be measured through changes in practices. This is particularly important to achieving SDG11, which focuses on creating 'Sustainable Cities and Communities' (United Nations 2018). This goal acknowledges the vital role of cities as potential sites for innovation and social transformation, where change often moves faster than at the national level (McGranahan, Schensul, and Singh 2016). Furthermore, SDG11 positions cities as 'hubs, sites, and drivers' in the pursuit of sustainable development at the global level (Barnett and Parnell 2016). The interplay of global environmental discourse and governance, on one hand, and local environmental change and practices, on the other hand, is

increasingly examined by researchers who look at everyday environmental action at the local level (Rudel 2011; Scott 2016; Schmidt et al. 2021; Wolf, Brown, and Conway 2009).

The relationship between people's perceptions and practices has been theorized through 'social practice theory,' which is an umbrella term for various approaches that seek to understand day-to-day habits, behaviours, and routines (Bourdieu 1990; Giddens 1979; Schatzki 1996; Shove, Pantzar, and Watson 2012).[1] Social practice theory crosses a variety of social, spatial, disciplinary, and methodological areas. Practice theory has also been used in research on environmental action to look at changing material and energy consumption patterns (Sahakian and Wilhite 2014), as well as local civic engagement in urban green space governance (Krasny et al. 2015). Policies and campaigns for encouraging change in commuting behaviours also tap into environmental movement efforts to help citizens reflect on their practices and shift away from car use towards less environmentally harmful modes of transport such as public transit, bicycling, or walking (Clark, Chatterjee, and Melia 2016; Scott 2016).

Within SDG11, one of the targets is to 'provide safe, affordable, accessible, and sustainable transport systems for all … notably by expanding public transport, with special attention to the needs of those in vulnerable situations' (United Nations 2018). All four of our case study cities likewise focus on increasing transit ridership as part of achieving their sustainability goals. Similarly, Amar and Teelucksingh note that affordable, accessible, good quality transit is an equity issue bound up with 'who belongs and has "right to the city"' (Amar and Teelucksingh 2015, 58). Shifting transportation practices away from more harmful modes, such as cars, and towards less harmful alternatives, such as public transit, is key to reducing pollutant costs of human transportation and is one of the main tools cities can use to address climate change (McCreery 2013; Scanu 2019). Transit use can also have health co-benefits for users by promoting "healthier, more active" communities (Sener et al. 2020). However, encouraging people to alter their practices and utilize public transit is not an easy process. As Ozaki, Steward, and Aoyagi (2021) argue, dominant techno-economic approaches to urban planning for transportation often fail to adequately consider user perspectives and social meanings related to sustainable mobility. There is evidence that city density, accessibility, and convenience of service affect peoples' transit use (Agarwal and Collins 2016; Fang 2015). Likewise, there is evidence that positive "attitudes and perceptions" towards transit use leads to increased intention to use transit, which translates into changes in social practices (Sener et al. 2020). However, there is less research exploring the impact of people's perceptions of local environmental conditions, such as air pollution, on their transportation practices. That is, do people act on their perceptions of changing environment or subjective perceptions of environmental harm?

Working from a model of sustainability that seeks environmental and human health co-benefits, another target of SDG11 is to 'provide universal access to safe, inclusive and accessible, green and public spaces' (United Nations 2018). Increasing the accessibility and use of urban green spaces is also a common theme across our case study cities. In planning literature, parks and green spaces are increasingly viewed as a vital part of a connected urban 'green infrastructure' that should be better incorporated into urban sustainability planning to improve the social wellbeing of residents (Choudhry et al. 2015; Ernstson 2013; Ugolini et al. 2020; Zwierzchowska, Haase, and Dushkova 2021). The protection and management of green spaces is also a key part of the toolkit cities have for acting on climate change and protecting biodiversity values (Guay 2019; Scanu 2019). The ecological, sociological, psychological, and physiological benefits of green spaces are interdependent, with beneficial impacts on health and well-being as natural water and air purifiers, sound barriers to urban noise, and natural solutions to urban heat island effects, but also as spaces where people have an opportunity to connect with biodiversity and ecology (Choudhry et al. 2015; Ernstson 2013; Guay 2019). Though not all people use or have easy access to parks and green spaces, research shows that parks that are larger and have more plentiful and accessible activities are used more regularly than parks that are smaller and have fewer activities (Cohen et al. 2010). By contrast, Ugolini et al. (2020) carried out cross-national research on green space use in European cities during the ongoing COVID-19 pandemic. Their work highlights the importance of having a diverse range of accessible smaller and larger parks located throughout cities, which can meet a variety of social needs, including exercise and relaxation in nature. Quality of life can be greatly enhanced by having local parks or green spaces available, particularly as spaces for physical activity, nature-oriented play, and social interaction (Pietilä et al. 2015; Zwierzchowska, Haase, and Dushkova 2021). Altering peoples' practices to increase their use of parks and green spaces is effective for increasing well-being and improving connections with nature, thereby creating ecological, social, and health benefits (Choudhry et al. 2015; Poe et al. 2013). Given their multiple social-ecological benefits, green space accessibility can be viewed as an equity issue related to the spatial dimension of environmental justice (Ernstson 2013; Guay 2019; Haeffner et al. 2017). Again, however, less research has been done on how people's perceptions of green space affect their use of such spaces. That is, do people use green space if they perceive

it as accessible and abundant, do they stop using it if they feel it is being lost, or do they begin using it if they feel it will be lost?

Increasing the use of transit or parks and green spaces requires a transformation of practice. From the range of approaches to practice theory, we draw on Shove and colleagues' (2012) approach because it has a more applied orientation, is well-used in environmental social sciences, and offers the conceptual tools we need. Their approach emphasizes the interplay of social meanings, materials (i.e., resources and technologies), and competencies (or the know-how to engage in a practice) as elements that reinforce each other in ways that either perpetuate existing social practices or facilitate the emergence and consolidation of new social practices. From this conceptual toolkit, our empirical analysis highlights the role of social meaning because practices are influenced by an interwoven conglomeration of experiences, motivations, and meanings (Shove, Pantzar, and Watson 2012). Subjective perceptions of conditions are central to practice theory because people actively navigate their way through a variety of possible practices, which are influenced by how they see the world and how they weigh costs and benefits of action. People's perceptions of the changing world around them influence whether they see problems that require action. Perceptions thus shape the practices they choose to engage in (Hards 2011; Ozaki, Steward, and Aoyagi 2021; Wolf, Brown, and Conway 2009). Looking at environmental action and subjective perception of environment through the lens of practice theory allows us to use the actual practices of participants' day-to-day environmental engagement to understand if people alter their current practices (Franklin and Dunkley 2017, 1502). Research shows that increased environmental awareness leads to more pro-environmental behaviours (Hards 2011; Harris 2006). Environmental awareness can be gained through both direct and indirect experiences of environmental issues (Kollmuss and Agyeman 2002). Direct experiences may include seeing physical evidence of environmental degradation in neighbourhoods or local bodies of water, while indirect experiences may come from more abstract discussions of environmental issues in educational or media settings. Perceiving direct negative environmental impacts on neighbourhoods or cities can be key to influencing pro-environmental behavioural change (Cheng et al. 2017). In other words, people may not act unless they perceive a problem or need to act or change the way they practice their everyday lives. Therefore, our first hypothesis is:

H1: Those who perceive change in their local environment are more likely to change their environmental behaviours.

A second subjective factor that might affect people's actions is their sense of belonging to a community. Researchers have noted that the longer people live in their neighbourhoods, the stronger their sense of belonging and fitting in to a community (Antonsich 2010; Young, Russell, and Powers 2004). The strength of a sense of belonging to one's neighbourhood has been linked to an increased likelihood of pro-environmental practice (Wakefield et al. 2001). It also may be linked to having deeper understandings of environmental changes occurring in a community as well as demonstrates commitment to it. In their study of urban blue space (lakes, rivers, canals, etc.…), Haeffner et al. (2017) find that length of residence is a key factor influencing greater awareness of — and more frequent usage of — blue space. Conversely, however, Nilsson et al.'s (2020) research on light rail development in North Carolina found that longer-term neighbourhood inhabitation correlated with less positive views towards new transit infrastructure development. Based on previously identified links between neighbourhood inhabitation and pro-environmental behaviours, we ask whether those who have lived in their neighbourhoods for a longer period and feel a strong sense of belonging will be more likely to increase their engagement in pro-environmental social practices. Together, we consider 'fitting in' and time spent in a neighbourhood as key aspects of inhabitation. This brings us to our second hypothesis:

H2: Inhabitation, as represented by level of 'fitting in' and time spent in a neighbourhood, increases local pro-environmental practices.

The SDG11 sub-goals stress that sustainable cities must be inclusive cities, with a need to attend to the needs of women, youth, elderly populations, and people with disabilities in sustainability planning. Relatedly, several sociodemographic characteristics influence environmental perceptions and practices. As a result, to be able to understand the impact of subjective perceptions of environment on practices, these too must also be accounted for. Many researchers have found a greater affinity among women than men towards environmental concern and motivation for action

(Eisler, Eisler, and Yoshida 2003; Tindall, Davies, and Mauboulès 2003). Ecofeminist research explains this in several ways, such as arguing that a Western capitalist relationship with the environment has patriarchal tones within its understanding of nature as a resource to be subordinated, exploited, degraded, and oppressed not dissimilar to human patriarchal relationships (Stoddart and Tindall 2011; Plumwood 1993; Sturgeon 1997). Ecofeminism also points to the socially ingrained 'nurturer' roles often adopted by women, which may extend to greater environmental concern (MacGregor 2006). This literature also points to the disconnect between hegemonic masculinity and pro-environmental practices because of persistent male 'breadwinner' social expectations that prioritize economic success and competition over long-term environmental survival (Stoddart and Tindall 2011; Connell 2005).

Racial inequality also has links to environmental awareness and experience. Environmental justice research highlights the disproportionate environmental health hazards, such as air pollution or water poisoning, that affect racial minority groups and, more specifically, Black, Latino, and Indigenous communities (Bullard 1994; Mohai, Pellow, and Roberts 2009; Pellow 2004). Racialized communities may also be disproportionately impacted by issues of accessible, affordable, and reliable public transit service, as demonstrated by Amar and Teelucksingh's (2015) research on Toronto. These experiences mean that awareness of certain environmental issues is likely to be amplified for members of racialized groups. In contrast, research on demographic predictors of environmental awareness have shown that concern for the environment can decrease for racial minorities when juxtaposed against issues such as housing, employment, or job security (Mohai and Bryant 1998). Either way both sets of literature show that race impacts daily perceptions and experiences in one's environment.

Other notable sociodemographic factors that may affect environmental concern and practice include age, level of education, and income. Research shows that age is negatively correlated with environmental concern, meaning that older people show less environmental concern than younger people (Jones and Dunlap 1992; Klineberg, McKeever, and Rothenbach 1998). Education also plays a role, with more highly educated people showing greater levels of concern for the environment and commitment to environmental protection (Dietz, Stern, and Guagnano 1998; Klineberg, McKeever, and Rothenbach 1998). Education has also been found to correlate with positive perceptions of the benefits of transit use and intention to ride (Sener et al. 2020). Likewise, those with higher incomes report greater environmental concern than their lower income counterparts (Marquart-Pyatt 2008). Furthermore, in a holistic assessment of the impact of social inequality on climate mitigation, Markkanen and Anger-Kaavi (2019) note that social inequalities based on gender, ethnicity, and wealth often creates barriers to decarbonization and pro-environmental change. For these reasons, our third hypothesis is:

H3: Demographic variables such as gender, racial or ethnic identity, age, level of education, and income influence the level of pro-environmental practice people engage in.

Drawing on social practice theory, we examine how subjective perceptions of environmental change affect changes in pro-environmental practices. While doing so, we also account for other aspects of people's lives, such as neighbourhood inhabitation and sociodemographic explanations that might account for such practices. We focus on how these subjective factors and demographic characteristics contribute to increased transit use and/or increased use of parks and green spaces, both of which are dimensions of the SDG11 vision for sustainable urban environments. By testing our three hypotheses, we gain important insight into how sustainability goals, such as SDG11, might be more successfully localized and integrated into everyday social practice.[2]

Methods and data

To understand how perceptions of environmental change affect environmental practice we use data from the 2017 Perceptions of Change survey, which examines perceptions of economic, social, and cultural, and environmental change in four Canadian cities (Charlottetown, Prince Edward Island; Halifax, Nova Scotia; Moncton, New Brunswick; and St. John's, Newfoundland and Labrador). A sample of 1,848 participants was surveyed by telephone from April to October of 2017. The survey had a 95% confidence level and a standard error of 0.025. Participants were recruited through a random selection of telephone numbers assigned to the four cities, drawing on lists of landline and randomly generated mobile telephone numbers with trunks assigned to the respective cities. Only those living in one of the four cities and aged 18 and over were invited to participate.

These cities make interesting cases to examine. Atlantic Canadian cities are small and mid-sized cities which are often overlooked in urban planning literature as well as research on environmental change. The region also tends to express more pro-environmental attitudes than the rest of the country (Environics 2018) and most of the cities have large rural and exurban spaces. The major cities in the region have also been experiencing significant change in recent years (Kaida et al. 2020), with urban sprawl and noticeable change to their built and natural environment (e.g., for research on change in Halifax see Gosse et al. 2016). The cities are also chosen because they provide different contexts of change. Charlottetown is the smallest of the cities and is capital to a largely agricultural-driven province and expanded its transit service in 2012. Halifax, in contrast, is the largest city of the region and is most industrialized and has three major military bases. It was also an early adopter of recycling in Canada. Moncton is a gateway city for transport and is bilingual, while St. John's is the hub for the offshore oil industry in the region. Because of growth all cities have seen loss of green space and at the same time investment in parks and trails. As seen in Table 1 each of the cities also has meaningful connections between SDG11 sub-goals and their sustainability and urban development plans.

In our analysis, we focus on the environmental questions, which addressed change in local environmental practice, perceptions of local environmental change, and the demographics of participants. Two measures of change in environmental practice asked participants about their self-reported increased use of public transit and self-reported increased use of parks and green spaces in the last five to ten years. We chose these practices because they are well-aligned with the sustainability plans of the four cities, as shown in Table 1. These variables included response options on a five-point Likert scale from 'strongly disagree' to 'strongly agree', and participants noted whether they had changed their patterns of use of these two practices.

We examine how people's perceptions of change influence environmental practices that are viewed as measures of sustainable cities, as per SDG11 and the sustainability and urban development plans of our case study cities. As such, our three main independent variables look at perceptions of city-level environmental change in air quality, in parks and green spaces in the city, and in overall environmental change. Each of these variables had three categories of response: 'change for the worse/fewer spaces', no change', or change for the better/more spaces.' Each variable is used to test the influence of environmental perception and awareness on pro-environmental practice.

We also considered neighbourhood inhabitation by analyzing two variables. The first looks at the number of years someone lived in a neighbourhood (0–5 years, 6–10 years, 11–20 years, 21–30 years, 31–40 years, 41–50 years, and 51+ years). The second examines a person's self-perceived level of fitting into a neighbourhood. The latter was measured on a scale of one to 10, where 10 was fitting in the most. We recoded the responses into three categories: 'low' (0–3), 'moderate' (4–6), or 'high' (7–10). The years living in a neighbourhood and fitting in are both expected to affect change in environmental practices and together address the inhabitation component of our research.

According to SDG11, sustainable cities must also be inclusive cities, asserting that the interests of women, youth, elderly populations, and other historically marginalized groups must be reflected in urban planning and social change. Our literature review also suggested that being a woman or a member of a racialized group may affect change in environmental practices. For these reasons, we examine measures of being a woman, Indigenous, or identifying as a racialized minority. Each of these was self-reported and a dichotomous yes/no question. We also control for city of residence to account for city-level material changes in public transit and green space accessibility.

We also consider other demographic factors such as age, level of education, and income. The reported age variable was recoded into aggregated categories of 18–30 years old, 31–50 years old, 51–64 years old, and 65 years of age and older. For our examination of socio-economic status, we used a measure for participants' highest level of educational attainment along with a self-reported income variable. We have eight value options for participants' highest level of education (no certificate, diploma or degree, high school or equivalent, non-university certificate, university – below bachelor's, bachelor's degree, professional degree, graduate degree, and other), and six categories for the income variable (less than $30,000, $30,001–$40,000, $40,001–$60,000, $60,001–$80,000, $80,001–$100,000, and over $100,000).

The analysis begins with a presentation of descriptive statistics of our variables, base tabular results of key variables looking at the link between subjective perceptions of environmental change and change in environmental practices. We then probe relationships further with logistic regression models to see how participants' perceptions of change in their local environment, inhabitation in a neighbourhood, and demographic characteristics affect change in environmental practices. We provide an Appendix with descriptive statistics, mean and standard deviation, of variables in our models. The models regress environmental practices on subjective perceptions while accounting for

Table 1
UN SDG 11, City Sustainability and Development plans, and measures used in study

UN SDG 11: Make cities inclusive, safe, resilient, and sustainable	Charlottetown, PEI: Integrated Community Sustainability Plan (City of Charlottetown 2017).	Halifax, NS: Halifax's Economic Growth Plan (Halifax Partnership, 2020).	Moncton, NB: Integrated Community Sustainability Plan (Dillon Consulting Limited, 2011)	St. John's, NL: Strategic Plan 2019-2029 (City of St. John's, 2019)	Measure used in study
11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport …	Affordable public transit as part of city sustainability goals.	Make Halifax a better place to live & work goal: City is easy to get around.	Targets to increase transit ridership per capita to meet objective for green community.	Create a sustainable & accessible transportation system.	Self-reported increased use of public transit in last 5-10 years (dependent variable).
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.	Air quality not addressed.	Air quality not addressed.	Moncton is committed to "sustainable outcomes of clean air, clean water … and an overall reduction in our environmental footprint."	Air quality not addressed.	Perceived change in urban air quality (independent variable); Perceived overall environmental change (independent variable).
11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces …	Goal for "active healthy living," linked with "maintaining parks … that provide essential spaces to improve and maintain health & wellness."	Make Halifax a better place to live & work: Improve outdoor recreational facilities.	Goal for healthy community: Increase number of parks and recreation facilities, area of park space per capita.	Trails & parks as "spaces & places that help people stay connected and actively engaged with the city"; land use planning "to preserve and enhance the natural … environment where we live."	Self-reported increased use of parks and green spaces in last 5-10 years (dependent variable); perceived change in the number of parks and green spaces (independent variable).

inhabitation and sociodemographic factors. We use this approach because it is important to understand what factors lead people to change their practices. In regression models, we dichotomized the two pro-environmental practice variables to look at those who felt their practices agreed that they had changed their practices in the last five to ten years compared to those who felt otherwise. Additionally, 'unknown' or 'not answered' are included as category responses but are suppressed in reporting. This was done to increase the sample size of the models.

Results: Do perceptions of change shape environmental practice?

We begin our analysis by looking at our dependent variables that measure environmental practices. We then probe how they relate to perceptions of environmental change and then look at additional measures that might account for change. Table 2 shows rates of self-reported increase in public transit and parks and green space use, both of which are dimensions of urban sustainability as per SDG11, as well as the sustainability and urban development plans of our case study cities. The table shows that 9% of participants agreed they used more public transit in their neighbourhoods than they did five to 10 years ago. Thirty-seven percent agreed they increased their use of parks or green spaces in that same time. These percentages show that most participants did not report increasing their use of public transit or parks and green spaces in the last five to 10 years. In other words, most people did not report a change in these environmental practices. Of those who altered their practices, these changes were more visible around the use of parks and green space, rather than use of public transit.

Table 2
Increased use of pro-environmental amenities compared to five to ten years ago
Source: Perceptions of Change, 2017

	Disagree	Agree
Use More Public Transit	91%	9%
Use More Parks/Green Spaces	63%	37%

Table 3 looks at the relationship between increased use of transit and parks and green spaces with perceptions of change in air quality and availability of parks and green spaces. In practice theory terms, these measures provide insight into the meanings and interpretations that participants ascribe to their urban environments. Practice theory asserts that meanings and practices are co-constitutive, so we would expect perceptions of environmental change

Table 3
Perception of change by more pro-environmental practices
Source: Perceptions of Change, 2017

	Use more transit	
Change in air quality	Disagreement	Agreement
For the worse	86%	14%
No change	93%	7%
For the better	84%	16%
	Use more parks/green spaces	
Change in parks/green spaces	Disagreement	Agreement
Fewer spaces	65%	35%
No change	65%	35%
More spaces	57%	43%

to relate to changing environmental practices (Hards 2011; Shove, Pantzar, and Watson 2012). Our results are consistent with this expectation. Those who perceive changes in the air quality of the city, either for the better or for the worse, had higher rates of increased public transit use then for those who perceived no change in their city's air quality. Of those who perceived a change in air quality for the worse, 14% agreed that they used public transit more. Sixteen percent who felt it had improved agreed that they used public transit more. Of those who perceived their city's air quality to have stayed the same, only 7% agreed that they have increased their use of public transit compared to five to ten years ago. It appears that there is support for the first hypothesis, though it appears that perception of any change — rather than for the worse or better — affects practice.

When we examine the relationship between perceptions of changing numbers of parks and green spaces and increased use of parks and green spaces, we find that 43% of those who perceived more parks and green spaces agreed that they use more parks and green spaces. In comparison, 35% of participants who said they perceived no change or fewer parks and green spaces reported increased use of parks and green space in that same time. Again, we find support for the first hypothesis, however, for this measure there is a directionality to the findings. It does appear that environmental perceptions and environmental practices are co-constitutive as asserted by practice theory.

To probe further, and test our additional hypotheses, Table 4 presents logistic regression models looking at the interplay of how environmental perceptions, inhabitation in a neighbourhood, and various sociodemographic factors affect change in environmental practices. Model 1 regresses increased public transit use on perceptions of air quality

Table 4

Regression of increased use of public transit in neighbourhood compared to five to ten years ago
Source: Perceptions of Change, 2017

	Model 1			Model 2			Model 3			Model 4		
	Odds Ratio	Std. err	z	Odds Ratio	Std. err	z	Odds Ratio	Std. err	z	Odds Ratio	Std. err	z
Air quality change in city *(Ref: No change)*												
For the worse	2.129	0.459	***							1.718	0.432	*
For the better	2.541	0.816	**							2.176	0.800	*
Green space change in city *(Ref: No change)*												
Fewer spaces				0.830	0.168					0.710	0.166	
More spaces				0.840	0.187					0.694	0.173	
Overall environmental change in city *(Ref: No change)*												
For the worse							1.085	0.301		1.148	0.350	
For the better							1.123	0.202		1.427	0.284	
Years Lived in Neighbourhood *(Ref: 0 - 5 years)*												
6 - 10 years										2.611	0.820	**
11 - 20 years										2.616	0.761	***
21 - 30 years										1.684	0.570	
31 - 40 years										1.194	0.479	
41 - 50 years										1.865	0.891	
51+ years										0.872	0.520	
Level of Fitting in to Nighbourhood *(Ref: Low)*												
Moderate										0.561	0.232	
High										0.384	0.145	*
Age *(Ref: 18-30)*												
31-50										0.955	0.351	
51-64										1.273	0.444	
65+										1.180	0.453	
Highest Level of Education *(Ref: No Certificate, Diploma or Degree)*												
High School or Equivalent										2.057	0.894	
Non-University Certificate										0.980	0.439	
University - Below Bachelor's										1.402	0.862	
Bachelor's Degree										1.036	0.464	
Professional Degree										1.000	(empty)	
Graduate Degree										0.659	0.341	
Other										1.673	1.475	
Income *(Ref: No employment income)*												
Less than $30,000										2.109	0.643	**
$30,001-$40,000										1.037	0.405	
$40,001-$60,000										0.890	0.314	
$60,001-$80,000										0.588	0.257	
$80,001-$100,000										1.034	0.465	
Over $100,000										0.479	0.252	
Gender *(Ref: Female)*										0.859	0.171	
Indigenous Identity *(Ref: Non-Indigenous)*										0.731	0.337	
Visible Minority Identity *(Ref: Non-visible minority)*										1.340	0.580	
Immigrant/Refugee Identity *(Ref: Non-immigrant)*										1.153	0.410	
City *(Ref: Charlottetown)*												
Halifax										1.032	0.245	
Moncton										0.488	0.131	**
St. John's										0.473	0.138	**
n	1793			1792			1792			1707		

* P ≤ 0.05 | ** P ≤ 0.01 | *** P ≤ 0.001

change and shows that perceptions of change in air quality appear to matter. When people perceive a change in their city's air quality, the odds of increasing use of public transit in their neighbourhood increases. Perceiving air quality change for the worse increases the odds by 113% and perceiving air as better increases the odds of more public transit use by 154%. This finding aligns with other researchers who find a positive impact of environmental awareness on pro-environmental practices (Hards 2011; Harris 2006). This finding aligns with our first hypothesis that those who perceive change in their local environment are more likely to change their environmental behaviours. In Model 2 we examine the impact of perceptions of change in the number of parks and green spaces in the city. The influence of these changes has a smaller effect on increased public transit use compared to the first model. Perceiving fewer spaces decreases the odds of increased public transit use by 17% and perceiving more spaces decreases the odds of public transit use by 16%. Again, the findings support our first hypothesis, though the influence works in the opposite direction. Model 3 looks at the effect of overall environmental change. Perceiving it for the worse increases the odds of greater public transit use by 8% and perceptions of overall change for the better increases the odds by 12%. Again, we find support of our first hypothesis but see an impact for both positive and negative perceptions of change. It appears perception of any change increases transit use and perceptions around air quality have a bigger effect on the odds than other measures of environmental perceptions.

The vision for urban sustainability articulated by SDG11 asserts that sustainable cities are also inclusive cities. As such, Model 4 looks at perceptions, but also controls for inhabitation and a range of sociodemographic factors. The odds of using more public transit increase by 72% for those who perceive air quality change for the worse and by 117% for those who perceive air quality change for the better. The odds decrease by 29% and 30% respectively for those who perceive fewer green spaces and more green spaces compared to five to ten years ago. The odds increase by 15% for those who perceive overall environmental change for the worse and are increased by 43% for those who perceive overall environmental change for the better. Again, we have support for our first hypothesis. Perceiving change affects practices; however, it does not matter if perceived changes are for the better or worse.

When inhabitation is examined, we see that the number of years lived in the neighbourhood also appears to make a difference for self-reported increased public transit use. Odds increase by around 160% for those who have lived in their neighbourhoods for between 6–10 years and 11–20 years compared to those who have lived in their neighbourhood for 0–5 years. This finding contradicts what was anticipated in our second hypothesis. Rather than finding an increase in environmental practices we found that both those who have lived in a neighbourhood for very little time or substantially more time are less inclined to increase their public transit use. Having lived in a neighbourhood for 51+ years decreases the odds of increased public transit use by 14%, using 0–5 years as the reference. The second measure of inhabitation also runs counter to our second hypothesis. Those who have higher levels of fitting in to their neighbourhood had lower odds of increasing their transit use. This is an unexpected finding because our background research led us to anticipate that the more people feel that they belong, the more likely they would be to engage in pro-environmental behaviours. The odds of increasing public transit use are 62% less for those with high levels of fitting in than for those with low levels of fitting in.

We explore our third hypothesis by looking at the effects of gender, Indigenous, and racial minority identities on increased transit use. When this is done, we see that being a woman decreased the odds of using more public transit by 14%, having an Indigenous identity decreased the odds by 28%, and being a visible minority increased the odds by 34%. This confirms our hypothesis of an impact on practices, however, runs counter to the extensive literature linking gender and racial identity to environmental awareness and action. It is in line, however, with other research looking at demographic impacts. When we examine other demographic influences, the age category 51–64 increased the odds of using more public transit by 28% compared to those in the 18–30, but none of the age categories were statistically significant. This runs counter to our third hypothesis that expected an impact. With respect to education, those with a high school diploma or equivalent had 106% higher odds of increasing their public transit use, compared to the reference group of no certificate, diploma, or degree. Income also seems to matter. Those who make less than $30,000 a year are more likely than other income brackets to increase their use of public transit with a 111% increase in odds of doing so. However, as with other demographic measures, most of these were not statistically significant.

We also controlled for the city of residence and found decreased odds of increased public transit use in Moncton by 51% and St. John's by 53% compared to the reference city of Charlottetown. There were increased, but marginally minimal different, odds for Halifax. We believe these differences are linked to schedule changes made in Halifax and Charlottetown in the last five to ten years (CBC News 2008; Jeffrey 2012).

In Table 5 we examine increased use of parks and green spaces over the last five to 10 years. In Model 1, we see

Table 5
Regression of increased use of parks/green spaces in neighbourhood compared to five to ten years ago
Source: Perceptions of Change, 2017

	Model 1			Model 2			Model 3			Model 4		
	Odds Ratio	Std. err	z	Odds Ratio	Std. err	z	Odds Ratio	Std. err	z	Odds Ratio	Std. err	z
Green space change in city *(Ref: No change)*												
Fewer spaces	1.013	0.119								0.965	0.131	
More spaces	1.380	0.173	**							1.378	0.195	*
Air quality change in city *(Ref: No change)*												
For the worse				1.004	0.145					1.247	0.209	
For the better				0.891	0.215					0.908	0.241	
Overall environmental change in city *(Ref: No change)*												
For the worse							1.217	0.209		1.299	0.242	
For the better							2.818	0.304	***	2.932	0.343	***
Years Lived in Neighbourhood *(Ref: 0 - 5 years)*												
6 - 10 years										2.960	0.531	***
11 - 20 years										1.857	0.306	***
21 - 30 years										1.791	0.343	**
31 - 40 years										2.206	0.464	***
41 - 50 years										2.088	0.573	**
51+ years										2.801	0.785	***
Level of Fitting in to Nighbourhood *(Ref: Low)*												
Moderate										1.943	0.687	
High										2.500	0.828	**
Age *(Ref: 18-30)*												
31-50										0.841	0.191	
51-64										0.540	0.123	**
65+										0.404	0.100	*
Highest Level of Education *(Ref: No Certificate, Diploma or Degree)*												
High School or Equivalent										1.188	0.343	
Non-University Certificate										1.371	0.389	
University - Below Bachelor's										2.002	0.781	
Bachelor's Degree										1.715	0.487	
Professional Degree										1.594	0.923	
Graduate Degree										1.797	0.544	*
Other										1.636	0.954	
Income *(Ref: No employment income)*												
Less than $30,000										1.022	0.217	
$30,001-$40,000										1.324	0.312	
$40,001-$60,000										0.900	0.178	
$60,001-$80,000										0.992	0.214	
$80,001-$100,000										1.008	0.245	
Over $100,000										1.238	0.278	
Gender *(Ref: Female)*										1.053	0.120	
Indigenous Identity *(Ref: Non-Indigenous)*										1.381	0.354	
Visible Minority Identity *(Ref: Non-visible minority)*										0.987	0.274	
Immigrant/Refugee Identity *(Ref: Non-immigrant)*										1.121	0.257	
City *(Ref: Charlottetown)*												
Halifax										0.809	0.128	
Moncton										1.024	0.157	
St. John's										0.964	0.150	
n	1799			1800			1799			1746		

* P ≤ 0.05 | ** P ≤ 0.01 | *** P ≤ 0.001

that perceiving an increase in the number of parks and green spaces in the city is associated with 38% higher odds of increased use of parks and green spaces at the neighbourhood-level. This is also statistically significant. This finding is in line with our first hypothesis based upon the research surrounding the positive impact that improvements to parks and green spaces can have on the use of parks and green spaces (Cohen et al. 2010) and the impact of environmental perceptions on environmental practices (Hards 2011; Harris 2006). As seen in Model 2, perceptions of change in their city's air quality for the better decreases the odds of using neighbourhood parks and green spaces by 11%. There is almost no impact for negative perceptions, which runs against our hypothesis. Overall perceptions of environmental change have a larger impact and Model 3 shows that perceiving overall environmental change for the better increases the odds of using more neighbourhood parks and green spaces by 182% and is also statistically significant. Negative perceptions also increase the odds but is not significant. This finding also supports the first hypothesis.

In Model 4, we control for other measures. Perceiving fewer parks and green spaces decreases the odds of more use of parks and green spaces by 3% and perceiving more parks and green spaces increases the odds of using more parks and green spaces by 38%. Perceiving air quality to have changed for the worse increases the odds of more parks and green space use by 25% and perceiving air quality change for the better decreases the odds by 9%, though neither of those effects are statistically significant. Perceptions of overall environmental change continue to have a large effect in the full model, with perceptions of overall change for the better increasing the odds of using more parks and green spaces by 193%. Again, we find support for our first hypothesis with perceptions of green spaces and overall

environmental quality. We also see a clearer directionality than with transit use.

When we examine measures of inhabitation, we find that living in a neighbourhood for longer than 0–5 years seems to matter, particularly for those who have lived there slightly longer (6–10 years) or for a very long time (51+ years). Living in a neighbourhood for 6–10 years increases the odds of using more parks and green spaces by 196% and living in a neighbourhood for 51+ years increases the odds by 180%, with both effects being statistically significant. Additionally, the stronger the sense of belonging through feelings of fitting in, the greater the odds of increased use of parks and green spaces in the neighbourhood. Feeling high levels of fitting in increases the odds of using more parks and green spaces by 150%, which is statistically significant. People who have lived in their neighbourhoods for a very short period or feel a low sense of belonging to their neighbourhoods are less likely to increase their use of parks and green spaces than their counterparts. This follows our anticipated findings in hypothesis two because it shows that inhabitation through time and belonging positively impact the increased use of neighbourhood parks and green spaces.

The final set of demographic variables shows that being a woman increases the odds of using more parks and green spaces by 5%, having an Indigenous identity increases the odds by 38%, and being a visible minority increases the odds by 1%. Having a high school education and above increases the odds of increased use of parks and green spaces. Those with some university education below a bachelor's degree had increased odds of using more parks and green spaces. The greater likelihood of more highly educated participants to increase their use of parks and green spaces is in line with past research noting education as a key characteristic that shapes pro-environmental practice. Income does not appear to be particularly salient for increased parks and green space use though making between $30,001–$40,000 increases the odds of using more parks and green spaces by 32%. Almost none of the demographic variables are statistically significant, showing little support for our third hypothesis. We also find that when we control for city of residence, it has little effect and is not statistically significant. Using Charlottetown as the reference, living in Halifax decreases odds by 19%, living in Moncton increases odds by 2%, and living in St. John's decreases the odds by 4%.

Overall, our analysis shows that perceptions of environmental changes increase use of neighbourhood public transit and parks and green spaces when controlling for inhabitation and demographic factors. Interestingly for transit use both positive and negative perceptions affect increased transit use. The pattern was clearer with use of parks and green spaces showing that positive perceptions were linked to increase usage of those space. Subjective perceptions of environmental change, or the meanings attributed to the local environment, explain changes in environmental practices more consistently than measures of inhabitation or sociodemographic factors. These findings support a practice theory interpretation of the co-constitutive nature of meaning and environmental practice.

Conclusion

The vision for urban sustainability articulated in SDG11, which is echoed in the sustainability and urban planning goals of our case study cities, sees increased transit use and increased use of parks and green spaces as markers of sustainable cities (City of Charlottetown 2017; City of St. John's 2019; Dillon Consulting Limited 2011; Halifax Partnership 2020; United Nations 2018). These practices are also part of the toolkit cities can use for local climate action and biodiversity protection (Ernstson 2013; Guay 2019; Scanu 2019). However, for cities to make progress towards these goals, they must have a clear understanding of how environmental practices change at the local level. Otherwise, gaps will persist between the expressed sustainability goals of cities and their translation into localized bundles of pro-environmental practices. Our results show that perceptions of local environmental change are a key subjective factor in re-shaping social practices. This co-constitutive relationship between understandings of environmental change and social practices is an essential part of integrating sustainability goals, such as SDG11, into everyday urban life.

Consistent with the version of social practice theory articulated by Shove and colleagues (e.g., Shove, Pantzar, and Watson 2012), we find that subjective perceptions of local environmental change — or shared meanings — are important for encouraging the uptake of pro-environmental practices. In addition to meanings, this version of practice theory also asserts the importance of materials (e.g., technologies and resources) and competencies (or the skills and know-how needed to engage in the practice). Our analysis focuses primarily on the dimension of meaning and subjective perceptions of change. Our results demonstrate that this dimension is indeed a key component of how urban environmental practices change. An important area for further inquiry is to examine the interplay of meaning,

materials, and competencies in relation to public transit and green space use.

Similarly, consistent with literature on experience of living in a place, or inhabitation, (e.g. Wakefield et al. 2001) we find that the longer a person lives somewhere and the greater their sense of belonging to that community, the greater the potential for uptake of pro-environmental social practices, at least for the use of parks and green spaces. Similarly, this affirms Haeffner et al.'s (2017) finding that length of inhabitation is related to greater awareness and usage of urban blue space. While perceptions of the local environment and inhabitation in a neighbourhood help explain changes to pro-environmental social practices, demographic characteristics like gender and racial identity were not clear-cut predictors of changing environmental practices in these Atlantic Canadian cities.

Our findings make three notable contributions to the literature on urban sustainability and environmental practices. First, at least in the context of Atlantic Canadian cities, a social practice approach appears to offer a better explanation for understanding changing local environmental practices than socio-demographic oriented approaches. Second, for some environmental practices, such as public transit use, the perception of environmental change itself is important for provoking changing environmental practices, rather than whether the perceived environmental change is for the better or the worse. Third, while social practice theory draws our attention to meanings, materials, and competencies, it has paid little attention to neighbourhood inhabitation as another key subjective factor that shapes the uptake of new environmental practices. Our results show that both perceptions and inhabitation are influential in changing local environmental practices. As such, the relationship between perceptions and inhabitation deserves closer attention in social practice theory. Attention to these relationships deserve much more attention in further research and planning for how SDG11 and other sustainable development goals can be localized into municipal-level social practices.

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Notes

[1] We are using a hypothesis testing approach to examine the relative importance of perceptions or environmental change, neighbourhood inhabitation, and sociodemographic characteristics in changing environmental practices. However, we are not treating these as mechanistic social forces that dictate social behaviour in a naturalistic methodological sense. Rather, we are interested in how these different understandings and characteristics may help facilitate or impede the uptake of new pro-environmental practices.

[2] As a qualification, social practice theory tends to focus more on habits and routines, rather than active processes of decision-making about environmental practices.

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Appendix

Variables used in regression

Variables	n	Mean	Std. Dev.
Increased use of public transit	1,797	0.086	0.281
Increased use of parks/green spaces	1,804	0.368	0.482
Green space change in city	1,839	2.530	2.209
Air quality change in city	1,837	2.293	1.860
Overall environmental change in city	1,814	2.453	1.247
Years lived in neighbourhood	1,824	3.269	4.166
Level of fitting in to neighbourhood	1,824	2.867	0.981
Age	1,848	495.129	2163.495
Highest level of education	1,848	6.694	14.584
Income	1,848	6.410	15.081
Gender	1,804	1.442	2.303
Indigenous identity	1,805	0.079	0.610
Visible minority identity	1,804	0.092	0.695
Immigrant/refugee identity	1,802	0.066	0.248
City	1,848	2.506	1.123