Paper Title: Interactions between public health and Toronto’s urban fabric

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Abstract:

This paper focuses on how, through planning and design, public and shared spaces are contributing to the improvement of social and health conditions in the city of Toronto. As the population of Toronto continues to rise rapidly, the capacity and quality of its health system is being persistently put to the test. This paper unfolds in two levels: the first reviews planning documents related to open and public spaces. The second explores how this major North American urban centre is implementing strategies and policies for a more walkable city. Finally, based on this research, this study proposes the itemization of hitherto individually looked-upon health variables for a more specified, individually-tailored healthier experience of the urban environment.

Keywords: Healthy City, Toronto, Planning, Design, Urban Fabric
Introduction
This paper focuses on how through planning and design, Toronto is improving the healthiness of the city and shaping its built environment as a result. It investigates physical, mental and social health and wellbeing through examining planning documents, guidelines and related policies. Our findings reveal that while the city is working hard to implement changes and take healthiness into account, more could be done to enable users to craft their individual urban journeys, by way of choosing routes that specifically cater to their health and wellbeing needs – or choices between what Gehl described as necessary, optional and social activities (Gehl 2011). These activities are not meant to cure illnesses, but could help improve the wellbeing of its citizens. For example, what kind of infrastructure and space could reduce the feeling of loneliness? What kind of spatial arrangement and materials can help limit ultraviolet exposure? What alternative routes could pedestrians take to ease their contact to pollutants? What types of areas encourage physical activity and where are they placed? These are just a few of the questions asked that can contribute to making healthier neighborhoods and, more broadly, a more livable city. We believe that by investing more in such infrastructure, cities, wards and neighborhoods could (i) help improve the health of their citizens; (ii) provide them with more alternatives (not just for recreational activities but also for their physical, mental and social wellbeing); and (iii) potentially alleviate some of the economic weight on its health system, while creating healthier individuals and stronger bonds within their communities.

Methods and findings
First, this paper identifies and examines the relationship between urban spaces, infrastructure and health; it maps and provides a comprehensive picture of open, green and walkable spaces and their potential health effects (Figure 2). Second, it researches and reviews key recent planning documents including the Toronto Official Plan, reports, policies, guidelines, Toronto Public Health publications like the Healthy Toronto by Design series and by-laws related to public health and design. These documents address different scales ranging from the urban to the neighborhood, from parks and squares to parkettes, and from streetscapes to urban artefacts. The paper proceeds as follows: first, it examines public open and green spaces, then it surveys efforts to improve walkability in the city. Each section offers a background on the factors that affect health and their relation to the built environment and investigates them through an exploration of physical, mental and social health and wellbeing. Finally, it concludes by briefly suggesting strategies for a healthier city.

Open and/or green spaces
Health Context
There is strong evidence that public open spaces contribute to health in positive ways (Kent et al. 2011). Based on this comprehensive and recent literature review, public open spaces lead to improved physical health, especially when large, green and local, facilitating regular physical activity (Paquet et al. 2013). Public open spaces increase the chance of incidental interactions resulting in a perceived higher level of safety and a declining feeling of loneliness. A number of scholars have demonstrated that these factors have positive mental health effects (Cohen et al. 2008, Koohsari et al. 2015). Furthermore, in urban settings with high population densities, noise pollution and lack of privacy, public open spaces with appropriate greenery can help alleviate urban stress factors (Maller et al. 2009). In the long run a built environment that motivates people to gather can lead to a strengthening of the local community and as a result to more collective activities like community events, recreational activities and cultural events.
More particularly on green spaces, recent literature indicates that they contribute to public health (Lee & Maheswaran 2011; Bowler et al. 2010, Lachowycz & Jones 2011, and Zupancic & Westmacott 2015, cited in Toronto Public Health 2014, Toronto Public Health 2015). Further, several studies positively associate the availability of green space with physical activity (Lachowycz & Jones 2010: 185) and there is also evidence that green spaces can reduce the Body Mass Index (BMI; ibid.: 186). However, the intensity of physical activity also depends on determinants like age, gender, ethnicity, disability, psychological factors (e.g. self-efficacy, perceived barriers) and safety (Lee & Maheswaran 2010: 218). While green spaces can facilitate physical activity, they do not necessarily lead to it. Still, research suggests that green space has a significant influence on health factors linked to the environment (Bowler et al. 2010). Parks, forests, ground and roof vegetation can cool the environment on a local scale - on average around 1°C – and by lowering urban temperatures, there is a reduced risk of heat-related health impacts (HRI) (e.g. circulation problems) especially during the occurrence of heat waves, increasing average air temperatures and areas with an intense Urban Heat Island (UHI) (Bowler et al. 2010: 154, Župancic & Westmacott, 2015: 7). Another environmentally-linked health effect of green spaces is the reduction of air pollutants like ozone, sulphur dioxide, nitrogen dioxide and particulate matter (Grundstroem & Pleijel 2014, Harris & Manning 2010, Kocic et al. 2014, and Roy et al. 2012, cited in Zupancic & Westmacott 2015). Especially trees show the best results in improving air quality on different scale levels (Nowak et al. 2014, cited in Zupancic & Westmacott 2015: 22). Lastly, green spaces with a dense tree canopy protect people from direct and indirect ultraviolet radiation and its harmful effects.

Recent studies also associate green space with positive mental health (Toronto Public Health 2015: 14); just the presence of green space in people’s life can have a significant influence on stress reduction, lower mental distress, lower levels of ADD/ADHD, feelings of loneliness, aggression, violence and mental fatigue (Jiang et al. 2014, White et al. 2013, Maas et al. 2008, and Kuo & Sullivan 2001, cited in Toronto Public Health 2015). Green spaces also contribute to a reduced noise level, which has positive influences on mental and physical health (Islam et al. 2012, Gonzáles-Oreja 2010). Further, social benefits of green spaces, like public open spaces encourage people to participate in community events, recreational activities and cultural events as those spaces, especially parks, “set the stage for neighborhood social interactions” (Cohen et al. 2008, cited in Kent et al. 2011 p. 67, Zhou & Rana, 2012).

**Brief Background on Open and Green Spaces in Toronto**

A dynamic, cosmopolitan and rapidly growing global city, Toronto boasts a wide range of open and green spaces accessible to the public. These include squares, “Privately Owned Publicly-Accessible Spaces” known as POPS (City of Toronto 2014), parks, parkettes and green streets amongst others. In addition to these, the city maintains a ‘Green Space System’ with a network of parks and other green spaces (Toronto City Planning 2015: 28). In 2012, Toronto’s parks system comprised 8000 hectares of city-owned and/or operated land, including over1600 parks and adding up to a total of 12.7% of the city’s land base (Parks, Forestry & Recreation 2013b: 7). Additionally, there are other park-like structures (e.g. school yards, cemeteries, institution grounds) accessible to the public. In Toronto, most residents live within a 500m-radius to a neighboring park, comparable to an approximately five-to-ten min walk (Parks, Forestry & Recreation 2013b: 9). Another distinctive element is trees. Toronto’s tree canopy covers about 28% of the city’s surface. The value of the urban tree canopy is estimated to be around $7.1 billion with annual ecological services of $28.2 million (Parks, Forestry & Recreation, Urban Forestry 2013a: 9, Nowak 2013: 1). However, the forest cover is distributed unevenly across
Toronto depending on land use and location (Nowak 2013: 7). 6% of the total are city street trees, 34% grow in city parks or natural areas, whereas their majority (60%) is located on private property (Parks, Forestry & Recreation 2013: 9).

Planning
The City of Toronto recognizes the health-related importance of public open spaces as it is “an integral part of our life and social well-being” (Toronto City Planning 2015: 28). To re-enforce the quality of the public realm in the city, the Toronto Official Plan provides a set of guidelines for the development of streets, parks, open spaces and public buildings. First, a high design standard is emphasised to create comfort, safety, accessibility and a unique experience (2.4 Policy 14a; 3.1.1 Policy 1; 3.2.3 Policy 1; 5.3.5 Policy 2). Second, open public spaces should be designed in a pedestrian-friendly way and be linked to provide an extensive network of places to meet and gather (2.3.2 Policy 3; 3.1.1 Policy 13a, 19a). Third, these spaces are and would be organized in a manner so that natural features can contribute to the wellbeing of the people (3.2.3 Policy 1). In combination with additional urban planning policies, they help create healthy public spaces by promoting social inclusion and wellbeing, reducing stress and mental health problems, and fostering physical activity in order to reduce risks of chronic diseases. Green spaces are an integral part of Toronto’s urban landscape, thus those spaces are highly protected and regulated on different scale-levels in order to ensure and maintain them and their functions. The Official Plan dedicates three chapters to green spaces: one on “Green Space System and Waterfront”, another on “Parks & Open Spaces” and a third on “The Natural Environment” (2.3.2, 3.2.3 & 3.4).

The course of action and overall direction adopted by the City of Toronto is also reflected in a report called “Active City: Designing for health” (Toronto Public Health et al. 2014, p. 9) which emphasizes the effect of design on health, whether for better or worse.

Based on the above-mentioned policies the “TOCore Proposals Report” focuses on amalgamating the individual characteristics and visions of the downtown area with the policy framework delivered by the “Official Plan”. Central for this plan is a scale-based approached, with which the downtown area is set to transform its existing public spaces and create new ones (TOCore 2016: 61). Also, due to the fact that Downtown is known to have one of the lowest levels of parkland provision in the city (6% of land covered by parkland), the document proposes to further invest in urban forest in the Downtown area to suit the intensity of use (TOCore 2016: 76–80).

Further, the City has approached the maintenance and improvement of urban green spaces by developing two visionary documents in coordination with the Official Plan: the “Parks Plan 2013 – 2017” (Parks, Forestry & Recreation 2013b) and the “Sustaining & Expanding the Urban Forest: Toronto’s Strategic Forest Management Plan” (Parks, Forestry & Recreation & Urban Forestry, 2013).

Besides the city-wide guidelines and policies mentioned above, the City of Toronto provides multiple design standards for appropriate greening on a smaller level for instance “Design Guidelines for ‘Greening’ Surface Parking Lots” (Toronto City Planning 2013). These guidelines

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are based on the Official Plan and the Toronto Green Standard (TGS). They take into consideration that parking very often tends to be functional spaces with poor landscaping, insufficient streetscaping and lack of pedestrian safety, comfort and amenity, that also leads to environmental challenges (e.g. UHI, extreme sun exposure) (Toronto City Planning 2013: 1). To reduce dangerous sun exposure for the public at public and open spaces the City has implemented city-wide Shade Guidelines “to provide UVR protection and Sun Safety measurements for outdoor environments” (Toronto Cancer Prevention Coalition Centre 2010, p. 7). The proposed measurement support City of Toronto staff to retrofit city facilities in order to create a sun safe environment.

At the tree level, the City of Toronto provides the following guideline “Toronto Street Trees. Guide to Standard Planting Options” (City of Toronto & Parks, Forestry & Recreation 2007). The City also provides a “Tree Protection Policy and Specifications for Construction Near Trees” (Parks, Forestry & Recreation, Urban Forestry 2016). Moreover, Toronto regulates green spaces with by-laws including the “Street Tree By-Law” (Toronto Municipal Code Chapter 813, Article II 2015) protecting City street trees, the “Private Tree-Bylaw” (Toronto Municipal Code Chapter 813, Article III 2015) protecting trees on private property, the “Ravine & Natural Feature Protection By-Law (Toronto Municipal Code Chapter 658 2016) and the Parks By-law (Toronto Municipal Chapter 608 2017).

Despite these very positive initiatives for a pedestrian friendly and greener city, some of them are more geared toward revitalisation or beautification, while others can contribute to health. Hence, it is important to determine, monitor and indicate more specifically the health-related aspect of public spaces. Useful indicators toward this assessment could include noise, vibration, shade and pollution levels.

**Walkability/Pedestrianization**

*Health Context*

As a mode of transportation, walking has major impacts on public health as indicated in a comprehensive review done by Toronto Public Health in 2012 (Toronto Public Health 2012). Based on this 2012 study, references to walking regularly reducing the risk of overweight and obesity are mentioned (Murphy et al. 2007, McAuley et al. 2000). Furthermore, it can decrease cardiovascular risk (Hamer & Chida 2008), prevent Type II diabetes (Hu et al. 2003), lower the likelihood of a stroke (Wannamethee et al. 1999) and reduce the risk of several types of cancer (Thune & Furberg 2001, Golshiri et al. 2016, Hou et al. 2004, and Wolin et al. 2009). In the long run, increased walkability could also decrease vehicular transport-related air pollution significantly. Research has shown that exposure to air pollution has an impact on all-cause, as well as cardiovascular mortality and morbidity (Hoek et al. 2002, Pope et al. 2002, and Brook et al. 2010). There is also evidence that there is a strong causal relationship between air pollution and a worsening of asthma (Health Effects Institute 2010), risk of lung cancer (Vineis et al. 2006) and non-asthmatic respiratory problems (Toronto Public Health 2007). Furthermore, less transport-related air pollution could also have a positive effect on the urban climate as it weakens the UHI effect and results in less heat-related problems in the population (Giguère 2009). Lastly, driving less leads to reduced noise pollution, which is related to negative health effects like hearing impairment, sleep disturbances and cardiovascular disturbances (Goiñes & Hagler 2007, Stansfeld & Matheson 2003).

Research also suggests that physical activity has a positive effect on mental disorders like depression, anxiety and panic disorders and in general on mental wellbeing (Paluska & Schwenk 2000, Fox 1999, Taylor et al. 1985, Hassmén et al. 2000, Byrne & Byrne 1993, and Salmon
Researchers have also found that walking can be an effective way of reducing anxiety and depression (Heesch et al. 2011).

**Brief Background on Walking in Toronto**

Based on the 2011 Canadian National Household Survey (NHS) 69.9% of Torontonians drove, 23.3% took Public Transit, 4.3% walked and 1.2% cycled to work (Statistics Canada 2011). The City of Toronto has an extensive pedestrianized network which consists of 7780 kilometres of sidewalks and 733 kilometres of walkways, pathways and recreational trails (Toronto Transportation Services 2015: 2). However, the density and availability of sidewalks varies across the City of Toronto and 1194 km of streets are still without any sidewalk or without sidewalks on both sides (Ibid: 2). The 2013 Walking Habits and Attitudes Study in Toronto indicates, that 9% of Torontonians walk to work, 22% walk to school, 20% walk to go shopping and 14% walk to leisure activities (Ipsos 2013, p. 15).

![Walkability Index for the City of Toronto, by Census Tract](http://www.torontohealthprofiles.ca/a_documents/aboutTheData/12_JReportsAndPapers_Walkability_WKB_2012.pdf)

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However, time spent walking varies across Toronto with highest rates in the city centre (Ipsos 2013: 22). 95% of the participants in the study self-assessed their neighborhood as “very
walkable” or “somewhat walkable” depending on the two main factors “amount/quality of sidewalks” (32 %) and “safety level” (20 %) (Ipsos 2013: 41-42). A second study has approached walkability by developing an “Urban Walkability Index” for Toronto based on four variables consisting of population density, dwelling density, availability of all retail and services and street connectivity (Glazier et al. 2012). The south-central downtown area was found to have the highest index values whereas suburban areas had significantly lower index values (Figure 1). Furthermore, high levels of walkability correlated with less car-related, but active transport, whereas low levels of walkability was associated with lower rates of physical activity and higher rates of overweight in different parts of Toronto (Glazier et al. 2012: 9-10).

Planning

Since the 2002 Toronto Pedestrian Charter, pedestrianization and a growing focus on walkability gained momentum. Pedestrian-friendly principles in association with positive health outcomes have also been strongly integrated and recognized within the Toronto Official Plan (2.4, Policy 1). To enhance walkability, it also provides a set of guidelines related to: (i) safety [from other modes of transports (e.g. cars, transit) (2.2 Policy 3a ii, 3b; 2.4 Policy 14a, c, d; 3.1.1 Policy 5a i, ii; 3.1.2 Policy 2), safety through a high quality of design and maintenance (e.g. sidewalk width and condition) (3.1.1 Policy 5a i, iii, 6a, 14; 3.1.2 Policy 1) and a safe social environment (e.g. lighting, crime prevention)]; (ii) linkages to streets, parks and open spaces (2.2.1 Policy 2a; 2.3.1 Policy 4; 2.4 14b; 3.1.3 Policy 13a, 16; 3.2.3 Policy 1c) and mixed-use development (2.2 Policy 2d); (iii) accessibility for pedestrians (2.2 Policy 3f, g; 2.4 Policy 14a; 3.1.1 Policy 11–13; 16); (iv) pedestrian-friendly infrastructure (e.g. curbs, lighting, tactile walking surface indicators) and facilities (e.g. public toilets, furnishing) (2.2 Policy 3b; 2.2.2 Policy 2 i; 2.2.3 Policy 2a ii; 3.1.1 Policy 5a ii); (v) a comfortable walking environment (2.2.1 Policy 11; 2.2.3 3c iii; 2.4.14 a, b, e; 3.1.1. Policy 1) with appropriate design aesthetics [(3.1.1 Policy 1, 2) including natural features (3.1.1 Policy 4, 6 a) and a focus on car-reduced spaces (3.1.2 Policy 2; 4.8 Policy 5 e)].

In 2009, the City of Toronto made a big step forward towards a pedestrian-friendly city when it released the “Toronto Walking Strategy” (City of Toronto 2009). While it corresponds with the “Toronto Official Plan”, it also “provides a long-term, comprehensive set of actions […] for walking and the public realm” (Ibid.:7). The strategy consists of a multi-faceted set of guidelines, of which four strategies are directly related to the built environment, including: “integrating networks for walking” (Ibid.:24), “designing streets for pedestrians” (Ibid.: 27), “creating spaces and places for people” (Ibid.: 31) and, focusing “on priority and tower renewal neighbourhoods” (Ibid.: 35). The document also explicitly emphasizes the aim to become a healthier city by encouraging people to choose active transportation over motor vehicle use (Ibid.: 6).

On a smaller scale, but related to the above-mentioned policies, in 2006, the city implemented a coordinated street furniture program called “Vibrant Streets” with the intention “to change how our city streets look, function and meet the needs of residents and visitors” (Toronto City Planning, Clean & Beautiful City Secretariat and Transportation Services 2012: 1). That program focused on the implementation and ongoing maintenance of “a family of beautiful, functional, technologically flexible, durable and coordinated furniture” that improves the movement, accessibility, safety of pedestrians, as well as the attractiveness and identity of Toronto’s streetscapes (Ibid.: 11). This was done by providing accurate design and placement guidelines to harmonize the design, form, scale, material and placement of future street furniture investments (Ibid.: 1).
Another key document for Toronto’s strive towards a more walkable city is the more recent “Toronto Complete Streets Guideline” (City of Toronto 2016), which offers guidelines for different agents (e.g. city staff, private developers, community groups) regarding future investments in street infrastructure in general and also addresses street design for pedestrians (particularly, chapter IV).

Finally, at the neighborhood level there are plans for the city’s downtown area. The “TOCore Proposals Report” directly refers to the “Official Plan,” the “Complete Street Guide” and the “Toronto Walking Strategy,” mentioned earlier.2

**Discussion: How can Toronto and cities in general become more livable?**

Based on this literature and recent documents and publications’ review, one can compose a comprehensive visualization of a number of health factors that open, green and walkable spaces can potentially contribute to (Figure 2). The resulting picture can be a useful tool for cities to think of their public spaces beyond beautification, revitalization and accessibility. The City of Toronto is such a case.

> **Figure 2.** Factors that potentially have health effects based on the reviewed literature.

2 A landmark project for the transformation of the downtown mobility system is King Street. As a busy surface transit route, King Street shall be transformed into a “true transit-priority” street (Ibid.: 121) to further enhance pedestrian-based commuting.
Toronto’s motto ‘A city within a park’ is fully justified by its substantial tree canopy and considerable areas dedicated to green and open spaces (partially indicated in figure 3). Still, the city continues to rethink how to better connect open, green and public spaces, in other words, how to become even more livable.

Figure 3. Isometric view of key components of the built environment that can contribute to a healthier city as presented in this paper. Based on data from ESRI and Open Data Toronto.
Towards this endeavor, this study proposes that health indicators are also ushered to the forefront, and in a combined fashion. Various actors and agencies are already engaged in monitoring individual aspects of a public space’s quality. For example, Toronto Public Health measures the quality of Lake Ontario’s water (e.g. E. coli levels) at the Beaches neighborhood (Toronto Public Health 2017). Another measured variable is Toronto’s walkability index. Further, University of Toronto researchers have been monitoring air quality (Air Quality Health Index), initially developed for the 2015 Pan American Games (Evans 2017, Suen 2017, Ministry of the Environment and Climate Change Ontario 2010). Since this technology exists and has been tested, it could be quite unique and helpful to implement it across key parks, streets and public spaces. Additional individual aspects of public accessible spaces could also include noise, vibration and heat as well as field sports facilities and fresh food-related spots (e.g. farmers’ markets).

There are no sufficient indicators for the public that Toronto’s green, open and walkable spaces, are indeed healthy for every individual. If so, in what ways (for example, physical activity focused, or low noise, tranquil spaces). To reinforce the notion of a healthy city, it would therefore be important to determine and distinguish which spaces are more focused on urban regeneration and beautification and which ones have what positive health effects based on the monitoring and itemization of real-time variables (heat, air and pollution levels). This extensive network of sensors and information could help make smart decisions about urban health. An example of specific (but limited) assessment of public space healthiness is the London-based Wellbeing Walk that pedestrianly links three key stations (St. Pancras, King’s Cross and Euston) to experience lower air pollution levels (Urban Partners 2017).

The main recommendation proposed by this study is to itemize, monitor and comprehensively present these indicators that together compose the qualities of public spaces (through, for example, an app or other user-friendly programs). In this way, individuals can select spaces based on specific attributes, and thus personalize and optimise the way they experience the city’s public and accessible spaces.

Conclusion
This paper reviewed how public health and the urban fabric are related through the lens of open, green and walkable spaces, and synthesized this information into a chart to provide a more comprehensive picture of potential health benefits related to these spaces. Further, it surveyed key planning documents of the City of Toronto, identifying efforts to make it a healthier environment. Finally, it put forward a recommendation for optimizing and personalizing the health effects of such spaces.

Further steps to move this research forward will include the creation of partnerships with different experts, monitoring, modelling, visualising and communicating diverse information catered to the public and to users towards making cities healthier, more livable and smarter.

Acknowledgement

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3 Toronto has a Noise Bylaw. The Toronto Noise Coalition is “advocating for effective, enforceable noise management.” (Toronto Noise Coalition 2017)

4 Toronto established discovery walks allowing individuals to visit important city landmarks but does not have the London feature.
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