6 Revisiting the Walking City: A Geospatial Examination of the Journey to Work

Don Lafreniere and Jason Gilliland

Abstract

The daily commute to work and its related social histories have long been of interest to historical geographers and urban historians. This article revisits the existing scholarship on the nineteenth-century journey to work and outlines a new methodological framework that uses a historical GIS to overcome many of the challenges identified in previous studies. These challenges include a reliance on small, atypical samples of workers, approximations of the spatial relationship between home and work, and unrealistic interpretations of journeys travelled by using only Euclidean paths. Combining city directories and decennial censuses through the use of probabilistic record linkage techniques uncovers the relationship between work and home for over 5,000 workers in London, Ontario in 1881. A GIS network-derived journey to work model re-creates more realistic journey that considers the many natural and built environment barriers that influenced the paths and distances workers travelled on a daily basis. Empirical results of the journey to work along the lines of occupational class, coincident home–work location, and gender are presented and contextualized to studies in other cities. The results highlight that the experiences of commuting differ widely along the lines of social class and gender.

Keywords

Journey to work · Space–time · Historical GIS · Census · Mobility

6.1 Introduction

The rapid industrialization and urbanization experienced in the late nineteenth century affected many aspects of daily life. For adults, one aspect that bridged all socio-demographic and economic groups was the journey to work. This unifying experience of daily life was a result of the growing spatial separation between home and the workplace due to changes in the nature of work, from primarily home-based artisanal work to wage labour. The journey to work also reflected larger evolving urban processes, such as suburbanization and segregation. In the second half of the nineteenth century, mid-sized Canadian cities were still largely dominated by commuters who travelled to work by foot, either on the streets, alongside the horse-drawn carts used for heavy or bulky loads, or on the rapidly emerging network of sidewalks. Commuters

D. Lafreniere (✉)
Michigan Technological University, Houghton, USA
e-mail: djlafren@mtu.edu

J. Gilliland
University of Western Ontario, London, Canada
e-mail: jgillila@uwo.ca

C. Travis et al. (eds.), *Historical Geography, GIScience and Textual Analysis*,
Historical Geography and Geosciences, https://doi.org/10.1007/978-3-030-37569-0_6

were closely connected to the physical and built environments they traversed, enjoying the pleasant fragrance of flowers wafting from the gardens of well-built homes or subjected to the foul odours that emanated from the breweries and cigar factories. They had to cope with the elements that the glass and steel of our modern automobiles shelter us from, such as July's intense sun and January's blowing snow and sleet. The daily commute provided individuals an intimate scale by which to experience the social environments present in the city. In the walking city, everyone else on the street was within earshot as well as within an easy visual distance, making the journey to work one of the periods with the highest potential for social interaction during an individual's daily time–space rhythm.

This chapter revisits the late nineteenth-century journey to work in the industrializing city, an area of research that has had little attention since the 1990s. Using the mid-sized Canadian city of London, Ontario as a case study, this paper extends the existing literature by exploring the spatial and temporal pattern of work at a scope and scale unprecedented in earlier studies. Through the use of a full count of the city's population in 1881 and 1891, which includes the workplace of nearly every male (and many female) workers, we can, for the first time, establish the relationship between home and work for an entire urban population. The dataset is interrogated using the spatial analytic capabilities of a GIS to re-create the daily time–space patterns of individuals from every socio-demographic and economic group in the city. This study of the journey to work was undertaken for an important methodological purpose—to re-create the spatial relationships between work and home. By having a sound methodology with which to re-create these relationships, other scholars can then re-examine the roles played by transportation, residential segregation, land use policies, and restrictive covenants on access to employment and their impact on demography, social mobility, and housing choice. This study looks to create a methodology that overcomes the many limitations noted in the literature of previous journey-to-work studies.

6.1.1 Related Work

The study of Canadian work history saw a resurgence in the late 1960s, thanks to British historian E.P. Thompson's call to recover the lives and experiences of working-class people 'from the enormous condescension of posterity' (Thompson 1980 [1963], p. 12). This call was answered by the likes of Kealey (1980) and Bradbury (1996), who both described the changes in working life during periods of industrialization in large Canadian cities (Toronto and Montreal, respectively). Several edited collections have been compiled, with chapters on the working lives of everyone from shantymen and railway workers to boys in mining camps and girls in textile shops (Craven 1995; Cross 1974; Opp and Walsh 2006). This scholarship provides a rich and invaluable narrative used by students of Canadian labour history across the country. However, the spatial relationships between work and home are less known. While there is little empirical evidence, especially for Canada, setting out details of the journey to work before 1900, the importance of the geography of the home–work relationship has been considered for several non-Canadian cities. The greatest attention has come from scholars who studied the dominant industrial cities of Britain, especially London (Green 1988; Lees 1969; Pooley and Turnbull 1997, 1999, 2000), as well as Birmingham (Vance 1967), Huddersfield (Dennis 1984), Liverpool (Pooley 1984), and Newcastle (Barke 1991).

In North America, work has been concentrated in large metropolitan areas such as Philadelphia; the journey to work was one of the areas of interest to the 12-year (1969–1981) Philadelphia Social History Project led by Theodore Hershberg (Greenberg 1980; Hershberg 1976; Hershberg et al. 1981). For Canada, Montreal has been the most productive laboratory, though we find the concerns of the relationship between work and home to be secondary to wages (Hoskins 1989), the process of industrial suburbanization (Gilliland 2004; Lewis 2000), segregation (Gilliland and Olson 2010; Gilliland et al. 2011; Olson and Thornton 2011),

and the nature of the work itself (Bradbury 1996). An important exception to the wide-gap of empirical research on the journey to work in Canada prior to 1900 is Goheen's study of Toronto (1970). Goheen uses the daily commute to illustrate the extent of residential segregation among differing social classes in Victorian Toronto. There has been more interest in the Canadian experience of the journey to work after the turn of the twentieth century. Richard Harris and Victoria Bloomfield examined the topic while exploring the processes of decentralization of workplaces and the broader suburbanization of cities (Harris and Bloomfield 1997; Bloomfield and Harris 1997). Their landmark paper (Bloomfield and Harris 1997) outlined a methodology that has served as the inspiration for much of this paper.

6.1.2 Identifying Methodological Challenges

Despite what may appear at first blush to be a wealth of previous research, the study of the daily commute to work has not received significant attention. Geographer Richard Dennis suggests that one of the reasons may be that 'data for studying journeys to work are exceedingly scarce, particularly for quantitative research in which a single source records both place of residence and place of work' (Dennis 1984, p. 132). As a result, previous research on the nineteenth-century city has utilized sources (data) that either represent a small, non-random, possibly atypical sample of workers or only allow for the inference of home and work, rather than absolute spatial links (Dennis 1984, p. 132). For example, Green (1988) uses only a wage book for a single employer, as did Hoskins (1989) for his study of railworkers in Montreal. Barke (1991) used city directories to capture a set of nearly 2000 workers over four time slices. However, his sample only included middle-class business owners because he did not have the workplaces of non-owners, so it only represented 4% of the middle-class population of Newcastle. Dennis (1984), though recognizing the limitations of his methodology and calling for alternatives, elected to use the census returns for only one industry, silk manufacturing. Industry-specific studies have also been completed by Pred (1966) for five industries in New York City. The Philadelphia Social History Project also used five industries, derived from the Census of Manufacturing, though this sample was still robust with over 3700 workers represented. Bloomfield and Harris (1997) concerned themselves with a similarly small sample of employers.

Methodological decisions surrounding how to best re-create the needed home–work links have typically been constrained by limitations in the sources or lack of resources necessary for compiling and analyzing a more comprehensive database of employees and employers. These limitations have led authors of most previous studies to use methods of approximation. Vance (1967) saw the need to combine the census along with a comprehensive source of workplaces—the business directory. However, the 1851 British census that he utilized did not include workplaces for those enumerated, so he was unable to match individuals to their specific places of work. Vance instead created labour sheds, or areas where workers reside, and employment fields, areas of workplaces, and compared the distances between them. Dennis (1984), using the same sources as Vance, was likewise restricted to only inferring home–work links in his study of Huddersfield's silk industry. The Philadelphia Social History Project (Greenberg, 1980; Hershberg et al. 1981) also inferred the workplaces of its city's workers by creating arbitrary labour shed boundaries for each industry and then matching an individual's occupational title to the product manufactured within individual businesses. Pooley, in his study of the journey to work in late-nineteenth century Liverpool, used a 10% census sample and calculated distances from an individual's residence to the nearest potential workplace. He explains that 'for dock workers this is defined as the nearest operational dock; all office workers are assumed to work in the C.B.D. [central business district]' (Pooley 1984, p. 134).

The impact of a lack of quality sources has resulted in other difficulties for scholars of the nineteenth-century journey to work. Many scholars are interested in evaluating the differences in how the journey to work was experienced by members of various ethnic or racial groups. Mayer (1977), in his study of Milwaukee, used individuals' surnames, as recorded in the city directory, to infer their ethnic affiliation. Mayer acknowledges the difficulties of this approach, suggesting that even in the best of cases only 70% accuracy can be expected (Mayer 1977, p. 54). Deskins (1972) used directories in a similar manner to examine the racial differences in the journey to work in Detroit in the late nineteenth century. He derived race by a 'coloured' notation within the alphabetical directory rather than utilizing the more authoritative and complete decennial federal census. His decision not to use the census was not explained, nor did he compare the aggregate population totals by racial affiliation between the two sources to gauge the reliability of the 'coloured' notation in the directory. From these assumptions, significant historical generalizations of race-based behaviour were generated. These criticisms were noted by his colleagues and resulted in a heated debate within the pages of the *Professional Geographer* (Deskins 1975; Gale and Katzman 1975).

Deskins' work has other methodological limitations, the ones shared with nearly all previous journey to work studies—poor spatial accuracy in locating home and workplace as well as the methodology used to calculate the actual journey to work. Deskins' work, separate from his controversial derivation of race, suffered the greatest shortcomings. He was unable to link individuals to their workplaces, nor did he have the resources needed to map individuals to their specific residences. To compensate, he elected to approximate the location of work and home by using the mean centre of residences and the mean centre of workplaces while controlling for the extremes by calculating the standard distance around each mean. The resulting 'worktrip vector' is nothing more than a measure between the residential areas of Detroit and the non-residential areas. Other studies suffer from similar limitations, though not as severe. Green (1988) attempted to map each worker in Henry Poole's bespoke tailor shop to their exact residence, but found that addresses in London (UK) during the later decades of the nineteenth century were haphazard. His efforts were limited by a combination of address changes, street name changes, and sources that did not coincide temporally. His solution was to estimate each street's addressing by assigning civic address #1 at one terminus of the street and assigning numbers at equal intervals moving down the street (Green 1988, p. 186). Both Goheen and the Philadelphia Social History Project elected to use arbitrary grids to map residences and workplaces. The Philadelphia Social History Project created 660 × 775 foot grids and measured from centroid to centroid to calculate the length of the daily journey (Hershberg et al. 1981, p. 131). Additionally, several studies have assumed that workers were employed at the closest workplace for which they were qualified. This assumption skews the results to indicate shorter daily commutes than may have been realized.

Owing to the lack of computational power and robust datasets, all previous nineteenth-century journey to work studies elected to use Euclidean, or straight-line, distances in their calculations, rather than taking into account the actual distances that would have been travelled on the existing roadways. Even the most contemporary of studies, those that are beyond the scope of my current research, rarely utilize the existing geospatial technologies to re-create more realistic paths (Corcoran et al. 2009; Sultana and Weber 2007), and one of the only exceptions uses hypothetical journeys (Bousssauw et al. 2011). This chapter first overcomes the limitations outlined above that have influenced the results of previous journey to work studies. Secondly, it extends the existing journey-to-work methodologies by utilizing the spatial analytical capabilities of GIS and computer-based probabilistic record matching algorithms. Lastly, this chapter will outline some of the journey to work experiences along lines of socio-economic class, gender, and age.

6.2 Case Study: London, Canada

Previous journey to work studies have been primarily concerned with large urban centres, rarely concerning themselves with the more common medium-sized nineteenth-century towns. Debats (2009) outlines how studying large urban centres is not practical when the scale of analysis is the individual. We heed his advice in this study and apply the same 'small city research strategy' he extols. This case study is the mid-sized Canadian city of London, Ontario, Canada. London provides a classic example of a city that was changing from a commercial to an industrial town. London is located half-way between Toronto and Detroit, an advantageous position that was quickly recognized by many investors and industrialists. Several major companies began to employ Londoners in the last two decades of the nineteenth century. The Grand Trunk Railway built its train car factory in London East in 1887, which added over a hundred jobs to its already large operation in the city. Imperial Oil commenced refining in London East in 1880. Established companies such as the brewers Labatt and Carling, the confectioner McCormick, and McClary's foundry increased their workforce during this era as the demands for their goods grew faster than the efficiencies of mechanization. Despite these increases, London continued to be a diverse commercial city with most of its workers employed at small- or medium-sized firms in a wide range of industries. In 1881, there were an average of 2.5 workers per business; by 1891 it had risen to nearly 4 workers per firm.

The London of 1881 was a quintessential British industrial town on Canadian soil. Both the established citizenry and the waves of recent immigrants were predominantly from the British Isles, and Protestant faiths dominated the religious composition of the growing city. With a population of 19,746 at the time of the 1881 Census of Canada, London ranked 8th among Canadian cities and 86th in North America, making it comparable to cities such as St. John, NB, Lancaster, PA, and Des Moines, IA. For this study, we also included the three major suburbs of London: Petersville (aka London West), the Village of London East, and the urban section of Westminster Township (aka London South). Together these suburbs totalled 3,890 residents. It is critical to include these suburbs as they contributed significantly to the available employers and the diverse workforce found about the city. Additionally, suburban populations and industries are often overlooked in other studies, mostly because the census separates them from the urban core when disseminating their enumerations.

6.2.1 Overcoming Limitations: Larger Samples and Absolute Workplaces

To overcome the limitations of small sample sizes and the lack of representativeness found in previous studies, this paper utilizes the robust built and social environment stages model (Lafreniere and Gilliland 2015). Specifically, this study harnesses the geocoded decennial census that was captured through the creation of the social environment stage. As outlined by the tables in Fig. 6.1, the census was record-linked to the city directory, which facilitated the geocoding of nearly all individuals to their residential location. This dataset locates nearly 90% of the population in London and suburbs in 1881 and provides the needed variables to determine the home residence for each worker in the city. No other journey to work study has captured what is arguably the whole of the workforce in an urban location. Various methods of sampling have been utilized and rarely, with the exception to a certain extent of Deskins and Mayer, have researchers compared the distribution of their samples to the total enumerated population. It is generally accepted by historical geographers and historians alike that the federal census represents the gold standard record of a past population, though there are critics (Curtis 2001). Figure 6.1 (*Table 1*) compares the geocoded population used in this study to the full census enumeration collected in London for the year 1881. To illustrate how representative the 90% sample is, the population has been disaggregated using key

demographic variables. It is observed that along the lines of religion, gender, and marital status, the variances are no more than 1%. For ethnic origin, we see an equally representative sample, with only a 2.55% overrepresentation of those of Irish decent and a 1.44% underrepresentation of Scottish in the geocoded sample versus the total population. Birthplace is also representative, with only a 1.92% underrepresentation of those born in Ontario. The representativeness of the sample population is without question. There are no concerns of an ecological fallacy (Sadler and Lafreniere 2017), as the sample is not only representative, but is also disaggregated to the level of the individual.

To overcome the limitation of previous studies that assumed workers were employed at the closest facility for which they were qualified, it was necessary to first establish the spatial link between each individual's home and their exact workplace. Workplaces varied widely in the industrializing nineteenth-century city, with many people still employed at home in semi-skilled trades and services, while others commuted daily to the factory or foundry. As London was also a commercial town, there was yet another significant cohort who travelled to work as clerks and support staff in the city's law offices, insurance companies, and financial institutions. Regrettably, an individual's specific workplace was not, and continues to not be, a question asked in the federal census. Occupation has been recorded since the first national census in 1871, but no question on workplace was asked until 1971. The modern questions on the journey to work are imprecise, with options such as 'worked at home', 'usual place of work', 'no fixed workplace address', or 'worked outside Canada'. Rather than a national enumeration, we instead turned to a local one, the city directory. City directories have been used, in some form, in many of the previous late nineteenth or early twentieth century journey to work studies, including Barke (1991), Bloomfield and Harris (1997), Deskins (1972), Goheen (1970), Harris and Bloomfield (1997), and Mayer (1977).

As with any source, they do have limitations. Harris (1986) reminds us that city directories were compiled for business purposes and likely underrepresented those who move often, including tenants and the poor. Bloomfield and Harris (1997) observe that working women are slightly underrepresented, a pattern also observed in the London directories. Regardless of these

Religion 1881			
	Geocoded Population	Census Population	Variance
	n = 21246	n =23636	
Protestant	83.46%	84.74%	-1.28%
Catholic	14.37%	13.33%	1.04%
Other	1.77%	1.45%	0.32%
Unknown	0.40%	0.48%	-0.08%

Gender 1881			
	Geocoded Population	Census Population	Variance
	n = 21246	n =23636	
Female	50.46%	50.45%	0.01%
Male	49.54%	49.55%	-0.01%

Marital Status 1881			
	Geocoded Population	Census Population	Variance
	n = 21246	n =23636	
Married	32.88%	33.49%	-0.61%
Single	62.68%	62.07%	0.61%
Widowed	4.44%	4.44%	0.00%

Origin 1881			
	Geocoded Population	Census Population	Variance
	n = 21246	n = 23636	
English	46.84%	46.61%	0.23%
Irish	28.81%	26.25%	2.55%
Scottish	17.69%	19.13%	-1.44%
German	2.02%	2.45%	-0.42%
French	0.96%	0.95%	0.01%
African	0.96%	0.94%	0.02%
Other European	0.70%	1.49%	-0.80%
Other	0.55%	0.49%	0.06%
Unknown	1.47%	1.69%	-0.22%

Birth Place 1881			
	Geocoded Population	Census Population	Variance
	n = 21246	n = 23636	
Ontario	57.60%	59.52%	-1.92%
England	18.78%	17.91%	0.87%
Ireland	8.81%	8.12%	0.69%
Scotland	5.52%	5.50%	0.02%
Canada	4.51%	4.16%	0.01%
United States	3.55%	3.49%	0.06%
Europe	0.77%	0.81%	-0.04%
Rest of World	0.29%	0.32%	-0.03%
Unknown	0.16%	0.18%	-0.02%

Fig. 6.1 *Table 1*. Geocoded census population compared to the total census population: London city and suburbs, 1881

limitations, Harris (1986) and Harris and Moffat (1986) support that city directories are arguably the most complete source of information on the specific employers of individuals. The study discussed in this chapter benefits from a collection of the London city directories that has been preserved in the Archives and Research Collections Centre at the University of Western Ontario and the London Room of the London Public Library. Four different publishers produced city directories between the years 1881 and 1891, with the London Publishing Company producing the directory of 1881 used in this study.

The London alphabetical directories include the name, residential address, tenure, occupation, and employer for each private citizen and business firm in the city. For widowed women, the name of their late husband is also noted. Those workers who did not work outside of their homes were also enumerated; the directory lists only a residential address or in some instances denotes this relationship between home and work with the word 'same'. These variables are captured from the social environment stage and used to establish the needed home–work link in this study. The geocoded business directory was utilized to determine the specific worksite of each employed person in the city. The business directory lists both major and minor employers, as well as sole proprietors, classified by their predominant industry or service (see Fig. 6.2 Upper). The name of the business and/or proprietor, along with a business address or the name of a significant commercial building is included in each listing. For those companies who paid an additional fee, a larger advertisement was included with some details of the services or wares for sale.

With the relationship between home and work established, it was necessary to record-link the combined city directory/census geodatabases with those of the business directory (Lafreniere and Gilliland 2018). To facilitate the record linkage across sources, we used *LinkageWiz*, a probabilistic record-matching software (*LinkageWiz* 2019). Records in both datasets were given a unique identifier, *WORK_ID* for the individual and *Business ID* for the business. Records were blocked using the municipal ward boundaries (captured through a spatial join with a temporally representative ward shapefile derived from a period map) and last names. Last names were blocked with various phonetic algorithms and string comparisons applied. A reference table was created due to the heavy use of short forms or nicknames used in the city directories for individuals' first names; examples include 'Wm' for William, 'Jn' for John, and 'Thos' for Thomas. Matching was then performed using match weights for last name, first name, gender (derived from a reference table of first names), occupation, and workplace (Fig. 6.2: Lower, *Table 2*). Last names had a variable weight determined by the number of instances within the dataset; this was used to overcome issues with commonality of


CLASSIFIED BUSINESS DIRECTORY.

LONDON AND SUBURBS.

Accountants.
Jewell Geo F, 3 Oddfellows' Hall.
Overell John, Albion Buildings.

Agricultural Implement Manufacturers.
Elliott John & Son, 301 Bathurst.
Globe Agricultural Works, s w cor Adelaide and Dundas.
Jackson George, 154 Fullarton.
Joseph Hall Mfg Co, e s Maitland, s e cor Bathurst.
Stewart & Co, 92 Fullarton.

Architects.
Craddock George, 272½ Dundas.
Ellis H D, Albert block.
Graydon Aquilla O, 76 Dundas.
Joanes Wm, 8 Oddfellows' Hall.
Peters S & Son, Albert Block, Dundas.
Tracy & Durand, City Hall Buildings.
Watson & Constantine, 145 King.

Artists.
(See also Photographers.)
Grant Wm, 110 Bathurst.
Hunt J P, 4 Oddfellows' Hall.
Judson Wm L, 348 Dufferin ave.
Lynn W F, 366 Grosvenor.
McEvoy H N, 204 Dundas.
Springer Mrs E B, 371 Dundas.

Baby Carriage Manufs.
(See Children's Carriages.)

Badges and Carriage Plates
Zabriskie & Thorpe, 90 Woodward ave, Detroit, Mich.

Bakers (WHOLESALE).
(See also Biscuit Manfs.)
Perrin D S & Co, 82, 84 and 86 Dundas.
The McCormick Manfg Co, cor Dundas and Wellington.

(RETAIL.)
Allaster Joseph, Elizabeth, London East.
Allaster P B, Adelaide, London East
Bartlett S G, 267 Wellington.
Bradford Amos, 194 Dundas.
Bridle O [illegible] 451 Dundas.
Caldwell John, Hamilton Road, London East.
Deans James, 579 Richmond.
Eldridge Mrs M A, 388 Clarence.
Fitzgibbon James, cor Ridout and York.
Friend Wm, n s Craig, London South
Fysh Hewitt, 234 Dundas.
Gerrie Bros, Dundas St, London East
Gore H H, 519 Richmond.
Jones J W, 91 Wellington.
Marchant J F, 247 Wellington.
Marsh J T, e s Adelaide, s Dundas

Variable	Match Weights
Last Name	Jaro-Winkler Variable
First Name	Exact Match: 5 Phonetic Match: 3 Nickname Match: 3
Gender	Exact Match: 1 Disagree: -1
Workplace	Exact Match: 8
Occupation	Exact Match: 5

Fig. 6.2 **Upper**: Excerpt of the London classified business directory, 1881 **Lower**: *Table 2*. Match weights used to record link census/city directory database to business directory

certain last names. For example, 'Smith' carries less weight than does 'Fowler' because there are 332 Smiths in the dataset versus 7 Fowlers. One-to-one matches were forced to ensure that a worker was linked with only one employer. A low minimum score of 10 for potential matches was maintained and only the most probable (over 16) were accepted as true matches. The potential matches were reviewed manually and adjustments to links made before they were included in the geodatabase. For workers who were employed by a large company with multiple worksites, such as the railway workers of the Great Western Railway, we used the occupation to estimate the most appropriate worksite. For example, engine builders were assumed to work in the engine house and wood and coal workers to work in the wood and coal yards. For complete unknowns, the main office was used, as it was assumed they would traverse there regularly for instructions and supplies or to retrieve wages. Each of these entries received a new record in the business directory geodatabase. For those who worked for an individual, such as gardeners or domestic servants, a new record was created in the business directory geodatabase for the home residence of the employer as listed in the city directory. To facilitate analysis, the field *WkPlaceID* was created to differentiate the worksites from the businesses.

The result is a robust sample of 5081 workers matched to their specific workplace out of the 2295 workplaces in the city. In previous studies, the largest sample of workers reported was 800, all from a single workplace (Harris and Bloomfield 1997). There were 14,707 adults between the ages of 17 and 63 in the city of London and its suburbs who were considered available for work. Age 63 was used as the upper limit as the number of individuals listed as 'gentlemen' was observed to increase significantly after this threshold. The reverse was observed for teenagers, with the rise in employment coming between their 16th and 17th year. It must be considered that 7,504 of the available workforce were women and this study was during a period where wage employment for women outside the home was still very low. It is estimated that 12% of working-aged women were engaged in wage labour or as proprietors in a home-based cottage industry.

Frances et al. (1996) found 11% of women were engaged in wage labour in Canada in 1891, while Costa (2000) found the number closer to 18% for the US in 1890. Bradbury (1984), on the other hand, estimates that 37% of Montreal women were engaged in wage labour during the same period. The numbers found for London appear to be in line, and any underrepresentation of women is likely an effect of the collection standards of the city directory enumerators. Finally, there were approximately 600 working-aged adults who lived in the city's asylum and old-age homes were included in the larger census but would be considered unfit for work because of various infirmities. The result is that the sample of 5081 workers used in this study represents 72% of the available workforce in the city of London and its suburbs in 1881, and although not as complete as the 90% sample of the total population, can still be considered the most robust ever compiled for a study of the home–work relationship in the late nineteenth century. Differences in the journey to work along ethnic and gender lines have been an area of considerable interest in the past, but little concern has been given to the representativeness of the samples which have been used to draw conclusions.

So, with the same concern as put forth previously for the representativeness of the geocoded 90% census sample, we must look to establish the reliability of the 72% workforce sample. These interrogations are critical, as subsampling inherently reduces the reliability of the inferences made about the larger population (Dixon and Leach 1977). This is particularly important in geodemographic studies where understanding the difference in behaviour or experiences across demographic variables and geographic space is the primary concern. Figure 6.3 (*Table 3*) provides a comparison between the working-aged population enumerated in the city directory and the workforce sample created in this study. Overall the sample is representative, with significant variances being found in a

Birthplace (% of Population)

	Geocoded Population	Directory With Workplace Link	Variance
Ontario	36.2	42.2	6.0
England	30.3	25.7	-4.6
Ireland	14.5	12.5	-2.0
Scotland	9.2	8.9	-0.3
Canada	4.2	4.8	0.6
United States	3.8	4.0	0.2
Europe	1.2	1.1	-0.1
Rest of World	.3	.4	0.1
Unknown	.2	.2	0.0

Ethnicity (% of Population)

	Geocoded Population	Directory With Workplace Link	Variance
English	46.7	43.8	-2.9
Irish	29.1	30.9	1.8
Scottish	18.1	19.2	1.1
German	1.8	1.9	0.1
Unknown	1.3	1.2	-0.1
African	.9	.6	-0.3
French	.9	1.0	0.1
Other European	.7	.9	0.2
Other	.5	.6	0.1

Occupational Class (% of Population)

	Geocoded Population	Directory With Workplace Link	Variance
1	11.3	14.8	3.5
2	6.2	7.5	1.3
3	10.3	14.7	4.4
4	42.7	44.0	1.3
5	6.4	5.6	-0.8
6	8.5	5.0	-3.5
7	4.5	6.9	2.4
8	.6	.1	-0.5
9	2.6	.9	-1.7
Unknown	7.9	.4	-7.5

Marital Status (% of Population)

	Geocoded Population	Directory With Workplace Link	Variance
Married	59.2	56.1	-3.1
Single	31.4	39.7	8.3
Widowed	9.4	4.2	-5.2

Gender (% of Population)

	Geocoded Population	Directory With Workplace Link	Variance
Male	81.2	85.8	4.6
Female	18.8	14.2	-4.6

Religion (% of Population)

	Geocoded Population	Directory With Workplace Link	Variance
Protestant	84.6	84.7	0.1
Catholic	13.1	13.2	0.1
Other	1.8	1.6	-0.2
Unknown	.5	.5	0.0

Fig. 6.3 *Table 3*. Comparison of geocoded city directory sample to journey to work sample, 1881

Occupational Class	Description
1	Merchant/Agent/Manufacturer
2	Professional
3	White Collar
4	Artisan
5	Semi-Skilled & Unskilled
6	Labourer
7	Servant
8	Farmer
9	No Occupation or Ambiguous *Note that this class includes students and gentleman

Fig. 6.4 *Table 4*. Modified Darroch and Orenstein occupational class scheme

select number of variables. For example, Ontario-born workers are overrepresented while those born in England are underrepresented. Single workers are overrepresented while those who are widowed are underrepresented. A brief explanation is in order for the occupational class variable outlined in Fig. 6.3 (*Table 3*). To facilitate the comparisons of the journey to work across the large number of occupations found in the sample, the author elected to use a modification of the occupational class scheme developed by Darroch and Ornstein (1980) for their study of the occupational structure in Canada in 1871. The scheme was modified by Dillon (2008) for use with the 1881 census and was provided for use in this study. The occupational class scheme is used as a proxy for socio-economic status since no wage information is available at the scale of the individual until the 1901 federal census (Fig. 6.4, *Table 4*). In addition to the lack of concern for representativeness in the sample datasets of previous studies is a complete lack of care to ensure adequate spatial coverage. No other study has considered whether the journey to work experiences they describe are representative of what individuals would have experienced across the urban fabric, from workers who lived in downtown residential hotels or above a store front, to those in the city's posh residential suburbs. Figure 6.5 (*Table 5*) outlines the spatial distribution of the workforce sample compared to those in the geocoded census with an occupation listed, by census geography, for each occupational class. Most of the variances are insignificant, with the major exception being that in Westminster

Geocoded Population vs. Total Population

By Census Geography

		Ward/Quartier No. 1			Ward/Quartier No. 2		
		Geocoded Population	Total Population	Variance	Geocoded Population	Total Population	Variance
occlass	1	11.19%	12.64%	-1.45%	15.99%	17.96%	-1.97%
	2	4.10%	3.97%	0.13%	8.15%	9.18%	-1.03%
	3	12.72%	13.36%	-0.63%	16.30%	14.04%	2.27%
	4	42.61%	43.32%	-0.71%	32.21%	33.13%	-0.92%
	5	9.05%	6.86%	2.19%	3.61%	4.33%	-0.73%
	6	9.56%	11.31%	-1.75%	4.70%	6.40%	-1.70%
	7	9.48%	7.22%	2.26%	15.52%	10.94%	4.58%
	8	0.09%	0.12%	-0.03%	0.55%	1.14%	-0.59%
	9	1.20%	1.20%	-0.01%	2.98%	2.89%	0.09%

		Ward/Quartier No. 3			Ward/Quartier No. 4		
		Geocoded Population	Total Population	Variance	Geocoded Population	Total Population	Variance
occlass	1	9.83%	11.20%	-1.37%	12.98%	17.11%	-4.14%
	2	4.62%	4.70%	-0.08%	12.98%	12.16%	0.81%
	3	9.56%	8.53%	1.03%	16.61%	15.05%	1.56%
	4	49.27%	51.88%	-2.61%	32.01%	33.40%	-1.40%
	5	8.42%	8.09%	0.33%	4.84%	4.33%	0.51%
	6	8.20%	7.59%	0.62%	2.77%	2.68%	0.09%
	7	7.71%	5.20%	2.51%	16.09%	13.81%	2.28%
	8	0.27%	0.72%	-0.45%	0.35%	0.62%	-0.27%
	9	2.12%	2.10%	0.02%	1.38%	0.82%	0.56%

		Ward/Quartier No. 5			Ward/Quartier No. 6		
		Geocoded Population	Total Population	Variance	Geocoded Population	Total Population	Variance
occlass	1	7.73%	8.16%	-0.43%	8.04%	10.01%	-1.97%
	2	4.84%	3.87%	0.98%	10.35%	11.28%	-0.93%
	3	10.39%	9.88%	0.51%	12.31%	12.92%	-0.61%
	4	48.82%	50.89%	-2.08%	42.03%	46.22%	-4.20%
	5	8.68%	7.73%	0.95%	6.22%	5.10%	1.13%
	6	11.69%	13.03%	-1.34%	6.85%	7.10%	-0.24%
	7	5.49%	4.58%	0.91%	10.56%	4.46%	6.10%
	8	0.59%	0.86%	-0.27%	0.28%	0.55%	-0.27%
	9	1.77%	1.00%	0.77%	3.36%	2.37%	0.99%

		Ward/Quartier No. 7			London (East/Est)		
		Geocoded Population	Total Population	Variance	Geocoded Population	Total Population	Variance
occlass	1	6.36%	6.14%	0.22%	7.62%	8.33%	-0.71%
	2	12.37%	13.05%	-0.68%	7.20%	2.78%	4.43%
	3	9.54%	9.40%	0.14%	5.05%	4.92%	0.13%
	4	38.52%	37.62%	0.90%	55.46%	61.41%	-5.95%
	5	7.60%	6.33%	1.26%	4.64%	3.85%	0.79%
	6	13.78%	16.31%	-2.53%	15.07%	15.13%	-0.06%
	7	8.48%	6.91%	1.57%	2.15%	2.06%	0.09%
	8	1.94%	3.07%	-1.13%	0.99%	0.72%	0.28%
	9	1.41%	1.15%	0.26%	1.57%	0.81%	0.77%

		Petersville (Village)			Westminster		
		Geocoded Population	Total Population	Variance	Geocoded Population	Total Population	Variance
occlass	1	7.11%	5.43%	1.68%	11.73%	5.34%	6.39%
	2	3.88%	3.04%	0.84%	7.62%	2.94%	4.67%
	3	10.56%	11.30%	-0.74%	9.79%	4.04%	5.75%
	4	53.45%	61.09%	-7.64%	36.03%	18.18%	17.86%
	5	9.05%	6.52%	2.53%	6.29%	2.67%	3.62%
	6	10.13%	8.70%	1.43%	11.61%	8.68%	2.93%
	7	2.37%	0.87%	1.50%	8.59%	4.24%	4.34%
	8	3.23%	3.04%	0.19%	3.14%	45.07%	-41.93%
	9	0.22%	0.00%	0.22%	5.20%	8.83%	-3.63%

Fig. 6.5 *Table 5*. Comparing spatial distribution, by census geography, of the workforce sample to the geocoded total population dataset distributed across occupational classes

Township artisans are overrepresented and farmers are underrepresented. This is due to the rural nature of the township and the methodology used in creating the social environment stage, which used fire insurance plans as the base dataset to capture civic addressing (Lafreniere and Gilliland 2015). This methodology suffers from a boundary effect between the edge of where coverage ceased for fire insurance plans and where the county atlases, which captured rural populations, began. Regardless, the sample used in this study is shown to be very representative of the overall population of London and its suburbs.

6.2.2 Calculating the Journey to Work

This chapter has thus far outlined a methodological framework for capturing a large sample of individuals at both their specific residential location and their specific daily worksite. Some studies have accomplished this feat, though not with the sample size and confidence we present here. What has limited all studies is the spatial accuracy of the calculated daily commute. Previous studies have used centroids of workplace and residential clusters, or arbitrary grids, and calculated the distances between them. Those studies that managed to map actual residences to workplaces used Euclidean distances rather than the more realistic street and pedestrian network paths. This straight-line approach removes the journey from the environment in which it took place and thus does not consider factors that may have influenced the commute. We know that the built form (building density, size, fencing), transportation networks (rail lines, roads, and pedestrian pathways), and natural barriers (rivers/lakes, elevation changes) influence the routes that individuals elect to take as they traverse the city (Ewing and Cervero 2010; Hanson 2004; Larsen et al. 2009, 2012). This study considers these environmental influences, providing a more reliable image of the daily commute to work in the late nineteenth century.

To begin, a built environment stage was harnessed to extract the 1881 road network for use in ArcGIS's network analyst. Possible pedestrian paths were added to the road network geodatabase by creating segments across obvious open space as denoted in the fire insurance plans. Two types of networks can be created for use in ArcGIS: a network dataset and a geometric network. It was elected to create a network dataset because it is optimized for undirected flow, whereas the geometric network is best used for directed systems such as rivers or utility lines. Default connectivity options were used and global turns were enabled as pedestrians are expected to be able to walk where they want and not have to follow restrictions typically imposed on vehicle traffic such as one-way streets (although there were no one-way streets in London in the nineteenth century). Length, expressed in meters, was the only cost calculated in the network; estimates of travel times were not added as they were too unpredictable to estimate for the 1880s because of poor roads and differences in personal behaviour. To calculate the path and distance to work, the shortest path route tools were utilized within the network analyst extension of ArcGIS 10. The first step was to use the calculate locations tool within network analyst to calculate and create a network location field for each business in the business directory shapefile extracted from the social environment stage. This is similar to snapping or linking the business to the road network, thus allowing the shortest path tool to more quickly and accurately locate the workplaces as stops. The distance from the centre of the businesses building polygon to the network was captured (an average of 24 m) to be added to the final calculated journey to work distance. The network dataset was used as the input analysis network. The search tolerance was set to 200 m in order to capture the few businesses that are far from the road network, such as the Great Western Railway and the Imperial Oil refining facility.

Numerous barriers to pedestrian travel were added before routes were calculated. These included dense multi-track rail yards and the two branches of the Thames River. Tolls existed on

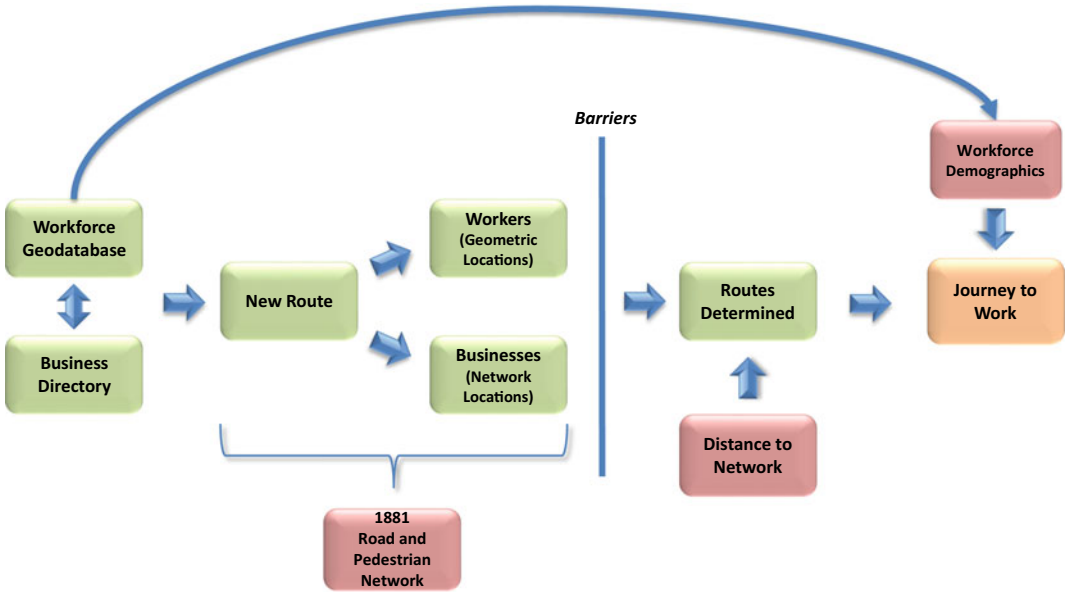


Fig. 6.6 Network-derived journey to work scheme

the many routes that emanated in and out from London's city limits, especially on bridges such as Clarke's Bridge on present-day Wellington Road. Diaries of the period suggest that these costs influenced travel paths for some of the lower income residents of the city and suburbs. While they may have had an impact on journeys, we elected not to include these tolls as barriers because of the difficulty in determining a toll's influence on a given individual. The workforce sample geodatabase and the business directory (with the newly created network location fields) were joined and a new route started in network analyst. The workers were loaded as stops using the default geometry search options. The businesses were then loaded as stops using the network location fields. The routes were solved, resulting in 4,945 routes calculated, and the distance to the network was added back to produce a final journey to work distance (Fig. 6.6). These routes represent the journeys of 97% of all workers. An examination of the failed routes showed that there were two workplaces, the insane asylum and Huron College, that were beyond the extent of the road network derived from the fire insurance plan and thus the routes to them were not able to be calculated. These workers were removed from the study. The final routes were then joined back to the original workforce geodatabase to allow for a socio-demographic relationship analysis.

The result is a reconstruction of the daily journey to work for some 5,000 workers from across the urban fabric of London and its suburbs. Figure 6.7 (Upper Left) outlines the distribution of commutes from the shortest to the longest. We see that the average commute for all workers is 1,071 m (the median is 954). 53% of workers travel more than 1 km but 88% travel less than 2 km. Figure 6.7 (Main) illustrates the completed journeys aggregated to each individual street segment. This provides a unique view of the daily commuting patterns in a nineteenth-century city. We can see the density of workers on street segments in the city's downtown core and the heavy use of arterial streets such as Richmond, Hamilton, King, and Queen. As we may expect, the pattern thins along the tentacles of the street network that reach out to the suburban fringe. In our largest contemporary cities, real-time traffic flow data is fed to our smartphones and vehicle GPS units or announced

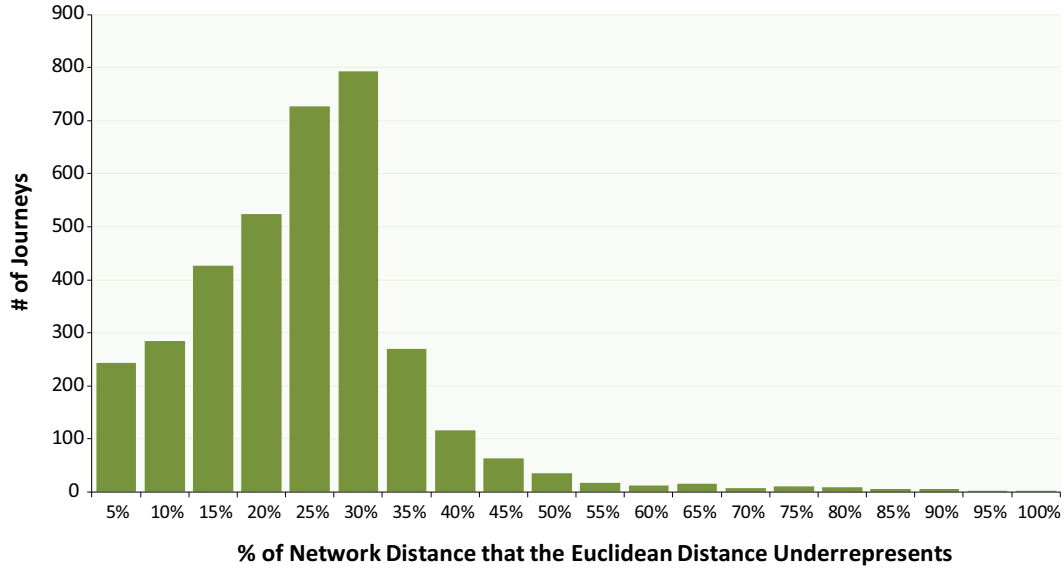
Fig. 6.7 **Upper left**: Distribution of distances travelled to work. **Main**: Daily traffic patterns in London and suburbs, 1881

to us over the radio. This view is the closest we have thus far to the same type of information for the pre-automobile city.

6.2.3 Comparing Euclidean and Network Methods

This study has depended upon the re-creation of daily journeys based on network distances rather than the Euclidean distances used in all previous studies. The use of network paths places the commutes in a more representative environment and allows for a deeper understanding of the role that natural and man-made barriers played on the routes individuals had available to them. But do the distances really change between the two methods of calculation? Figure 6.8 (Upper) illustrates that there is an overall average of a 20.8% underrepresentation when using the Euclidean method used in all previous studies versus the network method described here. We see that the Euclidean distance method used in previous studies has less effect on results as the journey lengthens; for the shortest journeys, distances are significantly underrepresented when the Euclidean method is used (Fig. 6.8, Lower).

The observed difference between the Euclidean and network-derived distances is a result of the aforementioned natural and man-made barriers. To illustrate, Fig. 6.9 (Left) outlines the difference between the Euclidean and network-based journeys of Ernest Smith, a bookkeeper who lived in the suburb of London South. His 1.5 km commute took Ernest across the iron York Street Bridge over the southern branch of the Thames River each day to his job at



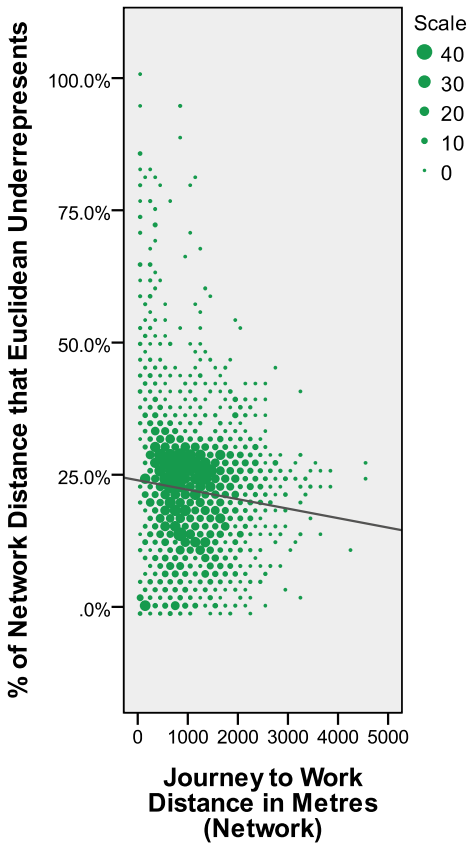


Fig. 6.8 **Upper**: Percentage of network distance that is underrepresented when the Euclidean method is used—by number of journeys * Euclidean mean is 848 m, network 1071 m. **Lower**: Percentage of network distance that is underrepresented when the Euclidean method is used as related to network-derived distance

the Bank of Montreal. Figure 6.9 (Left) illustrates that not only was a Euclidean journey literally not possible, but the difference between a Euclidean journey and a network one is substantial. What Fig. 6.9 does not show is the steep banks of the river that would have made it difficult to traverse any available shortcuts or alternative river crossings. If we look closer (Fig. 6.9 Right), we see the inability to continue with a more straight-line journey after crossing the river, as the density of the urban core of London restricted travel to the established roadways. These barriers resulted in a commute that was over 25% longer than the Euclidean distance, resulting in an extra 5–15 min' walk, depending on the weather and other factors.

6.2.4 Comparing to Assumed Workplaces Method

Many of the most influential studies of the nineteenth century journey to work utilized a method of approximation that assumed that workers were being employed by the closest employer for which they were deemed qualified to work (Dennis 1984; Deskins 1972; Greenberg 1980; Hershberg et al. 1981; Pooley 1984; Vance 1967). This paper suggests that this method of approximation leads to a significant misrepresentation of the true relationship between work and home, leading to an underestimation of the time spent travelling to work each day. A framework to overcome these assumptions has been outlined above, but the improvement has yet to be demonstrated.

To perform a comparative analysis between the two methods, it was necessary to find the closest workplace to each worker's home that would employ a worker with a related occupation, and then compare that distance to the actual distance the worker was travelling to work each day. To estimate what would be the closest workplace for which a given worker was qualified, it was necessary to link each worker with his/her industry of employment. However, due to the large number of industries (158) and workplaces (2295)—each of which would require a separate analysis—it was elected to use a sample. Two types of workplaces were chosen to represent two different industries, breweries and cigar factories. They were chosen because they represent workplaces that were not listed in multiple industry categories in the business directory, and thus provide a more direct relationship between home and a potential closest employer. Additionally, while they are both medium-sized industries in which workers commuted from a wide geographic area, they have differing levels of skilled labour and industrialization. Breweries employed 95 workers, a mix of skilled and semi-skilled labour, in a heavily mechanized environment. Maltsters, brewmasters, and coopers made up the skilled class, while semi-skilled workers included bottlers, packers, warehouse clerks, and teamsters. Some unskilled positions were also found in the city's breweries, such as those whose tasks were to shovel grain, load wagons, or clear rodents out of vats and barrels (Phillips 2000). Cigar manufacturing, a rapidly growing industry in 1881, was a modest operation with products made by hand by individual workers using a limited number of simple tools such as a rolling board, knife, and wrapping leafs. A total of 118 workers in our database were working in cigar factories. The 1889 Royal Commission on Labour and Capital includes testimonies from Londoners suggesting that many more individuals were employed in cigar making (Labour Commission 1889). They were primarily young women and children, recent immigrants who were 'secured by indenture' and paid the lowest of wages to complete the simple task of rolling tobacco leaves into cigars (Senecal 1889). We do not capture many of these indentured workers in this study. Those we do capture, however, represent a sample similar to that discussed in the Royal Commission reports, comprised of unskilled cigar makers, packers, and wood planers, including many who are women and teenagers.

To find the closest potential workplace on the road and pedestrian path network, we utilized the closest facility analysis tools in network analyst. Workplaces were loaded as facility locations using the network location fields created for the

Fig. 6.9 **Right**: Ernest Smith's journey to work using Euclidean and network methods. **Left**: Closer look at Ernest Smith's journey to work in the dense urban core

journey to work analysis. The workers were loaded as incident locations, again using the default geometry location functions. Routes were calculated between each worker's residence and the closest workplace within their industry. The exported result has a name field that indicates both IDs from the facilities (workplaces) and incidents (workers) separated by a hyphen (e.g. 125-50). These IDs needed to be separated so the distance calculations to the closest facility could be joined to the dataset with the worker's actual distance to work. To facilitate, a new field was created and the following VBScript run in the field calculator: *Left([Name], ((InStr (1, [Name],"-",1) -2)))*. The difference between the actual and potential distances was calculated with a 0 difference denoting that the worker was working at the closest employer and any positive number reflecting the difference in metres. Figure 6.10 (*Table 6*) charts the results, while Fig. 6.11 (Left and Right) provides graphical representations of the differences between closest and actual employer for brewery workers and cigar makers, respectively.

It is observed that only 19 of 95, or 20%, brewery workers are employed at the closest brewery to their residence, resulting in a difference of nearly half a kilometre in their average journey to work. A closer look reveals that of the 19 workers who did work at the closest brewery, 10 were employed as maltsters, a job that requires careful attention to the germination of the cereals used to create the malt for beer production. Grains had to be crushed, weighed, and boiled into mash, then cooked, filtered and drained, and boiled again with hops before fermentation (Phillips 2000). This delicate chemical process required constant attention and maltsters were on call seven days a week, living near their workplace in case they were needed to suddenly stop a malting that might finish early. Of the remaining nine workers, two were watchmen and another two held positions of responsibility as 'engineer' and 'foreman'. For cigar factory workers, only 13 of 105, or 12%, were employed at the closest factory to their residence, resulting in a difference of a half a kilometre in their average journey to work, similar to the brewery workers. With the exception of one foreman, a John Gerlach of WT Rutherford & Co's, the availability of inexpensive, convenient accommodations appears to have influenced the housing decisions of those who worked at the closest employer. All of the other cigar workers who worked at the closest factory were boarding either in a residential hotel or in a dwelling with non-related individuals. More than half of the women were under the age of 20, and another two were 15-year-old boys who were neighbours and worked together at William Kelly and Sons

	Total Workers	Work at Closest	Actual Workplace	Mean Difference in Meters
Brewery	95	19	76	496 Meters
Cigar Factories	118	13	105	528 Meters

Fig. 6.10 *Table 6*. Working at closest workplace versus actual workplace: brewery and cigar factory workers

Fig. 6.11 **Upper**: Brewery workers: differences between closest and actual employer. **Lower**: Cigar factory workers: differences between closest and actual employer

cigar factory, suggesting that we are picking up a few of the underrepresented workers in the city directory. Most of the city's cigar factories were located in the downtown core among other medium-sized factories that used paper and wood products, such as furniture manufacturers, carriage factories, and paper bag makers. Rents were low in this district of the city with most residential offering being in hotels or above storefronts, thus allowing an opportunity for the lowest paid cigar factory workers to find accommodations close to work, reducing their commutes to help compensate for the long work shifts that were demanded of them. It is recognized that many factors go into residential and workplace choice; however, these two examples, each with their peculiarities in occupational demands or residential needs, help illustrate that there are significant errors and omissions if one assumes that people work for the closest employer for which they are qualified. By establishing true home–work links, we can not only better understand what was a more realistic daily journey to work but can also begin to provide some insight into residential choices made by workers in the nineteenth-century walking city.

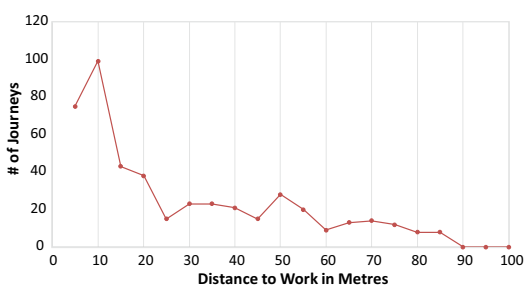
6.3 The Walking City Observed

The robustness of the sample, the spatial accuracy of the geocoding, and the sophistication of a GIS-based approach to the historical journey to work allows researchers to interrogate the daily commute in ways other studies could not. The socio-demographic variables available in the social environment stage can be extracted and used with the home–work linked sample to interrogate the commuting patterns along lines of ethnicity, age, gender, occupational class, or any combination of these that may be of interest. This section illustrates the possibilities of interrogating journeys by occupational class, workplace location, and gender. Before completing the socio-demographic analysis, it was necessary to first separate out those workers who were working at home and those who had a commute. Those who lacked a commute to work were as important to the social geography of the industrial city as those who had a daily journey. Although many records in the city directory

directly indicated that work was taking place in the home, there were numerous individuals for whom the information was either vague or missing. The expectation would be that the geocoding of home and work would then intersect; however, due to occasional imprecision in digitization or geocoding, some people who were indeed working at home were shown to have short commutes of anywhere from a fraction of a metre to 20 or 30 m. A decision was made to consider anyone working less than 50 m from home to be working at home. This threshold was selected as 50 m covers the maximum distance seen in the city lots from the front yard to a rear tenement, the residential experience for some of London's domestic servants. See Fig. 6.12 (Left).

6.3.1 Differing Commutes by Occupational Class

Interrogating how commutes vary across occupations, industries, or various occupational groups is a frequent and natural interest for researchers who examine the journey-to-work. Most of the studies outlined in the beginning of this chapter dissected the aggregate patterns of commuting along occupational lines. Goheen (1970), examining the journey to work in Toronto in 1860 and 1890, sampled select occupations to represent differing occupational sectors. For example, he uses a brewery and piano manufacturer to illustrate the industrial journey to work, and a retail outlet and life insurance company for the clerical journey. Lawton and Pooley (1976) followed a similar model using dock workers, shipbuilders, and office staff for their study of 1871 Liverpool. Aggregating individual occupations into three classifications is common in many studies, though the categories are not. Bater (1974) divided workers in St. Petersburg, Russia into managerial and professional, workshop owners and artisans, and factory workers. Barke (1991) divided his sample for Newcastle upon Tyne into the categories of professional, which included occupations such as accountants, lawyers and architects, producer-retailer, which included blacksmiths, watchmakers, and bakers, and finally retailers, which included pawnbrokers as well as those who sold fish, glass, or poultry. Taking a different approach, Hershberg et al. (1981) used industries to select their sample, starting first with ship building, sugar refining, iron rolling, banking, and morocco leather finishing. They were selected for their spatial coverage across Philadelphia, the ethnic composition of their workforces, and their respective longevity as industries in the city. To supplement their sample, they also used seven occupations to represent the swath of social classes, with physicians and lawyers representing the professional class, confectioners and bookbinders the small proprietors, and blacksmiths, cabinetmakers, carpenters, and the artisanal proprietors. Mayer (1977) categorized all occupations into one of eight



Occupational Class	% combining home & work	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	2.0	Median (km)
Merchants/ Agents/ Manufacturer	37.1	43.3	48.4	55.7	66.5	73.7	78.6	84.5	88.9	93.5	95.4	.86
Professional	26.2	31.8	36.5	44.1	51.7	61.7	68.0	75.9	80.3	85.0	89.8	1.04
White Collar	6.8	10.7	20.9	31.9	40.9	51.0	61.1	71.5	82.6	90.6	95.9	1.07
Artisan	14.6	19.7	28.0	36.3	47.2	58.1	66.8	73.9	80.5	85.9	90.0	.98
Semi-Skilled & Unskilled	22.6	31.7	39.8	49.3	58.8	65.3	70.9	77.0	82.9	88.0	90.8	.89
Labourer	13.0	14.6	23.0	38.3	46.0	57.1	67.4	74.3	79.3	84.7	88.9	.98
Servant	83.1	91.5	94.4	95.1	95.4	95.9	97.2	97.7	97.7	98.2	99.1	.19

Fig. 6.12 **Left**: Used to determine work at home versus work outside of the home status. **Right**: *Table 7*. Cumulative percentage at specified distances from workplace (in km)

occupational classifications using a scheme developed for the 1940 U.S. census by Edwards (1940) and later modified by Thernstrom (1973) and Conzen (1976).

To evaluate the differing journey-to-work across occupations in London, we follow Mayer's lead and utilize an occupational class scheme, though unlike Mayer, we employed one developed for the census that was used to build the dataset. This method allows us to easily examine all occupations across the entire spatial extent of the city rather than employing a sampling strategy, as done in the other studies. As all other studies have utilized Euclidean rather than network distances, it is impossible to accurately compare distances travelled across various cities. Additionally, the absolute distance travelled is largely influenced not only by residential and workplace choice, but by the size of the urban area, its density, the configuration of the street network, level of industrialization and commercialization, and development of transit systems, as well as barriers, both natural and man-made. Instead, patterns at the class level can be colloquially compared to previous studies by asking questions such as: are the distributions of the journey to work travelled different between occupational groups? Were labourers living near their factories and the professional classes near their offices? Do higher status workers travel greater distances than their lower class counterparts? *Table 7* in Fig. 6.12 outlines the journey to work experience for the seven urban occupational classes in the modified Darroch and Ornstein scheme. At first glance, with the exception of the very low median journey of servants, we see little difference in the median journey to work between the classes, with a difference of only 210 m between the longest and shortest median distances travelled by those who were not in service. As is observed in all other studies with a predominantly British population, most servants lived in their masters' domiciles, and those who did not lived very nearby, usually in boarding houses with other servants. However, if we examine the journeys closer by looking at the cumulative percentages at distance bands from 200 m to 2 km, we reveal a more complex pattern. Excluding servants for the time being, those in the highest occupational class of merchants, agents, and manufacturers, lived overwhelmingly closer to their workplaces than workers in any other group. Nearly 50% lived less than 400 m from work and three-quarters lived within a kilometre. They have the highest cumulative percentage of workers living close to work across every distance band but the very longest. Surprisingly, this pattern is not shared with the studies outlined above, where they found that factory owners and merchants, if they did not live at their businesses, lived a considerable distance away compared to other occupational groups. This difference may be a function of the very dense urban core of London that permitted a very short distance from the commercial and most of the industrial firms to the desirable neighbourhood on Talbot Street overlooking the Thames River and to the Woodfield neighbourhood adjacent to the city's only public park. The exception would be those industrialists involved in the growing rail and barrel works in the suburb of London East, as they lived in the same neighbourhood as their colleagues, but their businesses were significantly further away. When we turn our attention to the experiences of professionals and white collar workers, the patterns match many other studies. For example, Hershberg found that bank employees travelled further than their blue-collar counterparts. Barke found the same in Newcastle Upon Tyne, as did Layton and Pooley in Liverpool, Goheen in Toronto, and Mayer in Milwaukee. Interestingly, in London, one sees approximately a 10% increase in white-collar workers from one distance band to the next until 1.6 km, where the percentage catches up to the other occupational classes and the rate of increase slows. What is less pronounced in London is the number of labourers living close to their workplaces. This pattern was observed in Liverpool, Milwaukee, and somewhat in St. Petersburg. In London, however, labourers lag behind the other lower class group, semi-skilled and unskilled workers, until they meet at a 1.2 km journey. This may be explained by the high demand and limited inventory of housing in the core and nearby neighbourhoods. Instead, we

Fig. 6.13 Relationship between labourers and their workplaces

see labourers travelling from modest homes north-east of downtown as well as from the neighbourhood along the north shore of the south branch of the Thames to jobs along the rail lines in the centre of the city as well as the new industries in London East (Fig. 6.13).

6.4 Coincident Home–Work Locations

Studying the home–work relationship has primarily been the domain of feminist scholars who have been interested in the extent of unpaid domestic work by women and girls or the important role that piecework and cottage crafts played in supplementing the household income (Bradbury 1984, 1996; Bullen 1986). However, significant numbers of men still combined work and home. In the aggregate, we find that in 1881, 26% of London workers were combining home and work. 61% of the women worked at home whereas only 16% of men did. Women represent just over half (53%) of the work-at-home population in London in 1881. The methodology used to determine who worked at home versus outside the home was not clearly outlined in the few other studies that have directly investigated this relationship. The most comparable studies to this one are the work done by Hershberg et al. (1981) and Mayer (1977) who interrogated the frequency of coincident home–work locations in 1880 in Philadelphia and Milwaukee, respectively. Similar to this study, they relied heavily on the workplace information provided within the annual city directory; however, neither study outlines how they deemed a worker to be working at home. *Table 8* in Fig. 6.14 compares the frequency of workers who combined home and work, by occupation, for London to the case

Fig. 6.14 Left: *Table 8*. Percentage of workers with coincident home–work locations for select occupations: London, Philadelphia, and Milwaukee, 1880–1881

	London		Philadelphia		Milwaukee	
	N	% Combining Home & Work	N	% Combining Home & Work	N	% Combining Home & Work
Lawyers	14	0%	40	17.6%	57	10.5%
Physicians	38	84.2%	40	95%	44	65.9%
Carpenters	143	6.9%	115	53%	31	41.9%
Confectioners	28	14.2%	765	90.6%		
Bookbinders	16	18.7%	54	9.3%		
Blacksmiths	100	8.0%	112	23%		
Cabinetmakers	56	21.7%	129	54.3%		
Agents (unspecified)	40	5.0%			9	22.2%
Clerks (unspecified)	394	7.6%			19	26%
Tavern Proprietors	8	75.0%			206	89.3%
Barbers	24	20.8%			36	55.6%
Coopers	41	24.2%			34	64.7%
Foremen	59	22.0%			23	13%
Merchants	322	43.8%			54	29.6%
Butchers	54	46.3%				
Tinsmiths	35	8.6%				
Bakers	17	70.6%				
Servants*	511	87.9%				
Dressmakers*	59	55.9%				
Cooks*	40	72.5%				
Nurses*	44	97.5%				

* denotes occupations dominated by women

studies of Philadelphia and Milwaukee. All occupations listed in the comparable studies are included as well as select additional occupations for London. With the robustness of the London sample, we have the possibility to report every occupation, but have elected to only report some of the most notable here. Considering that each city has its own local industries that dominate the economy and the comparison cities have significantly larger populations than London (Philadelphia 850,000 and Milwaukee 115,000 in 1880), sample sizes for specific occupations are surprisingly similar across the cases.

Examining specific occupations, we see some immediate similarities between the three cases. No lawyers in London combined their home and work, and few did in Philadelphia or Milwaukee. Lawyers depended on centralized locations near the heart of the commercial district of the city, close to their clients in banking and insurance. However, they also had incomes that allowed for greater residential choice, with most electing to reside in some of the city's nicer neighbourhoods away from the downtown core (Fig. 6.15, Upper). The result is a long median journey to work of 1350 m, a pattern shared with the cohort in Philadelphia and Milwaukee. Unlike lawyers, in all three cities physicians rarely separated work from home. Instead, physicians operated out of their homes, in the transitional areas between the commercial core and the residential areas of the city. Two clusters are visible in London, one at the eastern edge of downtown bounded by Clarence and Colborne, largely along Dundas and Queen, and the other north of downtown between Talbot and Richmond. The five doctors who did have offices outside of their homes also located them in the same areas of the city (Fig. 6.15, Lower). One of the few offices in the commercial core was operated Dr. Oronhyatekha, a famous Mohawk doctor and businessman. His 1 km journey to work from his residence on Litchfield Street was the longest of all physicians in the city, where the median journey of physicians is a mere quarter of a kilometre. His election to operate his practice out of an office downtown on Richmond Street may be related to his appointment as the first Supreme

Fig. 6.15 **Upper**: Lawyer's residences and law offices in London, 1881. **Lower**: Doctor's residences and doctor's offices in London, 1881

Chief Ranger of the Independent Order of Foresters, whose offices in the Albion Buildings were a mere 150 m north of his office.

Skilled workers, such as carpenters, cabinetmakers, and blacksmiths, in London had a different home–work relationship than did their counterparts in Philadelphia. In London, these skilled workers rarely combined home and work. In Philadelphia, over half of carpenters and cabinetmakers, and nearly a quarter of blacksmiths, worked out of their homes. Hershberg et al. (1981, p. 138) suggest that Philadelphia saw an increase of small firms, employing 1–5 workers, working largely at home because the small profits associated with this artisanal production would have made operating a separate workshop cost-prohibitive. In London, carpenters and cabinetmakers had moved out of artisanal work by 1881 into the industrial setting, dominated by a couple of large factories. We find 45 (32%) of the carpenters were working at the Ontario Car Works in London East, building parlour train cars for the Great Western Railway. Another 26 (18%) were employed at Thomas Green's planing shop and sawmill. The remainder worked as carpenters in factories such as John Elliott's Phoenix foundry, where they made agricultural implements such as plows and shovels. Cabinetmakers follow much the same pattern, with over 80% being employed by three firms, the London Furniture Company, John Ferguson's coffin and cabinet factory, or the Bennett Brothers office furniture factory. London's blacksmiths were not found in a select few dominant factories, but rather spread across the industrial fabric of the city. The 100 blacksmiths in London were employed across 38 different factories, differing in form and function. Though not centralized, blacksmithing in London was still different from the more artisanal nature of blacksmithing reported for Philadelphia. The few blacksmiths who did combine home and work in London were all found in small homes with shops in the rear, located exclusively in largely industrialized areas of the city, presumably to reduce the possibility of irritating their neighbours.

Confectioners and coopers followed the same pattern, where few in London combined work and home compared to their counterparts in Philadelphia and Milwaukee. Most stark is the difference between London and Philadelphia for confectioners. A surprising 90.6% of confectioners in Philadelphia worked in their homes, versus a modest 14.2% in London. The only explanation provided for Philadelphia is that because they 'served a neighborhood market… they had little reason to separate their work and residence' (Hershberg et al. 1981, p. 137). In London, all but seven of the confectioners were employed by one of two firms, either McCormick's Manufacturing or Daniel Perrin's Biscuit Co. Both firms were substantial in size, employing over a hundred men, and had a large distribution of their confections across Canada. Coopers in London followed a similar pattern,

with the majority working for either Seale and Child's Cooperage or that of William Hawkins. Both firms supplied Labatt and Carling the barrels needed for their beer and ale. In contrast, Milwaukee's coopers worked in a more artisanal setting, with one or two coopers working out of a home, utilizing the ready access to cheap lumber from Wisconsin's growing timber trade to supply barrels to one of Milwaukee's 40 or so breweries. Turning our attention from industrial labour to commercial work, we see an expected home–work relationship pattern in London. Tavern proprietors, like their counterparts in Milwaukee, primarily lived above or behind their pubs. Agents and clerks largely worked outside of the home, as they served the needs of either a specific organization or the public at large. Curiously, this does not correlate with the experience in Milwaukee, where a surprisingly high percentage of agents and clerks worked at their residences. Unfortunately, Mayer does not specifically address why this was observed, an omission that raises the curiosity of this researcher.

6.4.1 Women's Experiences

Women's relationship between work and home is not explicitly treated by Hershberg et al. or by Mayer, so comparisons are not possible. A glance at Fig. 6.16 provides some insight into the experiences of women in London. Women's paid labour was dominated by occupations that extended from their duties at home. Few married women had steady employment outside of the home and thus most did not report an occupation to a census enumerator. Bradbury (1984) outlines that women worked for wages occasionally, taking in washing, ironing, sewing, or performing other domestic duties for neighbours, relatives, or friends. Dressmaking and tailoring in particular were popular part-time occupations for women; most women were sewing at home for their families and the more entrepreneurial also made items for sale to supplement the family income. Few of these part-time dressmakers are captured in the city directories; however, we are

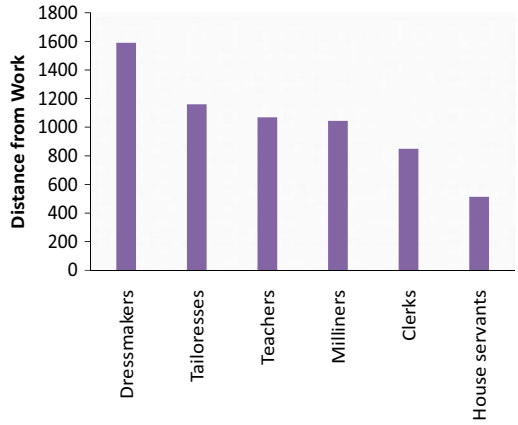


Fig. 6.16 Distance to work for women, select occupations, in metres

able to examine 59 dressmakers who appear to work on a more full-time basis producing dresses for the ladies of London.

Interestingly, only 56% of them work from home, with the remainder working primarily as one of many women at a dressmaking shop, such as those owned by Lydia Crone and by Mrs. Montague. These dressmakers had the longest commute of any women working outside the home, with a median journey of nearly a mile (1.6 km) (Fig. 6.16). The daily newspaper, the *London Advertiser*, had a steady increase in the number of notices in the female help wanted section for dressmakers and sewing girls through the 1870s. This increased demand for 'outsourced' dresses was partially a response to the School Act of 1871 which made schooling compulsory for all children, including the young girls who would have helped with the sewing (Ross 1896).

This loss of domestic labour, combined with the increases in real wages throughout the period, meant that women began to purchase dresses rather than make them themselves. The advertisements for dressmakers in the newspaper do not list a wage, though the frequency and voracity of the want ads suggest that the wages may have been higher than women would have made sewing at home, finding employment in the cigar factories, or working as cleaners in the one of the many hotels.

It should be acknowledged that the term 'dressmaker' in the census has been linked to prostitution in Victoria, BC (Dunae 2008, 2009). Census enumerators were instructed to record 'public women' in the census as a 'dressmaker'. Of course, not every dressmaker was in fact a prostitute. We harnessed a geodatabase of jail records for London and suburbs created for another project to quickly examine if the euphemism was possibly used in London, following the same methodology employed by Dunae. There were 54 arrests in 1881–1882 for the offence 'house of infamy', 'inmate of house of ilfame [sic]', or 'prostitute'. Six of these women had their occupation listed in the census as dressmaker, though none are found in our sample of workers. The enumeration goals of the city directory would have encouraged the directory enumerators to turn a blind eye to houses of ill repute. Although we don't have any 'prostitute dressmakers' captured in this study, the evidence suggests that it was possible that the environment found by Dunae in Victoria may also have existed in London.

The transition of girls to school and increasing household income resulted in more than just the need to purchase dresses from a dedicated dressmaker. It also helped support an increase in employment of domestic servants in Canadian middle-class homes. We found over 500 female domestic servants in our journey to work sample; this was the largest single occupation of women in the city. Nearly all (88%) lived in their masters' homes. The domestic servant was usually a single, young woman (median age in London was 23), and was primarily of English, Irish, or Scottish descent. Being 'in service', however, came with a stigma. Some scholars suggest that those women who had a choice preferred to work in factories, offices, or shops regardless of a difference in pay (Barber 1991, p. 8), while others argue that working-class parents preferred their daughters to work in private homes rather than being exposed to the dangers of the factory or receiving the low wages of the shops (Fahmi 1997, p. 73). We found the frequent advertisements for reliable servants to be increasingly dominant in the help wanted section of the newspaper from 1879 to 1891. The advertisements also served as a public notice that a household was capable of paying for domestic help, as the live-in servant was an important status symbol in Victorian Canada. Cooks and nurses represent another group of women who lived at work rather than working from home. London's cooks worked overwhelmingly in the city's hotels, working for both a wage and for room and board. They were older than domestic servants, with a median age over 30. The few that did not live at the hotel had a very short commute, averaging only a few hundred metres. All but a select few nurses lived at work, either caring for children in the Protestant Orphans' Home or for the infirm at the insane asylum. This section has illustrated the importance of interrogating the relationship between home and work, particularly for revealing the situation of a large portion of women. Women had long work days in the domestic sphere, and so did men in the factory. This was a period of industrialization when, in the aggregate, production shifted from being home-based and artisanal to factory-based. However, the decision to work outside or inside the home is still not always clear to historians and historical geographers. We need to continue to seek to understand the complexities of the geography of work in the nineteenth century.

6.5 Conclusion

This chapter has outlined a new methodological framework for re-creating the spatial relationships between work and home. The methodologies herein overcome many of the limitations of previous studies, helping to invigorate an area of research that has had little attention since the early 1990s. Although much of the data is the same as used by other researchers, by harnessing a complete digital record of the city's population and businesses, we can begin to understand the journey to work for not just a subset of the city's population, but for nearly every single individual, occupational group, workplace, or neighbourhood in the city. With a robust record linkage procedure, we have been able to make

absolute links between workers and their workplaces and calculate their daily journeys on a model of the street and pedestrian paths of the city. This method overcomes the concerns that Dennis (1984) postulated about quantitative research on the journey to work due to a lack of data that directly links work and home. It must be acknowledged that the methodologies used herein are not perfect. Like any interrogation of the past, we are limited by the quality of the data recorded. In this case, we must remember that city directories were compiled for an explicit financial purpose, to sell advertising and subscriptions to businesses and citizens alike (H.H. B. 1913). It was very much like a paid version of the telephone book that was commonly distributed a few years ago before the creation of internet searches. The census was not perfect either, as Curtis (2001), Hamilton (2007), Steckel (1991), and many others have thoroughly outlined. Census enumerations were and continue to be wrought with imprecise methods and procedures resulting in marginalized individuals being undercounted, misrepresented, or omitted completely. For this study of the journey to work, the effects include a skew towards full-time wage-workers, rather than those who worked part-time, did piecework, or were chronically unemployed. Married women who did not work outside the home, as well as teenagers who worked after school and on weekends, are also missed. These issues affect this study and must be considered when findings are analyzed. The algorithms used may also skew results. The study utilizes shortest path techniques provided by the software company ESRI. Although the mathematical models used have been scrutinized and accepted by the larger GIS community, the assumption that individuals are most efficient in their commutes is still not confirmed. In the walking city, it would be expected that some individuals trip-chained or took differing routes to meet with a friend or relative or to patronize a preferred vendor or service provider.

In addition, this study provides a methodology to study the journey to work at one point in time. We know that populations are not static and residential moves were frequent; less so were changes in employer or the specific worksite in which one carried out one's daily tasks. We know that residential mobility happens for many reasons, among them the attempt to better not only the daily commute but also the size and quality of one's accommodation (Gilliland and Olson 1998). A natural next step is to attempt to follow workers longitudinally across time. Other journey to work studies has looked at how patterns change over time, but no other has examined the same individuals over time. By looking at how the daily commute changed for individuals, combined with how their residential environments changed, we can begin to untangle how individuals made choices to balance the daily commute and the desire to improve the environment they and their children lived in.

References

Barber M (1991) Immigrant domestic servants in Canada. Canadian Historical Association, Ottawa

Barke M (1991) The middle-class journey to work in Newcastle upon Tyne, 1850–1913. J Transp Hist 12 (2):107–134

Bater J (1974) The journey to work in St. Petersburg 1860–1912. J Transp Hist *2*(4):214–233

Bloomfield AV, Harris R (1997) The journey to work; a historical methodology. Hist Methods 30(2):97–110

Bousssauw K, Neutens T, Witlox F (2011) Minimum commuting distance as a spatial characteristic in a non-monocentric urban system: the case of Flanders. Pap Reg Sci 90(1):47–65

Bradbury B (1984) Women and wage labour in a period of transition: Montreal, 1861–1881. Histoire sociale—Soc Hist 17(33):115–131

Bradbury B (1996) Working families: age, gender, and daily survival in industrializing Montreal. Oxford University Press, Toronto

Bullen J (1986) Hidden workers: child labour and the family economy in late nineteenth-century Urban Ontario. Labour/Le Travail 18:163–187

Conzen K (1976) Immigrant Milwaukee 1836–1860: accomodation and community in a frontier city. Harvard University Press, Cambridge

Corcoran J, Chhetri P, Stimson R (2009) Using circular statistics to explore the geography of the journey to work. Pap Reg Sci 88(1):119–132

Costa D (2000) From mill town to board room: the rise of women's paid labor. J Econ Perspect 14(4):101–122

Craven P (ed) (1995) Labouring lives: work & workers in nineteenth-century Ontario. University of Toronto Press, Toronto

Cross M (ed) (1974) The workingman in the nineteenth century. Oxford University Press, Toronto
Curtis B (2001) The politics of population: state formation, statistics, and the census of Canada, 1840–1875. University of Toronto Press, Toronto
Darroch G, Ornstein M (1980) Ethnicity and occupational structure in Canada in 1871: the vertical mosaic in historical perspective. Can Hist Rev 61(3):305–333
Debats D (2009) Using GIS and individual-level data for whole communities: a path toward the reconciliation of political and social history. Soc Sci Comput Rev 27 (3):313–330
Dennis R (1984) English industrial cities of the nineteenth century. Cambridge University Press, Cambridge
Deskins D (1972) Race, residence, and workplace in Detroit, 1880–1965. Econ Geogr 48(1):79–94
Deskins D (1975) A rejoinder to Gale and Katzman's comments on "Race, residence, and workplace in Detroit, 1880–1965". Prof Geogr 27(3):356–361
Dillon L (2008) 1881 Canadian census project, North Atlantic population project, and Minnesota population center. National sample of the 1881 census of Canada. Montreal, QC (Département de Démographie, Université de Montréal)
Dixon C, Leach B (1977) Concepts and techniques in modern geography. In: Sampling methods for geographical research, vol 17, Geo Books, Norwich
Dunae P (2008) Geographies of sexual commerce and the production of prostitutional space: Victoria, British Columbia, 1860–1914. J Can Hist Assoc 19(1):115–142
Dunae P (2009) Sex, charades, and census records: locating female sex trade workers in a Victorian city. Histoire sociale/Soc Hist 42(84):267–297
Edwards A (1940) Alphabetical index of occupations and industries. Government Printing Office, Washington D.C (Bureau of the Census, U.S Department of Commerce)
Ewing R, Cervero R (2010) Travel and the built environment. J Am Plan Assoc 76(3):265–294
Fahmi M (1997) 'Ruffled' mistresses and 'discontented' maids: respectability and the case of domestic service, 1880–1914. Labour/Le Travail 39:69–97
Frances R, Kealey L, Sangster J (1996) Women and wage labour in Australia and Canada, 1880–1980. Labour/Le Travail 38:54–89
Gale S, Katzman D (1975) Comments on race, residence, and workplace in Detroit, 1880–1965. Prof Geogr 27 (3):353–356
Gilliland J (2004) Muddy shore to modern port: redimensioning the Montreal waterfront time-space. Can Geogr 48(4):448–472
Gilliland J, Olson S (1998) Claims on housing space in nineteenth-century Montreal. Urban Hist Rev/Revue d'histoire urbaine 26(2):3–16
Gilliland J, Olson S (2010) Residential segregation in the industrializing city: a closer look. Urban Geogr 31 (1):29–58
Gilliland J, Olson S, Gauvreau D (2011) Did segregation increase as the city expanded? the case of Montreal, 1881–1901. Soc Sci Hist 35(4):465–503
Goheen P (1970) Victorian Toronto 1850–1900. Department of Geography, University of Chicago, Chicago
Green DR (1988) Distance to work in Victorian London: a case study of Henry Poole, bespoke tailors. Bus Hist 30(2):179–194
Greenberg S (1980) The relationship between work and residence in an industrialsing city. In: Cutler WW, Gillette H (eds) The divided metropolis: social and spatial dimensions of Philadelphia. Greenwood Press, Westport, Conn, pp 1800–1975
H.H.B. (1913) Making Toronto's Directory: A Prodigious Undertaking. The Toronto Star Weekly
Hamilton M (2007) "Anyone not on the list might as well be dead": 7 Aboriginal peoples and the censuses of Canada, 1851–1916. J Can Hist Assoc 18(1):57–79
Hanson S (2004) The context of urban travel: concepts and recent trends. In: Hanson S, Giuliano G (eds) The geography of urban transportation. Guilford Press, New York, pp 3–29
Harris R (1986) Housing in Canadian cities: an agenda and review of sources. Urban Hist Rev 14(3):258–266
Harris R, Bloomfield AV (1997) The impact of industrial decentralization on the gendered journey to work, 1900–1940. Econ Geogr 73(1):94–117
Harris R, Moffat B (1986) How reliable is the modern city directory. Can Geogr 30(2):154–158
Hershberg T (1976) The Philadelphia social history project: an introduction. Hist Methods Newsl 9(2–3):43–58
Hershberg T, Light D, Cox H, Greenfield R (1981) The "journey to work". an empirical investigation of work, residence and transportation, Philadelphia, 1850 and 1880. In: Hershberg T (ed) Philadelphia: work, space, family and group experience in the nineteenth century. Oxford University Press, New York
Hoskins R (1989) An analysis of the payrolls of the point St. Charles shops of the grand trunk railway. Cahiers de géographie du Québec 33(90):323–344
Kealey G (1980) Toronto workers respond to industrial capitalism 1867–1892. University of Toronto Press, Toronto
Labour Commission (1889) Royal Commission on the Relations of Labour and Capital in Canada, Report. Queen's Printer, Ottawa, ON
Lafreniere D, Gilliland J (2015) "All the World's a Stage": a GIS framework for recreating personal time-space from qualitative and quantitative sources. Trans GIS 19(2):225–246
Lafreniere D, Gilliland J (2018) Residential, occupational, and workplace mobilities, 1881–1891. In: Gregory I, Debats D, Lafreniere D (eds) The Routledge Companion to Spatial History, Routledge, London, pp 299–319
Larsen K, Gilliland J, Hess P (2012) Route based analysis to capture the environmental influences on a child's mode of travel between home and school. Ann Assoc Am Geogr 102(6):1348–1365
Larsen K, Gilliland J, Hess P, Tucker P, Irwin J, He M (2009) Identifying influences of physical environments and socio-demographic characteristics on a

child's mode of travel to and from school. Am J Public Health 99(3):520–526

Lawton R, Pooley C (1976) The social geography of Merseyside in the nineteenth century. Final Report to SSRC, Liverpool

Lees L (1969) Patterns of lower-class life: Irish slum communities in nineteenth-century London. In: City YC-C, Thernstrom S, Sennett R (eds) Nineteenth-century cities: essays in the new urban history. Yale University Press, New Haven, pp 359–385

Lewis R (2000) Manufacturing Montreal: the making of an industrial landscape. Johns Hopkins University Press, Baltimore

LinkageWiz (2019) LinkageWiz Data Matching Software. www.linkagewiz.net

Mayer J (1977) The journey to work, ethnicity and occupation in Milwaukee, 1860–1900. PhD Thesis, University of Michigan, Ann Arbor

Olson S, Thornton P (2011) Peopling the North American city: Montreal 1840–1900. McGill-Queens University Press, Montreal

Opp J, Walsh J (eds) (2006) Home, work, and play: situating Canadian social history, 1840–1980. Oxford University Press, Toronto

Phillips G (2000) The Odyssey of beer and brewing in Victorian London-Middlesex. Cheshire Cat Press, Sarnia

Pooley C (1984) Residential differentiation in Victorian cities: a reassessment. Trans Inst Br Geogr New Ser 9:131–144

Pooley CG, Turnbull J (1997) Changing home and workplace in Victorian London: the life of Henry Jaques, shirtmaker. Urban Hist 24(2):148–178

Pooley C, Turnbull J (1999) The journey to work: a century of change. Area 31(3):281–292

Pooley C, Turnbull J (2000) Modal choice and modal change: the journey to work in Britain since 1890. J Transp Geogr 8:11–24

Pred A (1966) The American Mercantile city: 1800–1840. Ann Assoc Am Geogr 56(2):307–338

Ross G (1896) The school system of Ontario Canada: its history and distinctive features. D. Appleton and Co, New York

Sadler RC, Lafreniere DJ (2017) You are where you live: methodological challenges to measuring children's exposure to hazards. J Child Poverty 23(2):189–198

Senecal A (1889) Report of the royal commission on the relations of labor and capital in Canada. Ottawa

Steckel R (1991) The quality of census data for historical inquiry: a research agenda. Soc Sci Hist 15(4):579–599

Sultana S, Weber J (2007) Journey to work patterns in the age of sprawl: evidence from two midsize southern metropolitan areas. Prof Geogr 59(2):193–208

Thernstrom S (1973) The other Bostonians: poverty and progress in the American metropolis. Harvard University Press, Cambridge

Thompson EP (1980 [1963]) The making of the English working class. Penguin Books, London

Vance J (1967) Housing the worker: determinative and contingent ties in nineteenth century Birmingham. Econ Geogr 43(2):95–127