Frequent walkers: from healthy individual behaviours to sustainable mobility futures

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*Plus il y a d'autos, de motos, d'avions et de chemins de fer à prix réduits, plus on peut circuler vite et confortablement, plus le vrai luxe, le vrai raffinement consiste à se simplifier et à ralentir le mouvement.**

Guy de Pourtalès
Journal, 23 August 1934

**: The more cars, motorbikes, aeroplanes and low cost railways, the more you can travel quickly and easily, the more the real luxury, the real sophistication is to simplify and slow down the movement (translation by D. Christie).*

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Résumé

La marche est souvent considérée comme une activité accessoire. Peu de choses sont connues sur la distribution de la marche dans les populations contemporaines, et encore moins sur les rares personnes qui marchent plus d'une heure par jour dans l'espace public, que nous appelons "grandes marcheuses/grands marcheurs". Parce qu'elles ont réussi à adopter et à maintenir ce comportement, ces personnes pourraient constituer une population pionnière, susceptible d'inspirer un basculement du système de mobilité vers un modèle sain et durable.

Ce projet cherche à comprendre comment et pourquoi on devient grand marcheur, comment intégrer cette marche dans son quotidien, et ce qu'on perçoit comme facilitateurs ou obstacles à la marche. Pour répondre à ces questions, nous utilisons des méthodes mixtes dans une perspective trans-disciplinaire. Dans la phase quantitative, nous analysons le Micro-recensement mobilité et transport suisse, constatant que la marche est distribuée de manière inégale: un jour donné, plus d'un tiers de la population âgée 6-99 ans ne se déplace pas à pied, alors que 13% effectuent 5 km ou davantage.

Des entretiens semi-directifs avec 41 grands marcheurs adultes, principalement dans la région Genève-Lausanne, montrent que la santé, le plaisir et le bien-être sont des motivateurs-clés. Des stratégies telles que se lever plus tôt ou varier les parcours à l'aller et au retour sont fréquentes. La marche est favorisée – mais pas de manière décisive – par les parcs et espaces verts. Des obstacles sont le trafic routier, les trottoirs étroits ou manquants, les feux trop lents, ainsi que l'exposition au bruit, à la pollution de l'air ou à la fumée de cigarette. Les motivations environnementales sont rarement mentionnées et nous ne trouvons aucune trace d'une communauté informelle de grands marcheurs. Ils ne se connaissent pas entre eux et ont tendance à se couper du monde extérieur lors de la marche, opérant sur un mode socialement fermé. Des motivations individuelles plutôt que collectives émergent de l'analyse.

Puis nous avons équipé 48 volontaires de capteurs GPS, pendant 8-10 jours, et avons effectué des entretiens de suivi assistés par ordinateur en nous focalisant sur les parcours précis effectués à pied. Dans une dernière phase présentée dans les Annexes, nous avons permis à 27 volontaires de rendre visite au Bus Santé des Hôpitaux universitaires de Genève, pour déterminer leur glycémie, cholestérol total, pression sanguine, rythme cardiaque, indice de masse corporel et rapport taille-hanches. Cette phase vise à collecter des données de base pour un projet ultérieur qui étudiera les effets de la marche fréquente sur la santé.

Nos analyses montrent que, chez un premier sous-groupe de grands marcheurs, la marche est liée au besoin de se déplacer et est intégrée au système personnel de mobilité. Un autre sous-groupe marche pour les loisirs et pas pour se déplacer, avec des impacts moins favorables sur l'environnement. Dans notre discussion, nous

considérons que la marche fréquente est une activité incarnée, située et discrète, avec des avantages instrumentaux limités à cause du temps et de l'effort requis. Des attributs symboliques, liés au statut auto-perçu et à l'identité, sont susceptible de jouer un rôle important et devraient faire l'objet d'études complémentaires. La conclusion inclut une proposition d'agenda de recherche ainsi que des recommandations pour promouvoir la marche régulière au niveau populationnel.

Mots-clés: marche, urbain, Suisse, suivi GPS, entretiens qualitatifs, méthodes mixtes, santé, trans-disciplinarité, mobilité

Abstract

Walking is often taken for granted or considered as an ancillary activity. Little is known about the distribution of walking in contemporary populations, and even less about the few people who walk for an hour or more in public space on most days of the week, for whom we coined the term "frequent walkers". Because they have succeeded in acquiring and maintaining this behaviour over time, frequent walkers may constitute a pioneer population with the potential to inspire change towards a sustainable and healthy mobility system.

This project seeks to understand how and why people become frequent walkers, how they integrate walking into their schedules, and what they perceive as facilitators or hindrances to frequent walking. To answer these questions, we undertook a mixed-methods study with a trans-disciplinary approach. In a quantitative phase, we analysed the Swiss mobility and transport micro-census, finding that the walking is distributed in an unequal manner: over one third of all people aged 6-99 do not travel by foot on a given day, while around 13% walk for 5 km or more.

Semi-structured interviews with 41 adult frequent walkers, mostly from the Geneva-Lausanne area, show that concern with personal health, pleasure and well-being are key motivators for walking. Time-management strategies such as getting up earlier in the morning or using alternative routes on the way out and on the way back home are common. Walking is facilitated – but not decisively – by parks or green spaces. Hindrances include road traffic, narrow or missing pavements (sidewalks), slow traffic lights, and exposure to traffic noise, air pollution or tobacco smoke. Environmental motivation is rarely mentioned and we find no trace of an informal community of frequent walkers, who do not know each other and tend to switch off while walking, operating in a socially closed mode. Individual rather than collective motivations emerge from the analysis.

We then equipped 48 volunteers with a GPS tracker, for a duration of 8-10 days and carried out computer-assisted follow-up interviews concentrating on the details of walking routes. In an additional phase presented in the Appendix, we enabled a subset of 27 volunteers to have a check-up in the Health Bus of Geneva University Hospitals, to determine their glycaemia, total cholesterol, blood pressure, resting heart rate, body-mass index and waist-to-hip ratio. This phase aimed at acquiring preliminary data for a follow-up project to investigate the health effects of frequent walking.

From the pooled analysis, there emerged a group of frequent walkers whose walking was mainly for transport and was integrated into their daily transportation routines. Another group walked for leisure but not for transportation, leading to less favourable impacts on the environment. In our general discussion, we consider frequent walking to be an embodied, situated and inconspicuous practice, with limited instrumental

advantages due to the time and effort involved. So-called symbolic attributes, related to perceived status and self-identity, are likely to play an important role and are worthy of future study. We conclude with a research agenda and recommendations for promoting frequent walking at population level.

Key words: walking, urban, Switzerland, GPS tracking, qualitative interviewing, mixed methods, health, trans-disciplinarity, mobility

1 INTRODUCTION

1.1 Foreword

In a context of renewed interest for urban quality and sustainable mobility across Europe, several research projects and programmes have focused on walking in urban settings. However, walkers themselves have rarely been asked about their personal experience regarding everyday walking. Especially, people who regularly walk over one hour per day (outside of buildings) have to our knowledge never been identified and never been asked what it is like to be a “frequent walker”. This is surprising, given the numerous injunctions that call for people to save energy, avoid using their car, or walk 10’000 steps per day – among other recommendations that sometimes conflict with each other.

Indeed, walking stands at the intersection of several policy sectors: public health, mobility and transport, and the environment (including climate change). It is clear that if many more people were to take up walking on a very regular basis, this would change the face of European cities – especially if this walking replaces the use of polluting transport modes. However, there is very limited available guidance on what such a walking city would look like. The approach adopted in this thesis is to identify the few people who already display this behaviour and find out how they set up and experience their lifestyle, which may be rare at present but which holds promise for the future.

We consider people who walk a lot on a regular basis to be potential experts on walking. This project seeks to understand their mindsets and behaviours, using applied methods and perspectives. We hope that this may help inform transitions and opportunities leading to sustainable mobility futures, a topic that is currently generating substantial interest among the international research community.

Walking is such a fundamental human behaviour that articles about it can be found across many fields of academia, from public health to mobility studies and transportation science. It is therefore necessary to explain what elements are the focus of interest in this trans-disciplinary project, and which are not. We define frequent walkers as people who walk for an hour or more in public space on most days of the week. What we mean by public space is publicly accessible areas, outside of homes, private gardens, workplaces and shopping malls. Our research is essentially about healthy adults. Such an approach is common in mobility and transportation science (although the fact that most of the subjects are healthy adults is not always acknowledged explicitly) but somewhat unusual in the field of public health. We believe, however, that our project is entirely compatible with the public

health approach, due to the universally acknowledged value of walking for disease prevention and health promotion, i.e. upstream of and independently from any specific medical condition.

Our choice to focus on walking in public space is also based on a practical element: information on walking in national surveys or that can be obtained by direct observation or GPS tracking is essentially about walking out of doors. Finally, this approach allows our research to enter into contact with the rich international literature about the quality and use of public space. Another area in which it proved necessary to concentrate and limit somewhat the scope of the project is geography. In order to understand what people are doing in time and space, it is necessary to have a strong initial understanding of the urban and other areas in which they are navigating. For this reason, after a couple of initial interviews with people living further afield, it was decided to concentrate on Switzerland, and specifically on the Geneva-Lausanne area about which we already had detailed knowledge.

The idea of focusing on frequent walkers, a term that we coined ourselves for this project, came to us spontaneously from the casual observation of people walking between Geneva or Lausanne main train stations and various spots within these two cities, as part of their morning commute. No frequent walkers were known to us before the onset of this project, and to our knowledge no trace of such a sub-population had ever appeared in the international peer-reviewed literature. Nevertheless, our observations and a cursory look at Swiss national survey data showed that frequent walkers were likely to exist, so we submitted this project for funding in February 2013. Despite the uncertainties linked to investigating a newly defined population, we are thankful that the Swiss national science foundation (and 3 anonymous reviewers) decided that our project was worth supporting.

DEFINITION

Our group defines “frequent walkers” as people who walk for at least one hour in public space on most days of the week. This is around least three times more than the average walking time of the Swiss population. One hour of walking corresponds to around 5 km on an average day, if the activity is carried out at a fast pace (5 km/h).

1.2 Research structure

Prior to the investigation of any research questions and hypotheses (these will be presented later, at the end of the Literature review), there is a considerable descriptive element to this thesis, which was essential since frequent walkers had not been described anywhere before. So, our first step is to identify and analyse the sociodemographic characteristics and basic behaviour of potential frequent walkers, using Swiss country-wide official surveys. Then we recruit frequent walkers in the Geneva-Lausanne study area and investigate whether they might provide information which could help lead society towards more a sustainable transportation system. As will be explained more fully in the Methodology section, we use a trans-disciplinary approach to describe frequent walkers, frequent walking, and to answer the research question and hypotheses.

Our Literature review concentrates on 3 core areas, which are necessary in order to understand the importance and interest of frequent walking: Health, Mobility and the Environment. Then a short Methodology section explains our trans-disciplinary, mixed-methods approach. This is followed by 3 Results sections describing our analysis of Quantitative, Qualitative and Spatial data.

Short discussion paragraphs disseminated through these 3 sections discuss the research results as they emerge, and seek to position them in relation to the international peer-reviewed literature and other sources of information.

A general Discussion section then seeks to piece together the “clues” acquired during this process, to answer the research question and test the hypotheses. The Conclusion contains suggestions for a research agenda as well as policy recommendations. It is important to bear in mind that the trans-disciplinary approach implies that we will try to bring, say, sociological insights onto health data. Likewise, we may look at transportation data in the Quantitative section with the eye of a public health researcher. The reader should therefore not expect a pure "transportation science" approach to national census data, any more than a bona fide "health promotion" outlook. Some preliminary health data and analyses are presented in the Appendix, with a view to kick-starting research to connect frequent walking with various health issues in future research projects. Finally, in a rather Continental European tradition, I have resorted to using the pronoun "we" rather than "I" (or the passive voice) throughout this thesis document. It should however be made clear that I carried out the work alone, except where mentioned otherwise, with the support of my supervisor, my co-supervisor, and a consultant, Mr Michael Flamm, who assisted me with the technical aspects of GPS tracking, such as computer programming, which are not described in this thesis.

2 LITERATURE REVIEW

2.1 Defining the scope

Walking is the focus of interest for reasons linked to public health, environmental protection, climate change and transport policy. These each form distinct policy areas, usually in the hands of different departments in city administrations as well as provincial (cantonal, in the case of Switzerland) and national governments. A similar fragmentation can be observed in scientific research.

This section presents several aspects of current research related to walking, then seeks to place them in a wider scientific and political context. The main source is the international peer-reviewed literature – accessed via platforms such as Web of Science / Web of Knowledge, PubMed (NIH), ScienceDirect and GoogleScholar – with occasional forays into recognised sources of grey literature such as national governments and United Nations organisations including the World Health Organization (WHO). As will rapidly become apparent, there is no literature on frequent walkers, so the review concentrates on walking in healthy adults. The abundant medical literature on the use of walking for handling a range of medical conditions is deliberately not treated here. The results of this wide-ranging literature review are presented topic by topic rather than discipline by discipline. This is in keeping with the principles of trans-disciplinarity, which will be explained more fully in the Methodology section. Although walking is simple in many ways, emerging research on walking shows that it is also a complex topic area.

For example, walking is often separated into walking for transport, walking for exercise and walking for leisure, with extensive literature in these three sub-fields. However, based on our experience and on expert opinion that we sought before the start of this project, we do not believe that it makes sense to operate an *ex ante* separation between these different types of walking. Motivations for walking (or not walking) are indeed complex and at least one study has found evidence of a correlation between the two types of walking, suggesting that it is common for a single walking bout to have both leisure and transport motivations (Spissu et al., 2009).

To guide our literature review, we begin with a citation from the European COST Action 358, entitled *Pedestrian Quality Needs* (Methorst R., 2010):

"People need to walk. The quality of their experience however can vary greatly and this in turn is known to directly impact on their decisions to choose to walk instead of choosing other modes and the frequency, length, scope and enjoyment of their trips. Walking is such a basic way of travelling that it is easy to forget its importance.

Walking however should be considered as the essential lubricant of the transport system. Although almost everyone agrees that it is important to have pedestrian facilities, few politicians give it priority (…). For pedestrian policy to be further developed and implemented a new impulse is clearly needed."

As has been recalled by contemporary researchers (Kelly et al., 2011), as long ago as 1979, a book named *Walking is Transport* reported that: “in both transport policy and practice, [walking] has been overlooked or at the least, has been inadequately recognised” (Hillman & Whalley, 1979). This may in part have been due to a feeling that walking would "take care of itself” and therefore required little attention (Litman, 2003).

There is evidence that, in previous decades, walking was not only forgotten but the victim of deliberate policies to curtail it, at least in some countries. In the USA, transportation and land use policies that made walking and cycling “less feasible, less convenient, and more dangerous” resulted in a reduction in the share of non-motorized trips of 10% to 6% between 1977 and 1995. However, at that time the mode share of walking was considerably higher in countries such as France, Italy, Switzerland and Germany (all between 20 and 25% in 1995). Interestingly, countries with very high levels of cycling often have slightly lower levels of walking. Denmark and the Netherlands topped the list in 1995 with 40-45% of all trips due to walking and cycling combined, but there already was more cycling than walking in the Netherlands and around the same proportion of each (20%) in Denmark (Pucher & Dijkstra, 2000).

2.1.1 Originality and practical importance of this project

To our knowledge, the phenomenon of people who spontaneously walk great distances on a regular basis has never been investigated. This is surprising since there is no doubt that such a behaviour is socially and politically desirable. It is therefore of strategic importance for several sectors of public policy to understand who these people are, how and where they walk, and why. We consider frequent walkers to be experts on urban walking. Identifying and getting to know them is therefore likely to help the scientific community acquire information on how frequent walking might be mainstreamed in the future.

The importance of encouraging frequent walking in the general population cannot be overstated. As the World Health Organization has emphasised on numerous occasions, promoting walking is one of the most important public health measures towards an eventual stabilisation of the increasing burden of non-communicable diseases. It is the cheapest, and in a financially constrained world this is an important argument. It is also socially inclusive, in the sense of being widely accessible, including to people with limited means. In a current global situation marked by

increasing urbanisation amid widespread economic, social, political, cultural and environmental inequalities, walking has the promise to improve urban quality for all inhabitants and users of such areas.

In order to encourage frequent walking among the population, it is necessary to possess some understanding of what frequent walking is, who currently practices it, in what conditions, and why. This is the preliminary objective of our research: to understand and comprehensively describe the “happy few” who already display a behaviour which is almost universally qualified as desirable. We focus on the Geneva-Lausanne area in Switzerland, because it is displays complexity while remaining accessible from a practical research point of view. Along the north coast of Lake Geneva, it includes two medium-sized cities and a dozen small towns, interspersed with suburban and rural pockets. It has relatively high levels of walking and a good public transport system. It features varied urban and mobility policies, linked to the fact that political responsibility is split between the municipal and cantonal levels and because territories in two cantons are involved (Geneva and Vaud).

This is not an advocacy project. However, we are aware that efficient advocacy needs to be based on solid science. Our project can therefore provide a useful science base which may be used by others to advocate for frequent walking. Indeed, it is worth considering whether these frequent walkers may be viewed as “mobility pioneers” (Kesselring, 2006). In social marketing terms, they may be described as "innovators" or "early adopters". If this is the case, the results of this study may be of interest for people active in social and preventive medicine and in the diffusion of so-called “preventive innovations” (Rogers, 2002).

2.2 Health and wellbeing

Walking is the most fundamental form of human transportation. It requires no particular talents or equipment; it is cheap, practical, feasible, accessible, modifiable and convenient. In recent decades, humanity’s natural tendency to walk has been strongly reduced by modern life (Tudor-Locke, 2012). Walking is also the least-understood major mode of transportation in many countries. Little has been done to collect data on the extent and nature of walking behaviour, even though knowledge about pedestrian behaviour has critical policy applications (Agrawal & Schimek, 2007). Although many researchers, advocates and experts on walking have argued that walking be placed firmly at the centre of transport policy, this is clearly not yet the case (Von der Mühll, 2004).

2.2.1 Genetics and evolution

Research has shown that the global decrease in physical activity is to a great extent due to daily physical activity patterns that are profoundly different from those for which humans are genetically adapted (Eaton, 2003). The ancestral natural environment in which our current genome was forged via natural selection called for considerable energy expenditure. Our genes were selected for a vigorous lifestyle and the change to a largely inactive indoor lifestyle was extremely abrupt by evolutionary time scales. Average walking distances for hunter-gatherers (past and present) are in the range of 5 to 15 km per day, corresponding to daily expenditures of 3300 to 5000 kJ or about 5 times that of modern sedentary adults (O' Keefe et al., 2011).

The best current estimates are that the physical activity levels of ancestral humans averaged about 1000 kcal per day with a caloric intake of around 3000 kcal per day, yielding a ratio of around 3:1. Today, sedentary humans commonly consume over 2000 kcal per day (i.e. less than a typical hunter-gatherer) but may only expend around 300 kcal per day. This would give a ratio around 6:1 or perhaps even 7:1 (Saris et al., 2003). Contemporary Amish populations typically walk over 11,000 steps per day (Katz et al., 2012) and their daily expenditure is around 600 kcal higher than in other North-American populations (Booth et al., 2012). These examples show that there is a global mismatch between present levels of physical activity and the lifestyle for which humans evolved.

2.2.2 Physical inactivity as a global risk factor

According to the World Health Organization (WHO), non-communicable diseases are now the leading global cause of death in the world and most of the surplus mortality and morbidity could be prevented by acting on only 4 key parameters: smoking, alcohol, nutrition and physical activity (WHO, 2011). Physical activity levels for adults in 122 countries were reviewed in 2012 by the Lancet Physical Activity Series Working Group, which concluded that, globally, around 31% of adults can be considered physically inactive. As shown in Figure 1, there are considerable differences between regions and Europe is close to the global average; it is interesting to note that, across WHO Regions, physical activity declines with age.

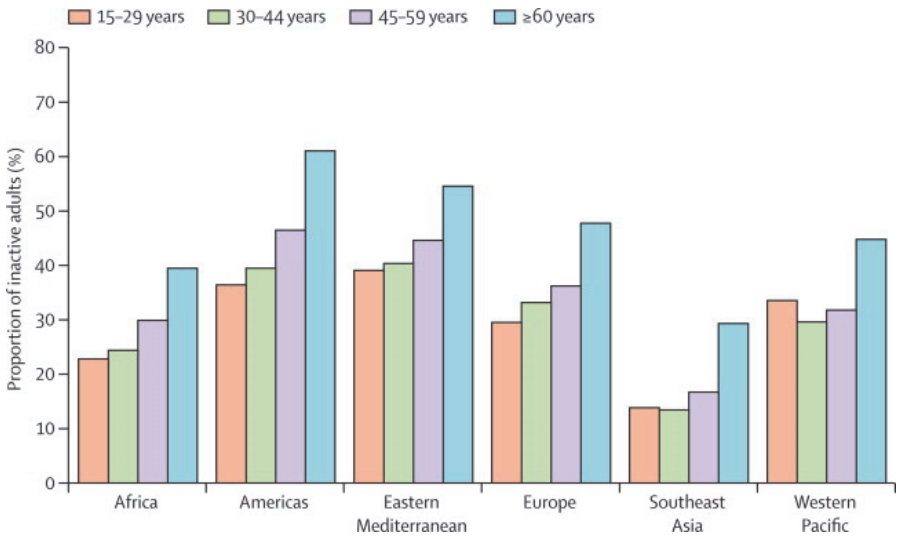

Figure 2-1. Physical inactivity in age groups by WHO region. Credit: Hallal et al. (2012)[1]

It has been known for many years that the increased prevalence of non-communicable diseases is linked to overweight and obesity, which themselves represent a growing threat to the health of populations in many countries. According to a series of peer-reviewed publications in *The Lancet*, at present over one-third of the global adult population is overweight, defined as having a body-mass index (BMI) over 25 kg/m^2, and around one-third of these are obese, with a BMI ≥30 kg/m^2 (Ng et al., 2014). This trend is by no means limited to Western Europe and North America: between 1980 and 2008, the age-standardised mean BMI for men increased in every sub-region in the world except central Africa and south Asia, at a rate of 0.4 kg/m^2 per decade (Finucane et al., 2011). In more recent years, a global review of pooled BMI data from over 2000 studies and 200 countries found that mean BMI is still progressing in the world, albeit with strong regional differences between regions, sexes and age groups. The highest levels were found in Polynesia, Micronesia, parts of south-east Asia, North Africa and the Middle East, as well as the USA and parts of the Caribbean. The prevalence of obesity was found to be over 20% in several countries in Polynesia, Micronesia, north Africa, the Middle East, the Caribbean and north America (Abarca-Gomez, 2017).

In recent years, thanks to continued research by WHO and its partners on the *Global burden of Disease (GBD)* project (Naghavi, 2017), it has been possible to prove that most countries in the world are making substantial progress towards helping their citizens achieve longer lives, in better health. However, action on non-communicable diseases is having a class-sensitive effect, unlike the action on infectious diseases, which may be consciously directed towards poorer segments of society where help is most urgently needed. Specially, the authors of the 2016 GBD Causes of death study group write (see underneath for explanation of abbreviations):

[1] Reprinted from The Lancet, 380(9838), pp. 247-257. Hallal, Pedro C et al. Global physical activity levels: surveillance progress, pitfalls, and prospects. Copyright (2012), with permission from Elsevier.

"Since 1980, annualised rates of decline for NCDs have been faster for high-SDI quintiles than low-SDI quintiles—a sharp contrast with the rapid reductions in CMNN diseases achieved by lower-SDI locations. This trend might reflect combinations of funding priorities, international programmes, and social determinants of health and behaviours (…)." (Naghavi, 2017)

NCDs: non-communicable diseases.
SDI: socio-demographic index.
CMNN: communicable, maternal, neonatal, and nutritional diseases.

It is clear that the GDB approach is based on healthcare and mortality data. Indeed, the words “physical activity” and “prevention” do not occur in the 60-page publication (“walk” or “walking” do not appear either, but as we will see, this is unfortunately to be expected). Nevertheless, the social determinants of health address health promotion in a way that is of interest to researchers in social science. The main objective in measuring these health determinants is to understand why there is a difference in life expectancy of 48 years between one country and another as well as differences of more than 20 years between the least and most advantaged within a single country. The ten most important headings of the social determinants of health are: social gradient, stress, early life, social exclusion, work, unemployment, social support, addiction, food, and transport (Marmot & Wilkinson, 1999; Wilkinson & Marmot, 2003).

Over the past decade, it has become clear that many low and middle-income countries are even more exposed than richer countries to the problems of overweight and obesity. The countries with the highest proportions of overweight/obesity are now in the Asia/Pacific region. Even areas such as sub-Saharan Africa, that seemed until recently to be less affected, are reporting rising obesity levels. Indeed, a review recently established that over 42% of adults in Ghana, West Africa, are overweight or obese (Ofori-Asenso et al., 2016).

Diseases linked to overweight and obesity include coronary heart disease, hypertension, stroke, several types of cancer, non-insulin-dependent diabetes mellitus (type 2 diabetes), gallbladder disease, dyslipidaemia, osteoarthritis, gout, and several pulmonary diseases (WHO, 2000a). Lack of physical activity has been identified as the fourth leading risk factor for global mortality (6% of deaths globally) and as the main cause for 21–25% of breast and colon cancers, 27% of diabetes and approximately 30% of the ischaemic heart disease burden (WHO World Health Report, 2011).

Along with renewed efforts in improving nutrition, reducing alcohol consumption and eliminating smoking, there is therefore no doubt that an increase in daily physical activity is one of the most important public health goals globally. In order to attain this

objective, one of the problems often mentioned is the difficulty to find sufficient time during a modern urban day to practice so-called leisure time physical activity. This is why this thesis has identified walking for transport as a key area for further research.

2.2.3 Recommended physical activity levels

While investigating physical activity levels, it may be helpful to clarify the use of the term MET (metabolic equivalent), which is the general consumption of the body when a person is resting ("quiet sitting"). The lowest MET is 0.9 and corresponds to sleeping. Working at a desk has a MET of around 1.5. Walking has very different METs depending on the speed involved, but as a rule of thumb slow walking is 2-3 MET and fast walking around 4-5 MET. Cycling ranges from 5 to 10 MET.

The often quoted minimum threshold of “30 to 60 minutes of medium intensity physical activity on most days of the week” (Tudor-Locke et al., 2011) is still used by many practitioners and researchers around the world. However, it is unattainable for around half of the global population. Another often-quoted figure is 10’000 steps per day, but this is an even higher level of physical activity. Although interpretations vary, in our experience it corresponds to around 2 hours of walking per day. Even if one hour were to occur indoors (implying an active lifestyle), that still leaves a full hour of walking in public space. It is important to keep in mind that these are recommended minima, intended to make inactive people become at least minimally active. Nothing is known about the other end of the spectrum: where people out-perform the 10’000 steps per day.

A team of US scientists investigated six population-based prospective cohorts in the United States and Europe (>660’000 people aged 21-98 years) for the connection between mortality and self-reported physical activity. They observed a dose-response relationship with a benefit threshold at approximately 3 to 5 times the recommended leisure time physical activity minimum (they also reported no excess risk at 10 times the said minimum). Compared to persons doing no leisure time physical activity at all, the threshold established itself at around a 39% lower mortality risk among persons performing 3 to 10 times the recommended minimum, i.e. 22 to 40 MET h/week (Arem et al., 2015).

At population level, walking already represents a substantial proportion of aerobic exercise. In the USA, an analysis of the 2011 Behavioural Risk Factor Surveillance System showed that walking contributed 47% of all aerobic exercise, running/jogging accounted for a further 13%, while sports and exercises (including stationary biking, stair climbing/stair machine, and active gaming) each accounted for around 9%. Interestingly, walking was more often reported by women than by men (Watson et al., 2015).

According to a review article taking into account published evidence over the 1991-2000 period, there already was at that time clear evidence of an inverse dose-response relationship between the amount of physical activity and all-cause mortality as well as cardiovascular disease incidence and mortality. The authors (Haennel & Lemire, 2002) reported that physical activity resulting in an expenditure of approximately 4200 kilojoules per week was associated with "substantial" health benefits. Importantly, they concluded that moderate physical activity "such as brisk walking for 30 to 60 minutes a day most days of the week", was associated with significant reductions in the incidence and mortality of cardiovascular disease.

Around the same time, a consensus meeting held in May 2002 in Bangkok, Thailand, unanimously adopted the following statement:

> "The current physical activity guideline for adults of 30 minutes of moderate intensity activity daily, preferably all days of the week, is of importance for limiting health risks for a number of chronic diseases including coronary heart disease and diabetes. However, for preventing weight gain or regain this guideline is likely to be insufficient for many individuals in the current environment. There is compelling evidence that prevention of weight regain in formerly obese individuals requires 60–90 minutes of moderate intensity activity or lesser amounts of vigorous intensity activity. Although definitive data are lacking, it seems likely that moderate intensity activity of approximately 45 to 60 minutes per day, or 1.7 PAL (Physical Activity Level) is required to prevent the transition to overweight or obesity." (Saris et al., 2003)

In another statement published in 2007, physical activity goals for adults (aged 18-65) were redefined by the American College of Sports Medicine and the American Heart Association. This is now very often cited and corresponds to 150 minutes of moderate-level physical activity (such as brisk walking) per week. In fact, the precise recommendation is a minimum of 30 minutes of moderate-intensity aerobic (endurance) physical activity on five days each week, or vigorous-intensity aerobic physical activity (such as running) for a minimum of 20 minutes on three days each week. Combining the two types of activity is permitted as long as each bout lasts at least ten minutes; and muscle-strengthening exercises are also recommended at least twice a week (Haskell et al., 2007).

It may be considered that these recommended levels are rather low, given the natural, genetic levels for which humans have evolved over millennia. However, this short review would not be complete if we did not mention that there have been calls for physicians to recommend even lower levels of physical activity to sedentary patients (Warburton & Bredin, 2016). At the opposite end of the spectrum, a recent review concluded that "people who achieve total physical activity levels several times higher than the current recommended minimum" had a significant reduction in the risk of five diseases: breast cancer, colon cancer, diabetes, ischemic heart disease, and stroke (Kyu et al., 2016).

Where both critiques can perhaps meet each other is in the notion that the health gains per unit of physical activity are far greater among sedentary people than among active people, although even active people also stand to gain from increasing their activity levels, i.e. the relationship is not linear. This can be seen in the diagram below, where relative risks for stroke and heart disease plummet amid low levels of physical activity: the two curves are undistinguishable between 0 and 1 MET (metabolic equivalents). Above a level of 4 or 5 MET, hardly any progress can be made by increasing physical activity (Kyu et al., 2016).

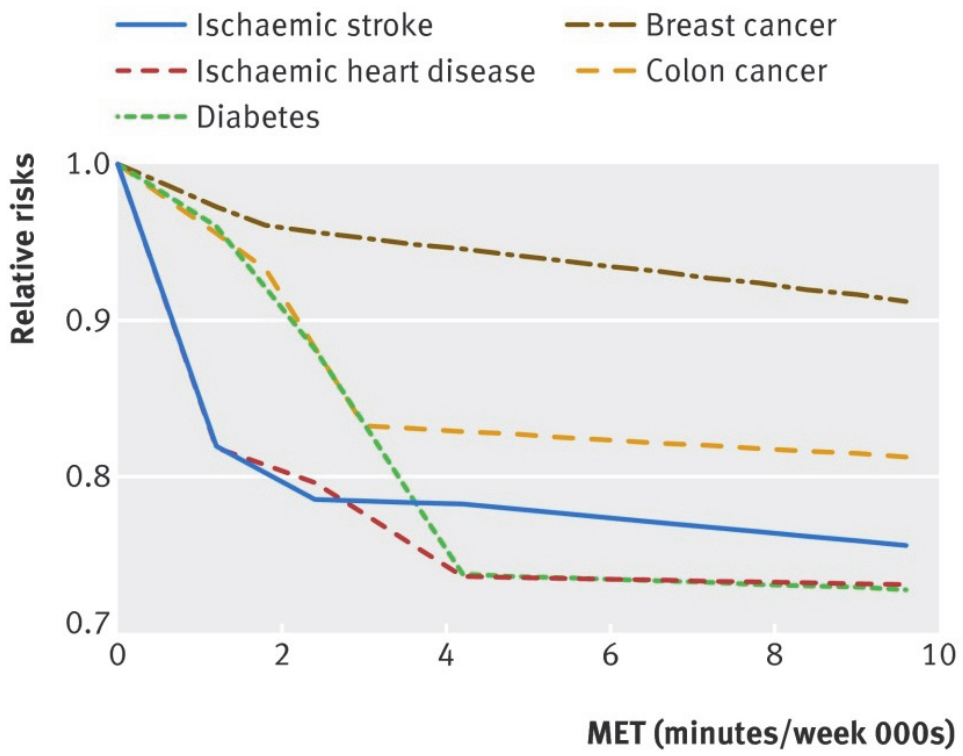

Figure 2-2. Physical activity and risks for selected diseases. Credit: Kyu et al. (2016)[2]

2.2.4 Physical activity and nutrition

It is evident that the global increase in overweight and obesity is being driven by a mismatch between energy intake and energy expenditure (Hill et al., 2012). There has been much talk about the necessity of people to eat less, or at least less sweet, fat and/or starchy foods. There is a consensus around the fact that it will be necessary to act at both levels – energy intake and energy expenditure – in order to tackle the huge scale of the overweight and obesity epidemic in the world (WHO, 2000b).

[2] Kyu et al. BMJ 354: i3857 - CC BY license 3.0)

According to some experts, increasing energy expenditure is a more feasible strategy for most people than restricting food intake to meet a low level of energy expenditure (Tudor-Locke, 2012). This fits in with the fact that there is evidence that physical activity rates have plummeted in most countries. For example, in the USA, over the last 50 years daily occupation-related energy expenditure decreased by more than 100 calories for women and men (Church et al., 2011).

In Switzerland, the latest federal report on nutrition (OFSP, 2012) observed that overweight and obesity have increased over the past 30 years while overall nutritional levels have not changed and levels of physical activity have plummeted. It is therefore increasingly clear that decreasing physical activity is the main driver behind the global overweight and obesity epidemic. However, it may not be the only one and the various factors may be literally impossible to disentangle because unhealthy behaviours are often correlated with each other. For example, an analysis of the 2002 Swiss Health Survey, found significant clustering between smoking and other unhealthy activities including insufficient physical activity (Chiolero et al., 2006).

There is evidence from other countries that many people are eating not only better food but also less than before. For example, the British National Food Survey showed that in 1970, the average daily intake was 2560 calories per person; in 2000, it had fallen to 1750 calories. However, thanks to motorised transport, both walking and cycling decreased in this period. In 1967, 77% of adults walked for at least 30 minutes every day compared with only 42% in 2010. So in the UK, there was an overall reduction in energy intake and an even stronger reduction in energy expenditure (Harrison, 2014).

It is becoming more and more clear that the global rise of non-communicable diseases is fuelled by the lack of walking. It is important to realise that some "risk factors" commonly quoted as fuelling the rise of non-communicable diseases are themselves subclinical (or even clinical) markers of inflammation and/or cardiovascular disease. It is not always correct to quote hypertension as a risk factor for example, putting it at the same level as lack of physical activity. There is plenty of evidence that lack of physical activity is one of the main reasons for the increased prevalence of hypertension at the population level.

2.2.5 Connecting sustainable transport with health

This chapter is based on the critical reading of a recently published book edited by Corinne Mulley, of University College London, with the Australian researchers K. Gebel and D. Ding (Mulley et al., 2017). We concentrate on Chapter 3, which bears the title "Understanding the determinants of walking as the basis for social marketing public health messaging" (Mulley & Ho, 2017). The contribution is based on work carried out in Sydney, Australia, where over 78% of the population do not meet the

target of 30 minutes of physical activity per day. Based on their empirical results, the authors suggest targeting driving license holders, households without cars, and promoting walkable environments. Most interestingly, they suggest promoting the accomplishment of more different activities on foot, rather than promoting walking for short trips. This is interesting, because many transportation departments (including the one in canton Geneva) have pinpointed short trips as an area where mode shift might occur. However, policies encouraging people to, say, shop in their vicinity, on foot, have never been considered. We therefore suggest introducing social marketing strategies that suggest new destinations that can be easily reached on foot. An idea might be to devise simplified maps that show people how close various destinations are to their home, workplace or public transport station. Such maps would have to show not only the destinations but also the preferred routes, preferably not along main roads in order to allow for the pleasure principle.

With Mulley and Ho (2017), we agree that it would be useful to use audience segmentation and message targeting rather than generic public health messages – an approach that has long been understood in tobacco control circles (Monso et al., 2001). In Sydney, it was found that households without a car and people with a driver's license were both interesting target groups. We suggest that similar scoping exercises be carried out in Switzerland and elsewhere to determine which groups stand to benefit the most from increasing their daily walking.

In the same book, a chapter on developing sustainable walking interventions by US-based researchers Liza Rovniak and Abby King also caught our attention. The take-home message of this chapter is that interventions tend to achieve short-term increases in walking, which are difficult to sustain over time. The authors stress that more "real-time, unobtrusive, and accurate measures" are required to monitor walking in cities (Rovniak & King, 2017). These researchers suggest using street-based sensors to measure the amount of walking that is going on, a suggestion that we wholeheartedly support for the Geneva-Lausanne area, where a great deal of counting is done for other modes (including cycling) but usually not for walking.

Rovniak and King (2017) emphasise that, while individual, immediate economic, social and physical incentives are necessary, they must be accompanied by "comprehensive changes in the built, social and policy environments" in favour of walking. We could not agree more: indeed, the relative success achieved by tobacco control campaigns globally was supported by the conjunction of personal gains (health) and policy measures such as the banning of smoking in enclosed spaces.

2.2.6 Trans-theoretical model (stages of change)

The trans-theoretical “Stages of Change” model (Prochaska & Velicer, 1997) encompasses concepts from several other models, such as the Health Belief model

(Janz & Becker, 1984). During the pre-contemplation stage, people do not consider change. They may not believe that their behaviour is a problem or that it will negatively affect them or they may be resigned to their unhealthy behaviour because of previous failed efforts and no longer believe that they have control (i.e. their Locus of Control is external rather than internal). During the contemplation stage, patients struggle with ambivalence, weighing the pros and cons of their current behaviour and the benefits of and barriers to change.

Cognitive-behavioural models of change (e.g., focusing on coping skills or environmental manipulation) and 12-Step programs fit well in the preparation, action and maintenance stages. Maintenance and relapse prevention involve incorporating the new behaviour over the long term. Discouragement over occasional “slips” may halt the change process and result in the patient giving up (Zimmerman et al., 2000). Many people go through the stages of change several times before the change becomes established, which has led some researchers to suggest that the framework is a spiral rather than a circle: i.e. it is possible to go through the process several times but neither the person nor the situation is identical to what it was before.

Figure 2-3. Linear rendering of the trans-theoretical model (Philciaccio/Creative Commons 3.0)

The figures above and below are just two examples of the different forms that the trans-theoretical model has taken, as it is pressed into service by an array of public health and other professionals. In the circular variant presented below, the original author, Rachel Clements, introduced an extra stage entitled "Determinism" (which we corrected to "Determination") which is not part of the standard model (she also modified "Action" to "Active Change" but we have preferred to revert to the original Action term).

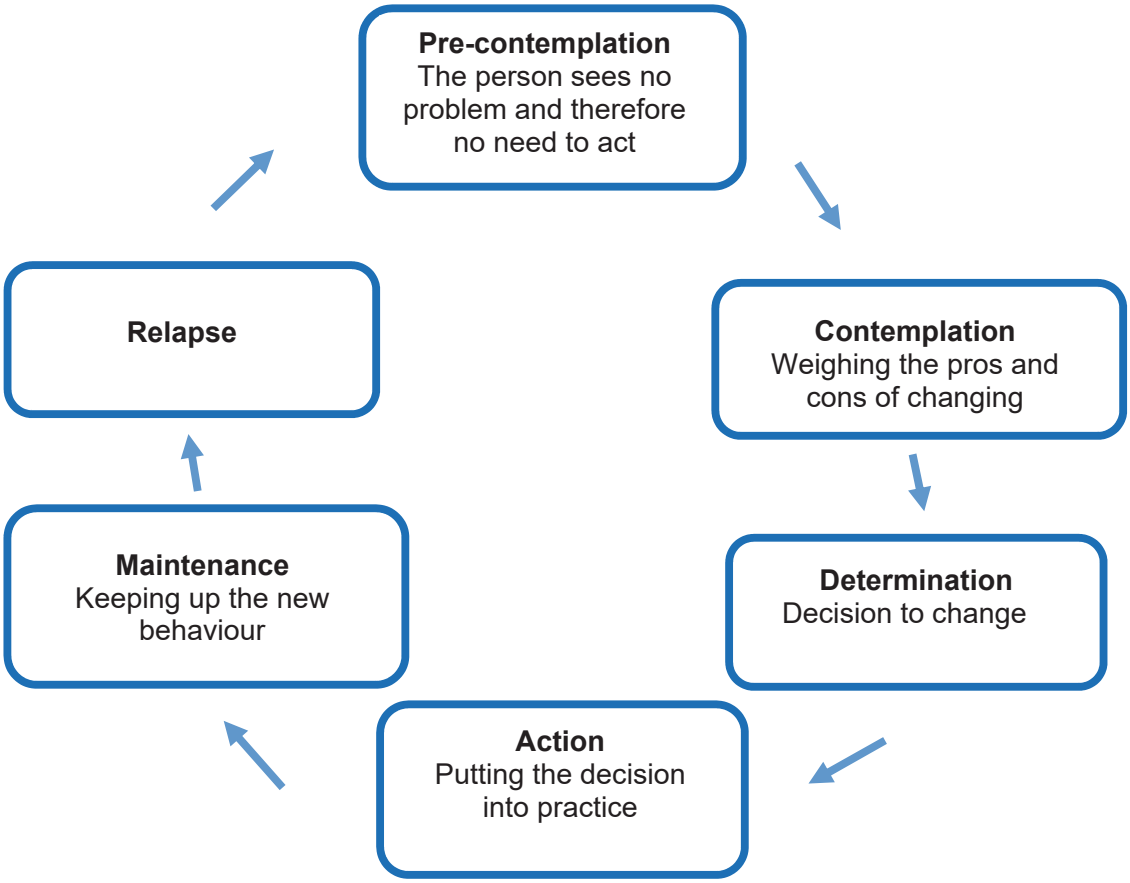

Figure 2-4. Circular portrayal of the trans-theoretical model (after Rachel Clements, modified)

Indeed, due to its success the trans-theoretical model has been modified and adapted many times over the past years. In order to understand the state-of-the-art model, we analysed the web site set up by its main author P. O. Prochaska (www.prochange.com) where these definitions are given for the two main stages of interest for our project (TTM refers to Trans-Theoretical Model, and the historical reference to smoking cessation is clearly visible). These two stages are described in detail here because it is evident that, since they are "already" frequent walkers, all our study participants are likely to be in these two categories.

Action is the stage in which people have made specific overt modifications in their lifestyles within the past six months. Because action is observable, the overall process of behaviour change often has been equated with action. But in the TTM, Action is only one of five stages. Typically, not all modifications of behaviour count as Action in this Model. In most applications, people have to attain a criterion that scientists and professionals agree is sufficient to reduce risk of disease. For example, reduction in the number of cigarettes or switching to low-tar and low-nicotine cigarettes were formerly considered acceptable actions. Now the consensus is clear—only total abstinence counts.

Maintenance is the stage in which people have made specific overt modifications in their lifestyles and are working to prevent relapse; however, they do not apply change processes as frequently as do people in Action. While in the Maintenance stage, people are less tempted to relapse and grow increasingly more confident that they can continue their changes. Based on self-efficacy data, researchers have estimated that Maintenance lasts from six months to about five years. While this estimate may seem somewhat pessimistic, longitudinal data in the 1990 Surgeon General's report support this temporal estimate. After 12 months of continuous abstinence, 43% of individuals returned to regular smoking. It was not until 5 years of continuous abstinence that the risk for relapse dropped to 7% (USDHHS). (From www.prochange.com)

2.3 Mobility and territory

In Europe and beyond, generations of urban planners have prioritized the car to the detriment of other modes of transport. The resulting "landscapes of mobility" have been described as "autologic" and unsustainable (Freudendal-Pedersen, 2009). It has even been said that transport can make or break a city (Banister, 2005).

Indeed, almost all cities in Europe were modified to a substantial degree in order to favour private cars during the 20th century. For example, in British cities there were already conflicts over the use of urban space that pitted motorised traffic against cyclists and pedestrians during the 1920s. By the 1960s, these conflicts had led to the marginalisation of all other transport modes in favour of the car (Pooley & Turnbull, 2005). Elsewhere, the introduction of the car also led to substantial changes, such as in Canada:

"The introduction of the automobile at the turn of the century revolutionized all aspects of Canadian life from sound and smell, to housing design, to street patterns and congestion. In addition to the physical changes brought about by its presence, the automobile radically altered established rural-urban relationships, and its proliferation also necessitated an increasing regulation of society as a whole. Thus, given the wide range of changes created by the automobile, few Canadians remained unaffected by its introduction in the first decades of the 20th century."

Over the past 25 years, many cities have invested in improving the supply side of public transport, with the dual objective of increasing public transport patronage and improving the "mode split", i.e. convincing people to give up the car for public transport, walking and/or cycling. Such objectives are increasingly included in legislation and now constitute the standard "rhetoric" of urban policy in most countries, although this does not prevent pro-car interest groups from questioning the legitimacy of such objectives, for example with a cantonal vote in Geneva in 2002

that upheld the right for each citizen to be free to choose their mode of transportation (Tanquerel, 2007).

In practice, it has proved very difficult to reduce car traffic (Banister, 2005; Orfeuil, 2001a). Up to 2006, car use increased steadily in Switzerland and many other European countries, at all levels: mode split, numbers and length of trips. Starting around 2007, the mode share of the car began to diminish within certain urban areas (Prognos, 2008), a tendency which was further reinforced after 2010. In Switzerland, this downward trend is particularly strong for commuting trips towards city centres, and for centre-to-centre travel between cities. In suburban and rural areas, however, car use has continued to grow. Decreased car use in cities has coincided with a renewed interest in walking in urban areas, whether for transport or for leisure (Buhler, 2012; Chalas & Paulhiac, 2008).

Finally, since the 1990s there have been various initiatives in favour of "calming" the city. This involves traffic calming and a general reduction in speeds, but also pleads for a more democratic use of urban space, where pedestrians can be more active and present. Importantly, this approach cannot content itself with a central pedestrianised area surrounded by less well-served urban and suburban areas, but seeks to transform the city as a whole (Dumont & von der Mühll, 2006). Although in many cities pedestrianised and low-speed areas tend to cover only central areas (or housing compounds not attached to the city), there is evidence that extending such measures geographically – despite initial resistance – can become acceptable and accepted by local residents and other users (Castillo-Manzano et al., 2014).

2.3.1 Car dependency

Car use has become unavoidable for many people who have daily or weekly routines which cannot be satisfactorily performed with another means of transport (Dupuy, 1999; Newman & Kenworthy, 1989). This interpretation draws on the fact that daily life has become more complex, with a higher number of more diverse activities within the same household (often with two adults working, as well as leisure and other activities for children) and a sprawl of the social space used in daily life (Tabaka, 2009). The result is a spatial and temporal tension within daily routines, with mobility playing a central role. Quality of life will often depend on the way in which chains of activities can be planned and carried out (Jurczyk, 1998). The mobility programming strategy of a household often depends on the car, because of its flexibility. However, with the renewal in interest in alternative travel modes, car dependency is declining in many cities (Canzler & Knie, 1998; Tabaka, 2009). More recently, a comparative study focussing on Strasbourg, France and Québec City, Canada, showed that car dependency is more present in periurban areas than in city centres (Villeneuve, 2017).

The relative efficacy of transport modes is becoming less important in explaining modal practices; reducing travel times is less critical for contemporary lifestyles (Kesselring, 2005; Metz, 2008). Time spent travelling is not empty space between activities, which needs to be reduced to an absolute minimum. Rather, it is becoming a social activity in its own right, with its own codes and characteristics (Bhat & Koppelmann, 1999). As a result, the challenge is not to decrease travel time but to maximise its quality. In this context, the car is losing part of its appeal. It offers few opportunities for diversifying one's activities during the travel time, contrary to the train for example (Jain & Lyons, 2008).

There has indeed been a shift in user preferences. For a long time, the population had a very positive image of the car because it was associated with being free to move around in space and in time, despite any misgivings linked to air pollution and accident risk (Kaufmann, 2000a; Pervanchon et al., 1991). This stands in contrast to the situation for public transport, which is considered environmentally friendly by most people, but also inefficient, restrictive (due to line and schedule constraints) and often overcrowded (Berge, 1994). Such attitudes reflect not only the actual quality of transit systems but also – and mostly – the cultural value placed on the individual, on flexibility and on private ownership (Kaufmann, 2000a). Over the last few years there has been a shift in these attitudes and several recent surveys have shown that people have become more open towards transport modes alternative to the car. This is usually interpreted as a result of transport policy decisions as well as a shift in values linked to the environment and health (Rocci, 2007).

In European cities, the shift in attitudes indicates that the population is not strongly prejudiced against public transport, cycling or walking (Kaufmann et al., 2010a). The car has become less entrenched, which is important because it has been shown that modal practices form the backbone of urban lifestyles (Bonnet, 1979; Haumont, 2001). According to this view, activities and routines structure themselves around transport use, particularly as far as destinations are concerned. Car drivers spend more time in the outskirts, while public transport users tend to have routines more closely associated with the city centre (Hess et al., 2005).

Because cars and public transport afford access to different parts of the city, mode switching may have a strong impact on how activities can be planned: in particular, having to rethink one's daily routines (Buhler, 2012; Flamm, 2001). Such changes imply costs which are far higher than the mode change itself. Given this context, it is understandable why acting only on the supply side of alternative transport modes (i.e. alternative to the car) is insufficient to lead to mode shift.

In the context of this research on frequent walkers, it is important to recall that, historically, much of the research on mode shift has relied on comparisons between public transport and the private car. Work on cycling is generally more recent and work on replacing motorised trips with walking are even more recent and still

relatively rare. Ultimately, each transport mode generates its own spatial pattern within which people operate. These patterns are significantly different from each other, as regards daily practices, potential for change, and symbolic significance (Kaufmann et al., 2001; Orfeuil, 2001a). This is of particular importance because, over the last few years, there has been rekindled interest in lifestyles less linked to car use (Thomas, 2011).

2.3.2 Measuring walking

Little information is available on the geography of walking behaviour, such as travel episodes, origins and destinations, routes, durations and distances – the exception being detailed research covering the area of Halifax, Canada (Millward et al., 2013; Spinney et al., 2012), which we will be discussing in several places during the course of this thesis. The description of walking at the scale of an entire country has been done very rarely. We identified a study entitled “Epidemiology of walking in a middle-income country”, but it turned out to cover only a single urban area (Pelotas, Rio Grande do Sul, Brazil). The methodology is nevertheless interesting in because the International Physical Activity Questionnaire (IPAQ) was used. Around one-third of the 6282 respondents could be described as moderately active, according to the criterion of at least 30 minutes of walking on at least 5 of the previous 7 days. Men (37%) were slightly more active than women (31%). Interestingly, vigorous physical activity was more strongly associated with leisure-time walking than with all-purpose walking in that study (Hallal et al., 2005).

A study on a general population sample in the USA found that only 16% of respondents had at least one daily walking trip, with a mean walking distance of 0.7 miles, or 15 minutes. The distances and durations of walking for recreation were substantially longer than those for other purposes. People with lower household income walked longer distances for work but shorter distances for recreation. The authors conclude that there is substantial variability in the distance and duration of walking trips by purpose and population subgroups and that these differences have implications for developing strategies to increase physical activity through walking (Yang & Diez-Roux, 2012). All in all, the consensus in the literature is that walking is relevant as a source of daily physical activity, all the more so that active commuting was recently linked to general physical activity levels, according to a study carried out in Cambridge, UK (Yang et al., 2012).

However, it is not always easy or pleasant to walk. A recent study investigated pedestrian attitudes, perceptions and behaviour in 19 European countries, not including Switzerland. Approximately 30% of all respondents expressed anger and/or frustration towards existing infrastructure for pedestrians (Papadimitriou et al., 2013). Another aspect on which there is substantial literature, especially from Asia, is the effect of walking in a natural environment versus walking in a built environment (Li et

al., 2008; Li et al., 2011; Li et al., 2009). There is an apparent trade-off between walking a longer distance through a park and enduring a shorter but less pleasant trudge along a major road. But a pleasant walk is not necessarily slow: there is evidence that some people may walk faster in a green environment in order to offset the longer travel time (Sellers et al., 2012).

Regarding baseline physical activity levels, a recent analysis of mobile phone users from 46 countries (each with at least 1000 participants using the Argus application developed by Azumio) recorded an average of only 4961 steps per day (SD: 2684). It therefore appears that the objective of 10'000 steps per day is double the current population average in many countries. Data made available by the authors, based at Stanford University, showed that the Swiss average was higher than many other countries, at 5822 steps for males and 5131 for females (Althoff et al., 2017). According to these figures, for the Swiss population to reach 10'000 steps a day would require 95% more steps for women and 72% more for men.

A prospective study on 14 healthy adults at the University of Pennsylvania compared 10 locally available applications and devices for a treadmill walks at 3.0 mph for 500 or 1500 steps. Each participant wore the Yamax Digi-Walker SW-200 pedometer and the Zip and One Fitbit accelerometers. On the wrist, they wore the Flex (Fitbit), UP24 (Jawbone), and Fuelband (Nike). In a trouser pocket, each carried an iPhone 5s (Apple) running 3 iOS applications: Fitbit, Health Mate (Withings), and Moves (ProtoGeo Oy). In the other trouser pocket, each carried a Galaxy S4 phone (Samsung) running the Moves Android app (ProtoGeo Oy). Compared with direct observation, the relative difference in mean step count ranged from −0.3% to 1.0% for the pedometer and accelerometers, −22.7% to −1.5% for the wearable devices, and −6.7% to 6.2% for smartphone applications (Case et al., 2015).

The previously mentioned Canadian researchers collected detailed data based on time diaries for the city of Halifax, Canada, where on any given day 32% of respondents take an active-transport walk, and a further 22% took a recreational walk. For those taking each type of walk, the mean times for daily walking were 23 minutes of "active transport" walking and 51 minutes of "recreational" walking. However, the medians were only 15 and 44, whereas the upper quartiles were 31 and 64, implying a highly skewed distribution (Spinney et al., 2012).

In a separate study, the same team (Millward & Spinney, 2011) reported a mean daily duration of all walks for all respondents of 15 minutes/day, and for those reporting walking (i.e., participants) of 37 minutes. This suggests a combined upper quartile (for all walking) of around 48 minutes/day. In their view, anyone walking over 75 minutes/day would be an outlier. In the Halifax data, 75 minutes is approximately 1.5 times the upper quartile for participants (those who walk on a given day), although it's perhaps 3 times the upper quartile for all respondents, suggesting that 75 minutes is also approximately the 95th percentile (Millward, personal

communication). For translating time durations into distances, the team reported mean speeds of 4.8 km/h for active transport walking, and 4.3 km/h for recreational walking (Millward et al., 2013).

2.3.3 Transversal approaches to walking

In the 2000s, there was a renewal of research interest in walking, linked to many factors including the fact that mode shares of walking ceased to fall in several countries and were even seen to rise slightly between 2000 and 2005 in Switzerland (Lavadinho, 2011). Nevertheless, very little research looked at the articulation of transport-inspired and health-inspired public policies in favour of walking with the practical and sociological problems associated with integrating walking into daily routines. A French researcher, Rachel Thomas, has argued that environmental and public health issues have revolutionised urban mobility in a way that may favour walking. Thomas and other researchers at *Le Cresson* believe that each bout of walking constitutes a unique cognitive and sensory experience between walker and environment (Thomas, 2010).

Thomas has also suggested that walking has the capacity to anchor a person to his or her urban environment, at a practical/physical level but also at social, perceptive and affective levels. It follows that walking in itself is a worthy topic of investigation, rather than a means for investigating other topics (such as sociocultural dimensions) which has often been the case in urban sociology. Rachel Thomas therefore favours a new, direct approach, which implies asking walkers to describe their sensory experiences while they walk through various areas (Thomas, 2007).

Travel mode has been shown to be linked to mood, because even for the most utilitarian travel there can be strong affinity for the travel experience itself (Morris & Guerra, 2015). In an Israeli survey on travel enjoyment, nearly 70% disagreed with the statement that ‘‘the only good thing about traveling is arriving at your destination’’ and only 20 % disagreed with the statement ‘‘getting there is half the fun.’’
Of particular interest is that walking and cycling were the best-liked modes, with 67 % of the sample liking and 9 % disliking them. The majority of respondents expressed a wish to walk and/or cycle more (Mokhtarian & Salomon, 2001).

The study of a single pedestrian route in Leeds, UK, indicated that a number of attributes were considered important by pedestrians, including pavement cleanliness, safe crossing places, good connectivity and sense of security. Importantly, the researchers note that the walking experience is affected by the "cumulative impact of multiple interactions (both positive and negative)" as people navigate through the pedestrian environment (Kelly et al., 2011). These researchers combined three methods: a computer-based tool using stated preference, an on-street survey and

"on the move" interviews of pedestrian volunteers as they were walking along the route.

2.3.4 The mobility turn

Beginning in the 1990s, the Mobility turn or *New mobilities paradigm* (Sheller & Urry, 2006; Sheller & Urry, 2016) has played an important role in rethinking the role of mobility across social institutions and practices. It recognises not only that the world has become more mobile since 1990, and mobile in many more different ways than before, but also that this increase in movement does not automatically lead to increased freedom (Freudendal-Pedersen, 2009). This “socio-material” rather than philosophical paradigm, in the sense of the earlier work of Thomas Kuhn, implies that methods should also change in relation to the new way of seeing things (Kuhn, 1962; Urry, 1973) towards what we might refer to as trans-disciplinarity (see the Methodology section of this thesis). Importantly, the *New mobilities paradigm* challenges the idea of space as a container where social processes take place. Rather than looking at fixed places, it involves analysing networks, relationships and flows (Sheller & Urry, 2016). The implication is that it is not sufficient to study individual behaviours. It is crucial to understand in what contexts travel choices are made, and to recognise that the pathway leading towards sustainable mobility will require multiple changes at the collective, organisational and social levels (Cairns et al., 2014).

Within this general framework, the concept of “motility” helps describe the ability of individuals to be mobile (Kaufmann, 2002; Kaufmann, 2006). Motility is defined as the conjunction of all the characteristics which enable people to be mobile, including social gateways, core competencies, and mobility projects (Kaufmann, 2011). Several studies have sought to measure motility (Canzler W., 2008; Kaufmann et al., 2010b; Kesselring, 2005). However, due to its inherent complexity this research area has not produced a standard method for measuring motility. Indeed, results published so far show that there are many different ways in which people can be empowered to move. These patterns vary according to social and spatial correlates, and are often weakly correlated with income and education levels. Importantly, many possible trips, including some that were meticulously planned, never take place for various reasons. The motility framework, which takes into account mobility potential, is useful for investigating such aspects (Kaufmann, 2014; Kaufmann et al., 2015).

Motility can form a good basis for the analysis of the motivations, decision-making processes, and constraints that dominate the use of space. Research indicates that motility is not a personal trait based on innate skills, nor a simple consequence of the geographic position of a workplace or place of residence. Rather, it is a construct based upon many interactions (Kaufmann, 2006). Indeed, it can be argued that the transport system of a city is based upon the total motility of its residents and users

(some of it expressed as transport and some of it not expressed in a physical manner). To draw a parallel with physics, the difference between mobility and motility is akin to the difference between kinetic and potential energy.

In this research project, we would like to apply the concept of motility to frequent walkers. In particular, we want to find out whether the potential to walk – this includes the walkability of the environment as well as personal/internal factors – is of value to the individual, or whether she has to carry out the walking activity in order to reap the benefits. The answer may seem straightforward from the public health point of view, but in sociological terms it is important to know whether walking can be considered a form of capital, in the same way that a car parked nearby may have value just by being available. Likewise, a decent pair of shoes and access to a safe environment are necessary for walking (Cass et al., 2005) but do not guarantee that any walking will actually take place.

In order to operationalise the concept of mobility, we turn to a recent publication on the topic, which concerns long distance work-related mobility (Kaufmann et al., 2017). The behaviours investigated in this article are very different from the concept of frequent walking, so we are using this article (in which the author of this thesis was not involved) in order to see how the basic concepts of motility can be operationalised. In this article, which we will refer to as *JobMob*, motility is defined as "a set of characteristics that enables people to be mobile, including physical capacities, social conditions of access to existing technological and transportation systems, and acquired skills (e.g. training, driver's license, and international English for travel)". It can immediately be guessed that such as definition might be a challenge for walking. Indeed, physical capacity is very important for walking, but access to transportation systems and acquired skills seem *a priori* rather straightforward as far as walking is concerned. We nevertheless reviewed the 3 classical motility dimensions, while attempting to "transform" them into something relevant to walking.

In viewing the table below, it would be useful to imagine walking as a "supply" that is more or less available to various people or groups; these people or groups have knowledge or skills that can help them "use" the walking supply or "transform" it into mobility – but they will only do this if they have "mobility projects".

Dimension	Definition	JobMob	Frequent walkers
Access	Conditions necessary for using the supply (social conditions of access)	Transportation infrastructure (roads, train lines, airports) and tools (car, Internet connection)	Pavements, walking trails, traffic lights, pedestrian crossings, slow or pedestrian areas, etc.
Skills	Knowledge and skills required to use the supply	Orientation in time and space, map reading, languages, communication skills, ability to appropriate unknown places	Observation and navigation skills. Ability to plan and improvise in time and space, knowledge of local areas
Projects	Actual use of the supply for materializing mobility plans	Willingness to practice work-related mobility such as long-distance commuting or migration	Motivation to walk for various motives: commuting, shopping, leisure, exercise…

Table 2-1. The 3 dimensions of motility, applied to frequent walkers. After Kaufmann et al. (2017), modified

2.3.5 Mode choice

Mode choice (also referred to as modal choice) is a well-known concept, widely used among researchers and practitioners involved in mobility and transportation. It is, however, largely unknown to public health experts, despite its strong effects on health and wellbeing. It refers to the habitual choice of transport mode, for example the preferred type of vehicle used for one's daily commute. Mode shift, i.e. the transfer of significant numbers of people from one transport mode to another (usually from car driving to public transport and/or active transport) is a cornerstone of mobility and transportation policy in many countries and cities. It is considered essential to reach the objective of a carbon-neutral and generally sustainable transportation sector (Pooley & Turnbull, 2000; Tattini et al., 2018).

Mode choice is affected by an array of different factors, including the choice of residential area and whether or not free (or cheap) parking is on offer at a person's workplace. Values and opinions also play a key role: a study on 3 French and 3 Swiss cities (including Geneva and Lausanne) found that the positive or negative representations that people had about various transport modes was linked to their actual transport behaviour. Combining these various factors has allowed the creation of a “typology of logics of action” which underlie mode choice (Kaufmann, 2000a). This typology was successively refined (Kaufmann & Guidez, 1998; Kaufmann et al., 2001) and now enables the identification, quantification and localisation of potentials for mode change. A further study enabled temporal comparisons for the cities of Geneva, Lausanne and Berne (Munafo et al., 2015). The typology now includes seven groups, shown and described in the box underneath. The first four featured in a reference article published in English (Kaufmann, 2000b); the last three are more recent and were freely translated from French by the author of this thesis (and may not correspond to translations into English in future publications):

Exclusive motorists, who only or almost only travel by car.

Motorists constrained into using public transport, who would drive all the time if they could be cannot because of external constraints (e.g. expensive or unavailable parking).

Open to all possibilities represents logical thinkers, who calculate the fastest and/or cheapest option for each trip, always aiming for highest efficacy.

Civic ecologists are environmentally motivated who have a strong set of ecological values.

Alternative mode contemplators prefer modes alternative to the car, but do not always use them for practical reasons. Their car is always available as a default mode.

Exclusive alternative users always use alternative modes, even if it takes longer.

Proximity anchors avoid both cars and public transport and tend to remain within a very small surface area.

This typology is not directly applicable to the frequent walkers whom we want to investigate in this thesis. We wish to keep it in mind because it is an example of a successful framework integrating values, motivation and actual mobility behaviour. Our study is not specifically aimed at studying mode choice, because some of our frequent walkers may have been walking all their lives, and therefore never experienced mode shift or mode change. But it is probable that some of them will have experienced significant mode changes in their lives, before becoming frequent walkers. So, it is useful to bear in mind the mode

2.3.6 Routines

Work on routines has shown that up to 80% of travel behaviour changes may be linked to life events such as a change of civil status, home and/or job. In a study conducted in Lausanne, only a minority of reported behaviour changes were linked to "pure" changes in attitude towards transport modes (Flamm, 2007). This work combined GPS technology with qualitative interviewing (Flamm et al., 2008) and has acted as an inspiration to this project.

In the "late modern" period in which we are living in at present, there is a lack of institutional buffers between the individual and the community. These buffers were represented by religion, family tradition, belonging to a social class and/or a clearly defined profession or activity, etc. This dichotomy between individuality and

community has been described as a constant struggle and has been investigated in the case of the choice between the private car and public transportation (Freudendal-Pedersen et al., 2016).

In previously published research (Freudendal-Pedersen et al., 2016), one of the aims of structural stories was to see how people whose behaviour was not favourable to the environment (i.e. they drove a car on a regular basis) could shoehorn their behaviour into a *Weltanschauung* that included attention to the environment. The paradoxes, contradictions or tensions involved are likely to be strong. In our case, it is rather different: we would want to know how people succeed in reconciling personal and collective considerations that are going essentially in the same direction: towards a healthier and more sustainable mobility system. The structural stories seeking to link together two parallel strands that are not paying any attention to each other should be just as interesting as those that are trying to explain perpendicular forces. To sum up this idea, we believe it would be advisable to use focus groups and other qualitative methods to investigate structural stories related to frequent walking. Because this was not part of the original research design of this project, we will suggest it for future research (see Research agenda in the Conclusion section).

2.3.7 Weak signals

The concept of weak signals originates neither in mobility studies, nor in public health but in strategical research for private businesses. Founded by Igor Ansoff in the 1970s, the concept was supposed to help private companies anticipate future developments. It initially lacked an accurate definition but can now be considered to have a theoretical grounding in futures research (Holopainen & Toivonen, 2012). The original idea was that the strategic planning departments of private firms could handle incremental or gradual changes – or even large changes if they were preceded by sufficient and timely information – but not sudden unexpected changes. So, the new concept was developed in order to try to detect the first symptoms of such strategic discontinuities, which might endanger the firm in one way or another. It is important to emphasise that, from the start, Ansoff was looking not only for negative events that might endanger a firm's future, but also for positive events (such as new possibilities) that might endanger a firm that missed the opportunity of detecting them early enough.

The general framework is that, when a weak signal first appears, it is indeed weak, and often very unspecific as well. Then over time, the level of information increases until the expected outcomes can be described and evaluated. Various forecasting techniques have been developed, over the years, in order to detect early warning signs: from Delphi studies using expert opinion to automatic on-line searches (Kaivo-oja, 2012). Ansoff himself considered weak signals to be "immature" warning signs,

not sufficiently developed to pass the surveillance, mentality and power filters that usually prevent observers from taking such signs into account. The first of these three filters, surveillance, refers to the first observation of a signal. The mentality filter consists in evaluating the relevance of the signal, while the power filter requires the "translation" of the signal into a format that will be understood at a higher level of the hierarchy (Miller et al., 2012; Rossel, 2012).

In this project, we do not use the concept of weak signals operationally, for the simple reason that its relevance to the topic of frequent walkers was not thought about until the final stages of the project. The framework is mentioned here so that the reader is aware of its existence. The author of this thesis was aware of it because it was being used in a future-oriented project called Post-Car World (Bahrami, 2017; Rigal et al., 2015), but it was only at the end of this project that the idea emerged that frequent walking might be, in fact, a weak signal. This idea is intended to inspire the Discussion section as one of the ways of understanding and thinking about frequent walkers with a future-oriented approach.

2.4 Walking and the environment

In this section, we investigate the role and effect of the natural and urban environments related to walking. We also evaluate walking as regards its influence on the environment as a whole, with a view to establishing to what extent it is a sustainable practice.

In Europe, although some cities are testing various innovative transport systems, urban mobility is still fundamentally inefficient. Apart from accidents, air pollution and noise, urban transport produces some 23% of all CO_2 emissions. Congestion, which is mostly located in and around urban areas, accounts for the loss of 1% of the Gross Domestic Product of the European Union (Bojković et al., 2018).

At a quantitative level, several studies have shown that land use mix, street and pedestrian connectivity, population density and neighbourhood design are important determinants of walking. Interestingly, a recent review found that connectivity, land use mix and traffic-related factors were associated with walking for transport but not recreational walking, whereas population density was associated with walking but not cycling (McCormack & Shiell, 2011). However, the way in which people interact with these elements on an individual and day-to-day level has not been studied in depth, and would require a qualitative approach. Despite many online searches and exchanges with experts on walking in Switzerland and abroad, we found no publications referring to frequent walkers.

2.4.1 Urban infrastructure

It is clear that mode choices and other mobility choices are influenced by the availability of urban infrastructure such as roads, pavements (sidewalks), pedestrian crossings, parking spaces, public transportation provision, traffic lights, etc. The realisation of the importance of urban infrastructure for walking and therefore for public health has been recognised at a high level. In its Global non-communicable diseases action plan, the World Health Organization called for urban planning and transport policies and supportive infrastructure to improve the accessibility, acceptability and safety of walking and cycling:

> "The lack of safe infrastructure for people to walk and cycle is an inhibitor for physical exercise. Therefore, well-known road traffic injury prevention strategies such as appropriate road safety legislation and enforcement, as well as good land use planning and infrastructure supporting safe walking and cycling, can contribute to the prevention of non-communicable diseases as well as help address injuries." (WHO, 2013)

The role of the built environment in determining short walking trips was recently investigated in a qualitative study in Spain. Busy roads, roundabouts, narrow pavements or pavements with terraces were perceived as obstacles by some participants (Ferrer et al., 2015). In the UK, a qualitative phenomenological study found that perceived lack of time was an important impediment to frequent walking. It is however important to emphasise that the participants were members of the general public, i.e. not people particularly prone to walking. Interestingly, these members of the general public did not value walking as a significant physical activity, leading the researchers to declare that “participants’ perceptions of walking were incongruent with current health promotion campaigns”. The authors conclude that there is “a need to address the misconception that walking is not proper exercise” (Darker et al., 2007). Further readings on the link between walking and the urban infrastructure will be discussed as the research results emerge, in the Qualitative and Spatial sections.

2.4.2 Sustainability

Walking is the most sustainable among all forms of mobility, but sustainability can be taken to mean several things. Walking is environmentally sustainable, in the sense that it does not damage the environment and does not comprise the future of the next generations. Another important aspect is social sustainability, which can be described as the development of economic, social and cultural structures that support human welfare while reducing inequalities and inequities. Here also, walking is more sustainable than other forms of transport, but this does not mean that there are no problems at all. This is because even walking requires some infrastructure,

and the access and skills required for walking are not distributed evenly throughout the population (Pooley et al., 2013).

The present global mobility system is inequitable, both environmentally and socially. For example, 1.25 million people die in car crashes every year. Most of the victims come from middle and low-income countries (LMICs) and around half of them are pedestrians, cyclists or motorcyclists (WHO, 2015). According to the World Bank, total passenger traffic (in passenger-kilometres) and the number of car on the roads are both set to double between 2015 and 2030. The transportation sector already produces around 7.7 gigatonnes of CO_2 equivalents per year, representing around 14% of global greenhouse gas emissions (SuM4All, 2017). This figure is considerably higher in many developed countries: in the USA, it represents 27% of emissions (EPA, 2017).

In order to try to mitigate the huge social and financial costs of the present transportation system, several forward-looking frameworks have evolved. One of them is Vision Zero, a public health approach to road safety that aims for zero fatalities or serious injuries from road traffic crashes. Hailed as a new paradigm for transport safety, its fundamental philosophy is to view every accident as avoidable, and its responsibility as being shared between vehicle drivers, vehicle manufacturers and urban space designers. In practice, suggested interventions often involve integrating compatible traffic components and physically separating those that cannot or should not be integrated,

In order to protect pedestrians and cyclists, Vision Zero suggests either separating them from motorised traffic or reducing legal speeds to 30 km/h or less. Because cyclists can sometimes reach such speeds, they also need to be slowed down or separated from pedestrians. Vision Zero implies the prescription of a large array of measures that require investment and/or enforcement. Examples are median barriers (to prevent frontal collisions), roundabouts, speed humps and pedestrian islands.

Pedestrian islands or so-called raised medians (not to be confused with median barriers) are areas situated in the middle of the road where pedestrians can pause while they are crossing. Various studies have shown that such engineering solutions help reduce pedestrian crash rates and are particularly useful for people who are slow walkers due to age or other reasons. This is interesting, because it has also been shown that the majority of walkers do not use them, i.e. do not like to stop in the middle of the road even if the infrastructure allows it (Kim et al., 2017).

2.4.3 International policy context

This chapter on the international policy context was presented at the International Conference on Urban Health, in Coimbra, Portugal, in September 2017 (Christie et al., 2017b).

Since the promotion of daily walking is an efficient means of improving urban health and has rarely been recognised as a priority, we investigated the hypothesis that this may be because walking is not sufficiently defined as a priority in key documents that could be used by policy makers in European cities. We carried out a secondary analysis on key documents used for the evaluation of Phase V of the WHO Healthy Cities European Network: 159 case studies and 71 city responses to a detailed questionnaire (de Leeuw et al., 2015a; de Leeuw et al., 2015b). Responses or case studies involving walking were selected for a second round of investigation.

Two Phase V core themes related to walking were identified: healthy living, and healthy urban environment and design. Within the latter, "healthy urban design" was one among 8 "important issues". It is defined as "creating socially supportive environments and an environment that encourages walking and cycling". In their responses to the questionnaire, 16 cities mentioned walking but only 2 of the case studies addressed daily urban walking. We also looked at UN/WHO publications relevant to international policy making and that might have included the promotion of walking. We noticed that very few of them even mention walking explicitly. For example, none of the UN Sustainable Development Goals (SDGs) contain the words “walk” or “walking”. We conclude that daily urban walking plays a minor role among many European cities, because walking is not recognised as a priority in key policy documents such as those of the Healthy Cities programme at European level or the SDGs at global level. We will discuss this lack of international leadership in the general Discussion section at the end of this thesis.

2.4.4 Policies in the Geneva-Lausanne area

It is supposed that the reader of this thesis has a basic understanding of the Geneva-Lausanne area, which covers two cantons (Geneva and Vaud) in Western Switzerland. Perhaps the most defining characteristic of this area, in recent years, is strong economic growth in a context of rising populations and strained housing and transportation infrastructure. According to a recent report, this French-speaking area is among the richest in Europe, trailing only behind central London, Luxembourg and a handful of other areas in Switzerland (Baechler et al., 2017). The map underneath, produced by the federal statistics office, shows the size and the proximity of the Geneva and Lausanne conurbations. For Geneva, over half of the conurbation has extended into neighbouring France (cf. the purple-coloured area on the map).

The two conurbations do not quite touch each other, but exchanges between them are increasing at a rapid rate. According to the Swiss national railways, the number of passengers on the Lausanne-Geneva axis doubled between 2000 and 2010 and is likely to double again between 2010 and 2030, to reach 100'000 travellers per day (CFF, 2017). The road and motorway network is likewise very strained, and the fact

that so many inhabitants of the Geneva conurbation live across the border is a demonstration of the strained situation of the housing market in the entire region.

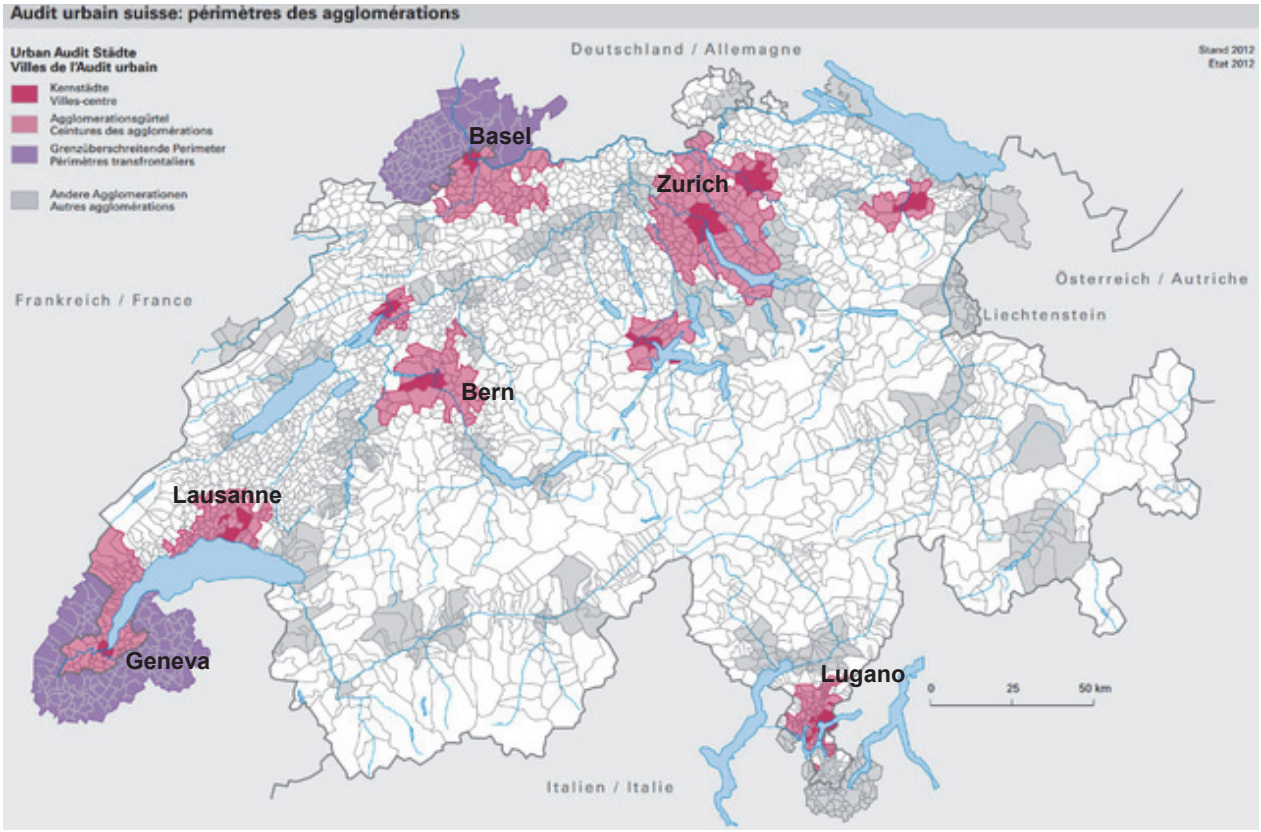

Figure 2-5. The largest metropolitan areas in Switzerland (OFS/TdG)

As far as transport policy is concerned, walking is mostly a municipal area of action, because cities are responsible for planning and paying for most of the roads, pavements, etc. However, cantonal approval is usually necessary, especially in Geneva where the political system is more centralised than in canton Vaud. Legally speaking, in both cantons, political responsibility for the transportation sector is at the cantonal level – except for motorways, railways and airports, that are controlled at the federal level.

There is therefore a mismatch between the towns and cities in the Geneva-Lausanne region that are trying to promote urban walking and the cantonal level which has more interest in promoting travel over greater distances, i.e. public transport and private motorised transportation. This tension is particularly strong in Geneva, where the city is dominated politically by the Socialist and Green parties, who have a strong agenda for developing urban design to favour walking and cycling, and the canton where the centre-right holds a solid majority and is more sensitive to the point of view of car drivers. The situation is slightly more relaxed in Lausanne, which has an institutional agreement with canton Vaud according to which it can decide many aspects of urban design itself.

Both Geneva and Lausanne can be said to have strong urban policies to promote walking. They both have the advantage of bordering the lake and having extensive green spaces. Over the past 10-15 years, both cities have published many illustrated maps encouraging residents and visitors to walk for transportation and for leisure, which can be found on the web sites of the respective cities.[3]

In another area of public policy, it is interesting to note that daily physical activity is hardly a priority in state schools in Switzerland. Federal legislation only imposes 3 hours of sport per week (LESp, 2012) and even this low level is not enforced in several cantons including Geneva and Vaud (RTS, 2015). Another relevant example is the current policy of the State of Geneva regarding health education in schools: the four topic areas covered are healthy living practices (hygiene), sex education, prevention of substance abuse, and first aid. Within healthy living practices, the promotion of physical activity is present alongside a balanced diet and healthy sleeping practices. However, although physical activity is recognised as an area for intervention, the relevant advocacy is entreated to sports teachers and daily walking is not treated at all by health educators.

A recent review of "public policies that reduced car dependence" (Buehler et al., 2017) in 5 cities in Germany, Austria and Switzerland (the only Swiss city was Zurich) dedicated a section to policies that promote walking. In the table below, the measures enforced in Zurich are quoted (those used only in the German or Austrian cities are omitted for the sake of clarity) and we have added our own comments regarding the situation in Lausanne and Geneva, so that our study area can be compared to Zurich, which is often cited as a model for walking and cycling promotion at the international level (Stevenson et al., 2016). As can be seen in the table below, which was compiled from published information, it can be said that Geneva and Lausanne are trying to catch up with Zurich.

[3] ville-geneve.ch and lausanne.ch

Policies	Zurich (ZH)	Geneva (GE)	Lausanne (LS)	Comments
Car-free pedestrian zones	Considerable pedestrian areas introduced from the 1970s	Very few pedestrian areas, but several are planned for 2018-2019.	Intermediate between Zurich and Geneva, in timing and in extent (surface area).	Pedestrian areas are a municipal prerogative in ZH and LS, not in GE where it is the cantonal level.
Traffic calming (20 and 30 km/h)	17 km of 20 km/h zones in 2014.	Many of both types. Especially 30 km/h zones, where cars have priority over pedestrians	Total length increased by 60% between 2005 and 2015.	Pedestrians have priority in 20 km/h areas, cars have priority in 30 km/h areas. Neither is allowed pedestrian crossings, by law.
Improving walking facilities (pavements)	No specific details given, but includes pavements and road crossings.			Widening and improvement of pavements began in ZH many years before GE, LS.
Signage and accessibility for all	Signs for pedestrians indicate main destinations	Signs are lacking or only concern tourist destinations	Signposting for pedestrians is very limited.	The Swiss-wide small yellow signs used in mountain areas are not used in cities.
Education and enforcement	Traffic education in schools.	Traffic education in schools.	Traffic education in schools.	Most courses in Switzerland are given by the TCS, a pro-car lobby.
Comments	Information from Buehler et al. (2017), modified and shortened	Information from the City of Geneva	Information from the City of Lausanne	

Table 2-2. Policies to promote walking in selected Swiss cities (after Buehler et al. 2017, modified)

A recent review of policies to increase active travel concluded that they should operate at the different levels of the socio-ecological framework, reformulated to include society, cities, routes and individuals. The provision of infrastructure is vitally important but clearly not sufficient: policies are more likely to be successful "when implemented in comprehensive packages", write the authors (Winters et al., 2017). The socio-ecological framework will be explained more fully in the Methodology section, because it has guided our entire research approach.

The idea of comprehensive (policy) packages leads us quite naturally to the topic area of tobacco control, where parliaments and civil society organisations have been relatively successful in modifying the legal framework to make it more difficult for tobacco companies to sell their goods – and for people to consume them. Making smoking more difficult by banning it indoors, increasing prices, etc. has helped reduce the proportion of regular smokers in many countries including Switzerland. Less known, perhaps, is the research behind this advocacy, which has shown that people need to be encouraged to quit smoking. In particular, their belief in their own capacity to quit smoking can be reinforced (Christie & Etter, 2005). Such thinking

leads us quite naturally to the so-called trans-theoretical model of behaviour change (Prochaska & DiClemente, 1983; Prochaska et al., 1988).

2.4.5 Walkability

Walkability is a central concept, which may be challenged by some of our research results. This is why we investigated this concept in detail. Indeed, it is widely admitted, at least in academic circles, that low levels of walking are perceived as associated, if not caused, by a physical environment that is not sufficiently “walkable” – and that may yet be modified by policy interventions. And in the context of this research we hypothesise that traditional walkability criteria may not explain where and why frequent walkers walk.

We investigated a leading walkability metric, the Neighbourhood Environment Walking Scale (NEWS). On web site "sallis.ucsd.edu/measure_news.html" we discovered that NEWS was developed in 2002 and that it “assesses residents' perception of neighbourhood design features related to physical activity, including residential density, land use mix (including both indices of proximity and accessibility), street connectivity, infrastructure for walking/cycling, neighbourhood aesthetics, traffic and crime safety, and neighbourhood satisfaction”.

A first article (Saelens et al., 2003) states that researchers feel “growing disappointment (…) with the inability of individually oriented models to adequately explain the high population prevalence of physical inactivity”. The article quoted in support of this claim (Baranowski et al., 1998) suggests that intervention research should "more carefully focus on understanding mediating mechanisms”. Under a sub-heading “Recommendations for research”, Baranowski et al. (1998) put forward ideas on how behavioural and social science research could be used to investigate why people engage in daily physical activities such as walking. These ideas are organised into three levels:

1) Theoretical behavioural and social science research focusses on the mechanisms of cognition, emotion, and behaviour; new research is needed in behavioural and social science, to understand why (or why not) people engage in physical activity.

2) Mediator change research tests methods for changing the variables related to the behaviours of interest; research is needed to define the characteristics of individuals and organizations that make them receptive to change (e.g. outcome expectancies and self-efficacy).

3) Interventional research employs methods from mediator change research and applies them in programmes to promote behaviour change.

Whereas Baranowski et al. (1998) are comprehensive in their covering of all three levels of behavioural and social science research, Saelens et al. (2003) are more selective, only taking into account the second level of recommendations: Mediator change research. Within this category, Baranowski et al. suggest investigating characteristics of individuals and organizations (our underlining) and integrating "constructs from alternative models and (…) more comprehensive models, especially (integrating) environmental/ecological and psychosocial variables in understanding physical activity".

Saelens et al. (2003) mentions the "inability of individually focused interventions to create long-term change or population shifts in physical activity", quoting another author (Orleans, 2000) who is explicit in putting forward a research agenda for:

- New models of population health behaviour change and maintenance that integrate individual-level with broader environmental and macro-level policy influences.
- A fuller model of the maintenance process, which views maintenance more as a journey than as a destination.
- More theory-based and interdisciplinary research on the maintenance process and on strategies for assisting special populations and addressing more than one behavioural risk at a time (Orleans, 2000).

Another author (Kahn et al., 2002) presents a systematic review of interventions aiming at increasing regular physical activity. It lists the various fields which contribute to influencing behaviour, quoting "informational, behavioural and social, and environmental and policy approaches". In their conclusion, Kahn et al. (2002) argue that policy and environmental approaches and behavioural and social approaches to increasing physical activity need to be combined, concentrating in particular on:

- Individually-adapted health behaviour change
- Creation of and enhanced access to places for physical activity combined with informational outreach activities

These three articles (Baranowski et al., 1998; Kahn et al., 2002; Orleans, 2000) all point towards the complexity of decision processes regarding daily physical activity. All three mention the importance of the individual, as well as the importance of collective or community levels. In contrast to these three authors, Saelens et al. (2003) have clearly decided to leave aside the individual level in order to focus on environmental or ecological factors.

Saelens et al. (2003) write that "Transportation research currently provides the best evidence that environmental factors can contribute to low levels of lifestyle physical activity" and that "Our study builds on the strengths of transportation research to fill

important knowledge gaps." This implies that transportation research is of high value for understanding daily physical activity. In an apparent contradiction, in the same article we can also read: "From a physical activity and health perspective, transportation studies have numerous shortcomings: the contribution of community design to overall physical activity is unknown, only a small number of environmental variables have been studied, and reliable and valid measures of environmental variables are not available."

Another article by the same team (Cerin et al., 2006) states that researchers "have been shifting from individually based theories to multilevel ecological approaches". The authors point out that, although the built environment can be monitored and evaluated objectively (e.g. by GPS), the NEWS approach is based on perceptions. Because the original NEWS survey contained 68 items, the main objective of this article was to create and test a shortened version: NEWS-A. In practice, pairs of items overlapping in content were identified, and 14 items which had inferior psychometric properties were excluded.

Despite its careful wording, the article by Cerin et al. (2006) seems to suggest that walkability criteria have a limited effect on walking. But, delving deeper into the results (Table 6 in the 2006 article by Cerin et al.) we notice that this is true only for walking for recreation, which seems to be disconnected from walkability around the place of residence. This is a significant result. Regarding walking for transport, the effect of the various factors is weak at the individual level, but strong at the spatial level, where several factors show statistically significant associations: positive for land use, infrastructure for walking and aesthetics/friendliness and negative for traffic hazards and perceived crime risk.

Another background article (Cerin et al., 2009) describes an overhaul of the walkability scale, towards a new model with six factors: land-use mix and access, street connectivity, infrastructure and safety for walking, aesthetics, traffic hazards, and crime. More recently, a similar group of authors (Cerin et al., 2013) published a methodological paper investigating the goodness-of-fit of NEWS and NEWS-A in 12 countries (not including Switzerland). But, according to a recent and sobering review (Grasser et al., 2013):

"no reasonable robust conclusions can be drawn on the best measures in relation to overall active transport and weight-related outcomes". (…) "Most of the studies were conducted in the US, and the applicability of the results to other countries has to be considered with caution. It is important to conduct similar studies in other countries and to attempt to validate the walkability measures across countries (…) In particular, more European research needs to be undertaken (and) a common set of environmental measures should be used to enable replication in various populations and to facilitate pooled analysis (…). Based on our results, this common set should include gross population density, intersection density and the walkability index."

Our foray into the literature on walkability demonstrates that it is an inherently complex field. In our view, a historic problem with walkability is its multi-disciplinary rather than trans-disciplinary focus. Such a high level of scientific integration is difficult to attain (Stock and Burton, 2011) but we will argue for trans-disciplinarity in our Methodology section, because we believe it is necessary for the investigation of urban walking. In our view, another shortcoming of walkability is that it does not address psychological motivations. In particular, ingrained habit is absent from the NEWS framework and has been shown to be important for mode choice decision making (Schneider, 2013).

2.5 Research question and hypotheses

2.5.1 Research question

The research question is informed by the literature review, at several levels. First, the research on health and wellbeing clearly demonstrates that the promotion of walking should be an urban priority, at global level. Second, research on the environment and sustainability shows that the present mobility system is not only dangerous and polluting, but also profoundly inequitable and unjust. Third, research on policy making and behaviour change show that, despite its inherent complexity, it is possible for the mobility system to change, with regular urban walking playing a much greater role than before. All these reasons justify our overarching research question, which is the following.

RESEARCH QUESTION:
Can frequent walkers help bring about a healthy and sustainable mobility system, based on walking?

2.5.2 Generation of the hypotheses

Many research projects have either research questions or hypotheses, the former being questions whereas the latter are statements. Our thesis attempts to combine and articulate these two approaches. This is because we want to know whether frequent walkers – themselves – are likely to help bring about a healthy and sustainable transport system based on walking. In case they are not able to do this on their own, we want to know what we can learn from them that could help mobility systems towards that objective. Here, the statements (hypotheses) come into play, because each of them represents an important aspect of the character and/or behaviour of frequent walkers. The idea is that the answers to the hypotheses can then feed back into the research question, which may therefore evolve:

Research question: Can frequent walkers help bring about a healthy and sustainable mobility system on their own?
Answer: Probably not, or they would need a lot of help.
Research question (reformulated): Is there information about frequent walkers that others could use to help bring about a healthy and sustainable mobility system?
Answer: Yes, look at the answers to the Hypotheses.

Three of the hypotheses were in the grant application made to the FNS in 2013. Two others arose during the course of the analysis, during the Quantitative and Qualitative phases. The first three– H_1, H_2 and H_3 – are listed here essentially as they were written in the FNS grant application, and now appear under the heading "Daily Practices". The two other hypotheses were present "in spirit" in the original grant application but not yet formulated as hypotheses and are placed together under the heading "Implications for Society".

Like the overarching research question, the 3 hypotheses on daily practices also emerge from the literature review. The first (H_1, on motivation) has a close link to the research question because motivation is essential for anyone interested in walking substantial distances in urban areas not necessarily designed for such a purpose. The second (H_2, on skills), comes from the forward-looking research associated with the mobility turn and the New mobilities paradigm. Both H_1 and H_2 have a link to the trans-theoretical model, where motivation, skills and other factors combine to allow behaviour change in a given context. The third (H_3, on walkability) comes directly from our critical analysis of the walkability concept in the literature review.

The two other hypotheses, as mentioned, emerged from initial research results rather than from the literature review. There are, however, several links to the scientific literature. The hypothesis on sustainability (H_4) has a clear link to the Sustainability chapter in our Literature review, in particular regarding the production of greenhouse gases such as CO_2. As for the hypothesis on the pioneer effect (H5), it is directly linked to the research question itself, as it suggests investigating the attitudes and behaviours of frequent walkers to see whether – and how – the research question can be answered. Further readings and frameworks linked to the pioneer effect will be presented in the general Discussion section of this thesis, so that their relevance to frequent walkers can be investigated in the light of our research results.

2.5.3 Hypotheses regarding daily practices

H_1: MOTIVATION. Integrating an hour or so of walking into a modern day is difficult, which is why it is rare and requires strong motivation.

One of the challenges is handling not only time but also space: integrating an activity which physically removes the person from home is more difficult than putting aside

an hour when at home, which is already a challenge for many people. The way in which modern life is organized, with multiple activities along tight schedules and in various geographical locations, makes it difficult for most people to use walking for transport on a regular basis. This anti-walking context is compounded by physical barriers to walking such as major roads, discontinuities in the urban form, and discomfort linked to road traffic. We hypothesise that frequent walkers require strong motivation in order to initiate and maintain their frequent walking behaviour.

H_2: SKILLS. Frequent walkers have advanced navigational skills enabling them to plan and improvise complex routines in time and space.

Frequent walkers are likely to have advanced observation and navigation skills, linked to an ability to plan ahead and organise and/or an ability to improvise in time and space. Knowledge about shops and other services in the relevant area is likely to be high among frequent walkers, as well as what our group has dubbed “openness to opportunities” (Flamm et al., 2008). It is likely that these people possess a high level of motility, in the sense of ability and skills necessary to travel. We hypothesise that they also have some form of internal motivation which needs to combine with external characteristics (see H_3) for frequent walking to take place.

H_3: WALKABILITY. Frequent walkers use areas which do not always correspond to traditional walkability criteria.

These areas are likely to be strategically located and/or pleasant to walk or spend time in. Frequent walking occurs when a specific person (the frequent walker) is able to identify an area or path which has strategic and/or sensory advantages. This corresponds to the coming together of internal and external factors which ultimately lead to the behaviour taking place. Knowing not only why frequent walkers walk but why they walk in some places rather than others should help us understand what is special not only about the people, but also about the places where they go. Our results may or may not be comparable to walkability indexes published by other research groups; no specific hypothesis is made about this.

2.5.4 Hypotheses regarding implications for society

H_4: SUSTAINABILITY. Frequent walkers vary according to the degree of integration between walking and their personal mobility system, which has implications for sustainability.

This hypothesis emerged from the Qualitative data acquired during the course of this project. If the participants who were not frequent walkers were excluded, two groups seemed to emerge: one using walking as a transport mode, the other as a pastime. The former group would park their car outside the city centre in order to walk into

town – or they would walk from the train station across the city of Geneva or Lausanne, rather than taking the bus. The latter group would usually drive a car all day, then park at home – or elsewhere – before going for a walk in a pleasant area. Whether these differences should be viewed as a continuum (scale), or as a difference between two or more groups (typology), will be considered in the Results section.

H_5: PIONEER EFFECT. Frequent walkers have experience, attitudes and behaviours that can inspire others to become frequent walkers.

This hypothesis was developed for an international workshop called *Desirable Transport Futures*, held in Freiburg im Breisgau in July 2016. It emerged during the qualitative interviews, when we noticed that frequent walkers tended not to know each other, and that personal motivations such as pleasure and well-being were often mentioned, while collective values such as those pertaining to environmental issues were absent. This led us to the idea that, although the answer to the overarching research question might turn out to be negative – i.e. frequent walkers were unlikely to launch a transformation of the general mobility system on their own – there were elements emerging during the interviews that might be used in order to pursue such an aim.

In the light of the information that we will have obtained regarding these hypotheses, we will return to our overarching research question. The upcoming Methodology section will explain what approaches were chosen in order to explore frequent walking and frequent walkers, with the objective of finding an answer to the research question questions and testing the hypotheses.

3 METHODOLOGY

This chapter concisely describes our methodology, concentrating on which methods were chosen and why. Details about the individual methods are given in the Quantitative, Qualitative and Spatial sections, respectively. This is because initial analyses, such as defining the basic criteria of the 2010 Mobility and Transport Micro-census (MRMT2010) database, already yield results that are not available in peer-reviewed publications. This is also the case for the sections on qualitative interviewing, GPS tracking (or for the health data presented in the Appendix), where the characteristics of the participants can already be considered as results.

This chapter therefore discusses the main project objectives and explains which methods were chosen to try to answer them. It also includes specific sections on inter-disciplinarity and trans-disciplinarity, which are necessary to understand the spirit in which the research was carried out. The reader interested in research findings may switch directly to the various Results sections, labelled as follows: Quantitative, Qualitative and Spatial (GPS tracking).

3.1 Background

The proportion of citizens who regularly walk for an hour or more is unknown in Switzerland, and also unknown in other countries as far as we could tell by analysing the international scientific literature (none of which focuses on frequent walkers). Therefore, the first objective of this study was to show how walkers and potential frequent walkers are distributed across Switzerland. Indeed, it has been argued that qualitative approaches in mobility research need to be informed and supported by quantitative data (Manderscheid, 2016). So, before generating our own empirical data, we used the most readily available and dependable information source: the Swiss mobility and transport micro-survey, which is updated every 5 years.

This approach helped us answer a first series of questions regarding basic sociodemographic aspects, urban/suburban/rural differences, as well as differences between the three main linguistic areas. More detailed spatial analysis concentrating on the 5 largest conurbations in Switzerland helped us understand with more precision where frequent walkers live and walk. This still did not tell us why frequent walkers walk so much. So our research plan included a qualitative phase where we went and recruited frequent walkers, followed them for 8-10 days, then engaged in semi-structured interviews. A subset of these potential frequent walkers, and some others that we succeeded in recruiting, went on to a Spatial/GPS tracking phase.

Using the GPS data and information from the interviews, we sought out what elements in the daily walking routines are planned, which are improvised, and how the planning and improvising aspects interact with each other. We probed whether frequent walkers have always walked a lot or if they went through a conversion process. We also wanted to know whether internal or external factors (e.g. concern about one's health or the walkability of the neighbourhood, respectively) are more frequently mentioned as facilitators or barriers to frequent walking. We asked whether frequent walkers self-identify as walkers and whether they perceive walking as a default mode or a true travel mode.

3.2 Project objectives

3.2.1 Describe walking in Switzerland at the aggregate level

Using data from the Swiss 2010 Micro-census on Mobility and Transport, we sought to find out how much walking is being done, by whom, where, and for what given reason, over the whole of Switzerland. Using SPSS, we accessed detailed demographic and socio-economic data on walking, and compared it with previous micro-censuses carried out in 1995, 2000 and 2005 (we also acquired access to these data). From all this information, we extracted a snapshot of what a frequent walker might look like.

For several of these analyses and comparisons, we provide a focus on the five largest cities in the country: Geneva, Lausanne, Berne, Basel and Zurich. This enabled us to see to what extent Geneva and Lausanne (the focus of the following phases of the research) are comparable to the three other medium-large cities in Switzerland.

3.2.2 Meet, engage with and describe frequent walkers

After the quantitative phase, we entered into contact with frequent walkers, to find out why they walk so much and how they fit this activity into their daily lives, using both spatial and temporal perspectives. This part of the project focused on Geneva and Lausanne. For recruitment purposes, we extended our catchment areas to cover not only the two conurbations, which do not quite touch each other according to the Swiss Federal Office of Statistics, to include the totality of the Geneva and Vaud cantons. Participants were expected to reside and/or work in one of these two cantons. We believe that this approach is justified because exchanges between the Geneva and Lausanne conurbations are more and more common, to the extent that official differences between them are becoming somewhat artificial. The *Grand Genève* and Lausanne-Morges conurbations remain officially separate, partly

because this allows them to compete for federal funding, but joint initiatives between the two cantons such as the *Métropole lémanique* (metropolelemanique.ch) or *Greater Geneva Berne Area* (ggba-switzerland.ch) make it clear that it is reasonable, in the context of this study, to treat the Geneva and Vaud cantons as a single study area.

The initial recruitment plan included several methods. First, in the field, the idea was to go up to people found walking in areas which we considered to be potential walking hotspots. We already had experience in contacting unknown people in various settings to discuss research issues. Nevertheless, we did not want this stage of the project to be dependent on such a recruitment method. We also planned to use snowballing. When these strategies yielded insufficient results, we resorted to alternative approaches to identify and recruit frequent walkers, as will be explained in the Qualitative section of this thesis.

In total, we aimed at recruiting 50 frequent walkers in Geneva and Lausanne. The set-up being qualitative in nature, we were looking for people as different as possible from each other: people of both sexes, all ages, of various socio-economic groups, and living in urban, suburban and rural settings. We also tried to vary our sample as far as daily routines are concerned. For example, we wanted people who always walk the same path at the same time on each day of the week, as well as others more open to improvisation. Our aim in doing all this was to reach *saturation* regarding walking behaviours and their correlates.

The recruited people were asked to give informed consent, then equipped with a GPS tracking device. The tracking device is linked to a travel diary software package developed by our group. After around 8-10 days (1 week + 2-3 days to enable the discussion of repeated behaviours) an audio-recorded debriefing interview went through the various trips that took place during the period, to understand where they walked, when and why. Extra questions were used to probe the motivations, values and attitudes underlying the walking behaviour. This information aimed at enabling us to understand whether or not frequent walkers have well-defined routines in time and/or in space.

In order to acquire information that might be of use to public health researchers, and as a pilot study to inspire future research connecting frequent walking and health, we asked selected participants to undergo a standard health test at the *Bus Santé* in Geneva or in Lausanne. This produced basic medical information such as height, weight, blood pressure, resting heart rate, as well as total cholesterol and glycaemia. We also asked them to fill out the International Physical Activity Questionnaire (IPAQ). The related data and results are presented in the Appendix.

3.2.3 Answer the research question and test the hypotheses

The ultimate objective of this thesis is to answer the overarching research question and test the hypotheses, using our data. This will be done in the Discussion section. What we want to emphasise here is that we are proceeding with a firmly forward-looking mindset. So, when we analyse the motivations, skills, character and behaviour of frequent walkers, we intend it as a means to an end: one of the final deliverables of our thesis is a series of public policy recommendations in order to make frequent walking easier and more prevalent. Another key deliverable is a scientific research agenda, with ideas for intervention studies that can help demonstrate how frequent walking may play a key role in the future for the development of healthy and sustainable mobility systems.

So, the methods were chosen in order to maximise the chances of finding useful information. Rather than testing an established framework, we simply treated our study participants as respected experts on walking, who were more likely to teach us about walking than the other way round. Since such an approach is not specifically grounded in any particular research area, we decided to adopt a trans-disciplinary approach.

3.3 Trans-disciplinary approach

This section draws on various scientific disciplines and publications in order to see how the field of urban science can be investigated using disciplinary, interdisciplinary and trans-disciplinary approaches. A specific focus on urban walking was intended for this work, but most of the articles that we found on interdisciplinarity and urban science did not to refer to walking. Many of them did not even refer to transport and mobility, or only in passing. As a result, the focus of this chapter is on urban science under a general definition: a body of interdisciplinary research aiming towards sustainable urban living, inspired by disciplines such as geography, public health, sociology, town planning, political science, etc.

Although distinctions between approaches are hard to draw, it is generally accepted that there is a gradual increase in integration from multi-disciplinary to inter-disciplinary and up to trans-disciplinary research. Drawing on contributions from various authors (Lawrence, 2006; Stock & Burton, 2011), we wish to set out a few definitions:

Disciplinarity: the specialisation of academic disciplines.
Multidisciplinarity: research where each specialist remains within her/his discipline and contributes using disciplinary concepts and methods.

Interdisciplinarity: the bringing together of disciplines that retain their own concepts and methods that are applied to a mutually agreed subject. In these studies, one contributor usually co-ordinates the research process and seeks integration. Interdisciplinary contributions can therefore be considered as the mixing together of disciplines.
Trans-disciplinarity: involves a fusion of disciplinary knowledge with the know-how of lay-people thus creating a new hybrid that is different from any specific constituent part.

Importantly, this implies that trans-disciplinarity is not an automated process arising from the bringing together of people from different disciplines or professions. It implies giving up “sovereignty” over knowledge, and the capacity to consider the know-how not only of professionals from other disciplines but also from lay-people. This emphasis of not only sharing knowledge with other researchers but also reaching out to share knowledge with community stakeholders is shared by other authors, some of which even consider it to be a hallmark of interdisciplinary research and also a justification why interdisciplinary projects generally require more time before they can yield results (Angelstam et al., 2013).

Disciplinary, multidisciplinary, interdisciplinary and trans-disciplinary approaches are complementary rather than mutually exclusive. Indeed, without specialised disciplinary studies there would be a lack of in-depth knowledge and data. In the opinion of Roderick Lawrence, an expert on interdisciplinarity at the University of Geneva, “there still are too few interdisciplinary contributions about health and residential environments, and trans-disciplinary contributions are even rarer” (Lawrence, 2006).

Introducing the concept of urban morphology, Anne Vernez Moudon writes that buildings, gardens, streets, parks and monuments are constantly in flux and interaction with each other, thus forming the main elements of urban morphological analysis. This topic area was founded by the coming together of researchers from at least three language areas and disciplines, but who shared some common ground. First and foremost was the belief that a city can be “read” and analysed based on its physical form. Another tenet was that urban morphology was to expand “beyond its original confines in geography” and emerge “as an interdisciplinary field”. Furthermore, urban form, resolution and time were recognised as the three fundamental components “present in all studies, whether by geographers or architects, and whether they focus on a medieval, baroque, or contemporary city” (Vernez Moudon, 1997).

3.3.1 Trans- and interdisciplinarity in urban studies

Many academic areas claim to be interdisciplinary or to use interdisciplinarity, but urban studies is probably one of the areas where this is the most noticeable. A systematic review of published articles has shown that scientific output (i.e. the number of publications) in urban studies has literally exploded since 1991, with the United States and China playing an increasingly strong role. Of the top five categories of articles identified in this review, two were from SCI databases (Science Citation Index) and three were from the SSCI databases (Social Science Citation Index), thus demonstrating, if need be, the inherently interdisciplinary nature of urban studies (Wang et al., 2012).

According to Roderick Lawrence and his team, the current inability of scientific research to resolve complex problems including climate change, public health and urban planning is linked to their inherent complexity, but also to the fragmentation of topic areas. In order to deal with these limitations, he suggests doing away with "excessive specialisation, segmentation and bureaucratisation of knowledge" (Lawrence & Després, 2004).

The topic of urban environmental research was investigated based in a series of seminars held in 2004. The authors (Petts et al., 2008) remark that conversation between disciplines can be hampered – but also enriched – by language and other differences. Another important conclusion of their article is that interdisciplinary research is often applied, but it “need not” be applied research.[4] They conclude with the idea that interdisciplinarity should be viewed as a series of negotiations and recursive interactions between disciplines.

According to Matilda Annerstedt of the Swedish University of Agricultural Sciences (Department of Landscape Planning), there is potential for trans-disciplinarity as a method for investigating interactions between territories, the environment and public health (Annerstedt, 2010). She argues that there is an increasing need for complex interventions to solve complex problems and that a trans-disciplinary approach is suitable for this. She puts forward a new way of regarding trans-disciplinarity which she calls Inference to the Best Understanding, an expression coined explicitly in reference to a book by Peter Lipton that uses this term (Lipton, 2004).

The analysis of social behaviour touches on the link between science, society and policy, according to Annerstedt (2010). Indeed, she believes that policy can be seen as an effort to influence human behaviour. Despite many calls for policy making to become evidence-based, she argues that policy has so far failed to change people’s routine behaviours. This is especially the case when it comes to health promotion or the management of natural resources, topics which are very close to walking in our

[4] Their emphasis.

view. She concludes that "applying a trans-disciplinary method to these questions is one step towards empowering public health and environmental research with the credibility that is necessary for it to have an impact on policy" (Annerstedt, 2010).

3.3.2 Interdisciplinarity and public health

Much of the work on the scientific underpinnings of interdisciplinary research has been carried out in the field of public health. Sally Aboelela and her team at the Columbia University School of Nursing in New York proposed a definition of interdisciplinary research based on a review of 14 definitions from multiple fields of study, which they then field tested on 12 individuals with interdisciplinary research experience. They thus identified three key characteristics: the qualitative mode of research (and its theoretical underpinnings), the existence of a continuum of synthesis among disciplines, and the desired outcome of interdisciplinary research.

An example of an interdisciplinary domain often mentioned in the scientific literature is tobacco control, where the epidemiological evidence that tobacco use is associated with adverse health effects did not lead spontaneously to smoking cessation at the population level. The addition of research on the perception of risk, on motivation (e.g. the trans-theoretical model) and public policy frameworks (including advertising, indoor smoking bans, etc.) proved instrumental in designing programmes to lower rates of tobacco use (Aboelela et al., 2007).

Aboelela et al. (2007) observed divergent paradigms of inquiry between the physical and social sciences, on the one hand, and the humanities on the other hand. The former were found to employ “a positivist or post-positivist mode of inquiry in which an appreciable reality exists and is objectively (although sometimes imperfectly) knowable. The methodologies of the physical and social sciences are primarily hypothesis driven and use experimentation and manipulation to achieve objectivism.” The most cited framework mentioned by the social, health, and physical sciences experts interrogated by Aboelela et al. was the Rosenfield typology (Rosenfield, 1992). This is consistent with the hypothesis-driven approach in which the starting point is a common problem or question (see Table below).

Degree of synthesis	Lattuca (2001)	Klein (1996)	Rosenfield (1992)
Least	Informed disciplinarity: disciplinary questions may be informed by concepts or theories from another discipline	Instrumental interdisciplinarity: bridge building between fields. Problem-solving activity, does not seek synthesis or fusion of different perspectives	Multidisciplinary: teams work in parallel or sequentially from their specific disciplinary base to address a common problem
Moderate	Synthetic disciplinarity: questions that link disciplines (question either belongs to both disciplines or to neither)	Epistemological interdisciplinarity: restructuring a former approach to defining a field	Interdisciplinary: teams work jointly but still from a discipline-specific base to address a common problem
Greatest	Trans-disciplinary: application of theories, concepts, or methods across disciplines with the intent of developing an overarching synthesis. Conceptual interdisciplinarity: questions without a compelling disciplinary basis.	Trans-disciplinary: a movement toward a coherence, unity and simplicity of knowledge	Trans-disciplinary: teams work using a shared conceptual framework, drawing together discipline-specific theories, concepts, and approaches to address a common problem

Table 3-1. Typologies of Interdisciplinary Research, after Aboelela et al. (2007), modified

In contrast, (Aboelela et al., 2007) found that the humanities employ a critical theory or constructivist mode of inquiry in which reality is experientially based, historically shaped, and whose understanding is only relative in nature. The methodologies are therefore not hypothesis-driven. The approach emphasises subjectivism and the interaction between investigator and subject (Guba & Lincoln, 1994). Qualitative modes are a key feature, with explicated assumptions and values.

3.4 The socio-ecological model

The socio-ecological model is sometimes referred to as the socio-ecological model of health, or of health-related behaviours. However, it is not only used in the health sector. In this project, we use the socio-ecological model as an overarching framework. Its four levels or components are the individual, social environment, physical environment and policy. There are multiple relationships between levels and with the activity (e.g. a physical activity such as walking) that an individual may or may not carry out. The general idea is that strategies or interventions to change behaviour are more likely to be successful when several levels of influence are addressed at the same time.

3.4.1 Uses of the socio-ecological model

The socio-ecological model is often used for the promotion of physical activity (Fleury & Lee, 2006; Hesketh et al., 2017), but rarely specifically for the promotion of walking (Feuillet et al., 2015). The interest of the model lies in the fact that no single level accounts for how much walking a person does, they all interact with each other to

determine how much walking a person achieves. This model is widely used and has many declinations. Here, we present a vision shared by the public authorities of the province of Victoria, Australia (VCAA: Victorian Curriculum Assessment Authority).

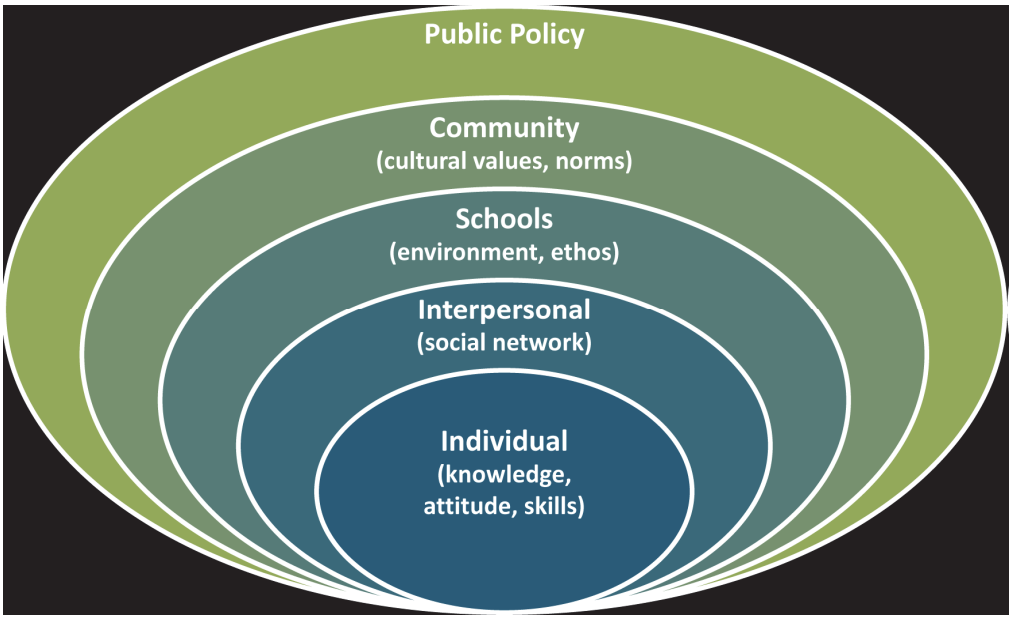

Figure 3-1. The socio-ecological model. Source: VCAA (Creative Commons)

The information presented in the image above and the sections below comes from the Victorian Curriculum Assessment Authority (Creative Commons license), specifically from a document entitled "Week 3 – Socio-Ecological Models and Physical Activity" which we have slightly modified and simplified for ease of reference.[5]

[5] VCE. Physical education unit 3, area of study 1: Monitoring and Promotion of Physical Activity http://edf4423-group1.wikispaces.com

3.4.2 The levels of the socio-ecological model

3.4.2.1 Individual level

- age
- sex
- health or disability status
- family situation
- level of education
- socioeconomic status
- employment status
- knowledge, attitudes, beliefs, motivation, skills, etc.
- self-efficacy

3.4.2.2 Social environment

- partner and/or family support
- peers
- institutions (schools, workplaces, civil society organisations, etc.)
- influence of mentors such as doctors, teachers, etc.
- community norms
- cultural background
- socioeconomic status of the community

3.4.2.3 Physical environment

- natural factors (weather, topography, geography, etc.)
- availability and access to parks, sporting grounds, walking or cycling tracks, etc.
- aesthetic or perceived qualities of the natural and built environments
- safety such as crime rates or amount and speed of traffic
- land use, density of housing, street connectivity
- public transportation systems

3.4.2.4 Policy

- urban planning policies
- active transport policies
- education policies
- health policies
- environmental policies
- workplace policies
- funding policies.
- incentives

3.5 Using study objectives to refine methods

From the inception of our project, it was obvious that we would use mixed methods, because of the innovative and difficult-to-grasp nature of the subject matter (frequent walkers) and because no single method could answer the many questions that we had. Thereafter, the choice of precisely which methods would be used was dictated by a combination of scientific and practical criteria.

At the scientific level, there was a desire to find out how walking is distributed in the Swiss population and what the socio-demographic characteristics of frequent walkers might be, compared to the general population and other groups. We felt we could best answer this by using quantitative data. At the practical level, we resorted to the Swiss 2010 Mobility and Transport Microcensus (MRMT2010), which at the time of writing was the most rigorous and up-to-date dataset on transportation issues in Switzerland. At the practical level, we had ready access to it (EPFL being part of the Swiss Confederation) and it was possible to analyse it using the SPSS statistical package.

The necessity was also felt to understand how and why people ever become frequent walkers, as well as their perceived barriers and encouragements to walking. Daily routines were a further interest in this area, which we felt would be best covered by using qualitative interviewing. These interviews were audio recorded. It was decided not to use quantitative analyses on this qualitative material, for two reasons: first, the interviews were exploratory and free-ranging, so it would not have made scientific sense to analyse them in a quantitative way; second, we found it far more practical to listen to the interviews and write down the gist of each interview, only doing verbatim transcriptions when it was felt that the material was particularly relevant to the analysis.

We also wanted to know where the walking was done and what were the characteristics of the streets or other places where frequent walkers are to be found. We tested the idea of placing the location of residence of frequent walkers on maps. But this proved unsatisfactory, for several reasons. First, in order to respect confidentiality, we were not allowed to use precise localisation on high-resolution maps (this was spelt out very clearly in the confidentiality agreement that we had to sign in order to be allowed access to the MRMT data). Second, a preliminary attempt at mapping frequent walkers (and another group that walked very little or not at all, to allow for comparison) yielded equivocal results: dots could be seen across Lausanne and Zurich (the two selected cities) but no clear pattern emerged (Christie et al., 2015b). Third, mapping of walking routes was attempted by our group but essentially showed that walking was concentrated in city centres to a far greater extent to what was expected (Ravalet et al., 2014).

During the course of this project, we decided to link the idea of producing maps with the data that we succeeded in acquiring for individual GPS tracking, which we felt would give more interesting results that we could relate to the characteristics of each frequent walker. In a nutshell, we decided that spatial analysis, in this project, made more sense when associated with qualitative rather than quantitative approaches.

Finally, we felt very strongly that the linkages between health and walking needed to be addressed in this project, because this would help us understand to what extent frequent walkers are similar or dissimilar from the general population. We had planned to collaborate with the Bus Santé Genève, and this ultimately met with success but not after overcoming many difficulties: ethical approval took over a year to be obtained, many people refused the analyses or could not access them for organisational reasons, others were given only some of the tests that were required (because some of the apparatus is not kept on the bus all the time).

Last but not least, the recruitment of frequent walkers, what is more in a geographically restrained area (cantons of Geneva and Vaud), was bound to be fraught with difficulties. We believe that we achieved a remarkable success in this area, simply by the numbers of people that we succeeded in contacting and interviewing. The downside is that several of these people turned out not to be *bona fide* frequent walkers. Others participated only in some parts of the project and not others, and some dropped out during the project course. In a nutshell, we were not spared the habitual pitfalls of complex fieldwork.

We are mentioning recruitment in this paragraph because methods certainly had to be rolled out in order to achieve this recruitment. This will be described in more detail in the various Results sections. For now, we would like to mention the fact that various recruitments processes were used. In canton Vaud, a collaboration with a pedometer-linked competition for State employees was very helpful. In canton Geneva, a newspaper advertisement in a local newspaper (Tribune de Genève) gave interesting results. Other successful methods included personal posts on Facebook and e-mails to former colleagues at the Association for Transport and Environment, and at the University of Geneva (Faculty of Medicine, Public Health sector).

One method that had been considered at the onset but which had to be hastily abandoned was direct recruitment of walkers in the field (in parks, on bridges, in pedestrianised areas, etc.). At least 50 people were contacted in this way and were given a business card and/or a project description, but not a single study participant was recruited in this way. Another potential method for recruitment was through identifying where frequent walkers live, using the MRMT data. But preliminary analyses showed that potential frequent walkers lived all over conurbations (we ran a test on Lausanne and Zurich) rather than in defined "pockets" (Christie et al., 2015b).

3.6 Articulation of the phases of the research plan

The first objective of the quantitative phase was to describe walking in Switzerland comprehensively, which had not been done before. A second objective was to describe potential frequent walkers at aggregate level. The biggest shift in emphasis is between the Quantitative phase, which relies on official data from the Swiss statistical office, and the Qualitative phase, which is the first where we enter into contact with "real" frequent walkers.

The objective of the Qualitative phase was to gather preliminary information about frequent walkers: who they were, what they did, why and when they did it, etc. During the course of this phase, an interview guide was reviewed in an iterative manner (questions were added, modified or removed, as their relative interest became clearer). The interview guide, in French, can be found in the Appendix. Most of the questions revolve around the person's walking habits and – especially – around the reasons why they walk in such and such a place, or time or way.

The Spatial/GPS phase is the only phase that could objectively "prove" not only the amount of walking going on in our sample, but also which routes were being chosen. GPS debriefing interviews were conducted in this phase and should not be confused with the prior interviews mentioned above. For practical reasons, some participants had only one of these two interviews, whereas others had both. Reasons for not proceeding from the Qualitative through to the Spatial/GPS phase were as follows: perhaps not a frequent walker (8 cases); pregnancy (2 cases); accident or health problem (2 cases); living abroad (2 cases); lack of time or interest (5 cases); drop out with no reason given (5 cases).

A total of 74 people took part in our research project, as can be seen in the figure below. This included 72 people living or working in the study area and a 2 who lived abroad and who only had a prior interview.

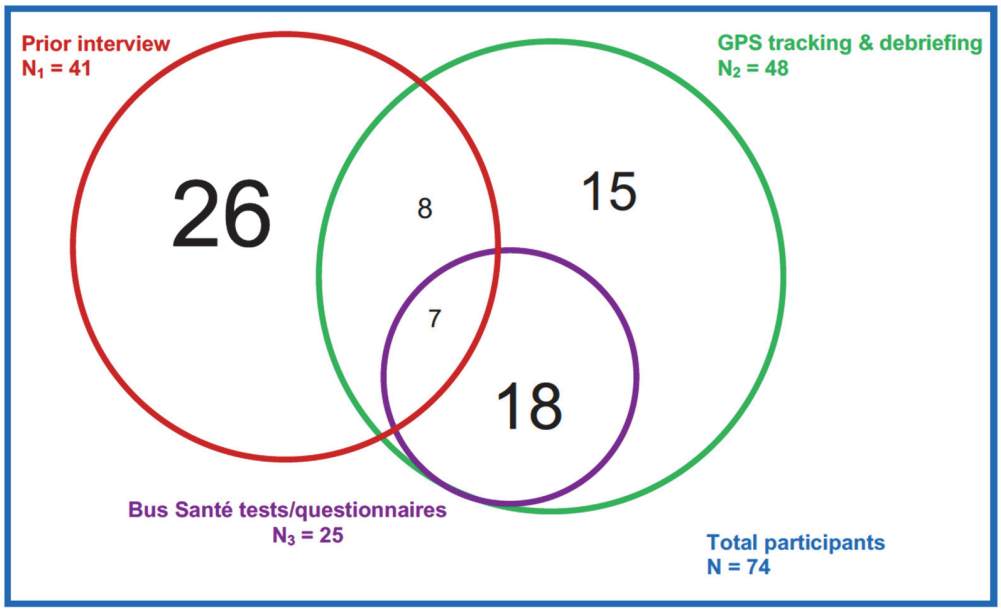

Figure 3-2. Experimental set-up showing the status of the 74 study participants
The Prior interview category corresponds to the Qualitative phase.
The Bus Santé tests/questionnaires refers to the Health pre-study presented in the Appendix.

The participants directly recruited to the Spatial/GPS phase were not subjected to a prior interview because we felt saturation had been achieved and it was unnecessary to submit them to an extra appointment, with the risk of contributing to participant

fatigue. Furthermore, by that time the emphasis of the project had changed and the objective was to encourage study participants in the Spatial phase to proceed through to the Health pilot-project (described in the Appendix).

The fundamental difference between the two types of interview is that the prior, qualitative interviews were in-depth interviews based on the 4-page interview guide. They had the double objective of understanding the motivation and behaviour of the individual person, and of acquiring a general idea of the attitudes, values and behaviours of frequent walkers as a group. They were analysed by identifying common themes that appeared in the data (thematic analysis). As for the GPS interviews, they were conducted while reviewing GPS tracking data on a screen, in real time, and had more practical objectives. Most of the questions in these interviews were related to individual decisions that could be visualised on screen, such as*: Why did you go along the main road in this case, rather than cutting through the park?* Or: *Why did you use a different route on the way back?*

The timeline of the project evolved as follows. In a nutshell, the participants for the prior interviews were recruited during the first half of 2016, then a subset of them were selected for the Spatial phase, where a new set of participants, mainly from Geneva, were added to the sample. Then around half of the participants of the Spatial phase participated in the Health phase. This is because several of them refused to participate (they were not asked to supply a reason), others could not adapt to the rather narrow opening hours (this applied especially to those living in canton Vaud) and a couple more were deliberately not asked to go to the Bus Santé because they had serious underlying health conditions (n=2).

- March 2015: first contact by e-mail with the Ligues de la Santé (ça marche avec mon podomètre), through a frequent walker met by chance at a conference.
- April 2015: first meeting with the Ligues de la Santé.
- 22 September 2015: presentation of the recruitment plan to the PhD monitoring committee.
- 18 January 2016: the Ligues de la Santé send out an e-mail to their 378 participants declaring > 10,000 steps per day.
- 12 June 2016: e-mails sent out to various civil society organizations related to healthy urban living (no result).
- January – June 2016: handling the recruitment and carrying out the interviews.
- 31 August 2016: an advertisement is published in the Tribune de Genève. During the same week, a page is put online on the epfl.ch web site, e-mails are sent out to several known lists and people, information on the project is also posted on Facebook (despite 30 shares and 14 enthusiastic comments, no direct recruitment occurred over Facebook).
- September-December 2016: recruitment of Spatial/GPS participants.
- February 2017: recruitment of participants for the Health phase (health pre-study)

3.7 Reflexivity

The empirical part of this thesis (Qualitative, Spatial and Health phases) is clearly exploratory, which may be related to the academic profile of the author. Indeed, it is interesting to note in what frame of mind this work was carried out. In particular, how were the questions in the questionnaire chosen?

In order to answer this question, it is useful to take a look at the CV of the author of this thesis, who began his academic life with a B.Sc in biology in 1991, followed by an M.Sc in biology (Medical Genetics), in 1993. Then he did a Master's degree in Tobacco Control (2002) followed by a Master's degree in Public Health (2008). During much of this time, in fact since March 1996, he was also an environmental activist within a large civil society organization called Association for Transport and Environment (ATE, ate.ch) which is one of the main pressure groups in favour of sustainable transportation in Switzerland.

All these prior experiences were combined in my approach to this PhD thesis. It is therefore logical to find all of these influences in the questions asked to the study participants. In particular, many questions were related to health and many others to interactions with the environment. Leading questions about tobacco smoke were deliberately avoided, however we cannot exclude that we may have, subconsciously, been more aware of the perils of tobacco smoke because we have studied the subject. Again, we are more aware than most people of the perils of air pollution and noise, due to our biology and public health background. The idea behind the related questions in the questionnaire was not to influence our sample, but to see how much knowledge they had of the health risks associated with these environmental hazards.

Other questions were related to the author's own experience as a relatively frequent walker, in the Geneva-Lausanne area. Having experienced first-hand the potential problems of lacking or narrow pavements, slow traffic lights and other problems, it was felt necessary to include such items in the questionnaire. The author had heard casual reports of verbal conflicts between pedestrians and motorists or cyclists, which is why this specific question was asked. Finally, some of the behavioural questions were inspired by scientific publications, such as the idea that healthy behaviours may be correlated with each other.

4 QUANTITATIVE ANALYSIS

The objective of this Quantitative phase is to describe and understand the state of walking in Switzerland. It lies upstream of the research questions and hypotheses, while containing some elements relevant to motivation, skills and walkability.

4.1 Introduction to the quantitative phase

This objective of this section is to acquire a broad understanding of walking in Switzerland. It describes how quantitative, country-wide surveys were used in order to acquire a general picture, including who walks, why, when and where. The primary dataset used is the 2010 Swiss mobility and transport micro-census, hereafter: MRMT2010. Organised by the federal government, an MRMT takes place every 5 years, takes a full year to be carried out and usually another year is needed before the results are published and made available for research (OFS, 2012; OFS & ARE, 2012).

When most of the quantitative analysis was carried out, MRMT2015 was not yet available. Therefore, almost all of this quantitative section is based on the analysis of MRMT2010. Nevertheless, an additional paragraph was added, with basic statistics not only from MRMT2010 but also from MRMT2015 and reaching back to MRMT2005 and MRMT2000 (and, to a limited extent, MRMT1994). The objective of this additional analysis was to give an idea of the evolution of walking over time. It goes into less detail than the parts only using MRMT2010 and seeks to put into perspective the (accurate) claim that levels of walking increased between 2000 and 2005 (Lavadinho, 2011).

A health-related dataset was also pinpointed for investigation: the Swiss Health Survey (SHS), which takes place every ten years. Only the most recent version was used: SHS 2012. However, as will be seen, only very limited data on walking could be found in that database.

These datasets (MRMT and SHS) are all official national surveys organised by the Swiss federal government's statistics office, hereafter OFS/BFS (*Office fédéral de la statistique / Bundesamt für Statistik*). The data are available to researchers operating in Switzerland, after the signing of a confidentiality agreement. Permission to use these data was acquired by signing such agreements with OFS/BFS.

As a complement to the Methodology section of this thesis, the methods used for each analysis are briefly described in each sub-chapter, so that the ways of analysing the data can be visualised as close as possible to the results obtained. All

analyses were carried out on a PC computer, using IBM SPSS software, successively with versions 22, 23 and 25.

The most recent survey (MRMT2010) took place throughout 2010, data were consolidated by the Federal authorities in 2011 and released in early 2012. The term micro-survey refers to the fact that the data are at the level of individuals and households (Molloy, Ployhart, and Wright 2010). Indeed, MRMT2010 is not small.

4.1.1 The main database, MRMT2010

Part of this information was presented at the 15th Swiss Transport Research Conference in Ascona, Switzerland, in May 2015, and was included in a conference paper under the title "Analysing the distribution of walking in the Swiss population" (Christie et al., 2015b).

MRMT2010 contains data from 62’686 individuals aged 6-99 interviewed by telephone, in a representative stratified sample covering the whole of Switzerland. It is made up of 13 interlinked databases each with between 4 and 214 variables and between 8000 and one million data lines (OFS and ARE 2012).

The telephone interviews were carried out by operators with specific training and who were instructed to visualise the person's movements on a screen during the conversation. Therefore, despite the usual pitfalls connected with self-declaration, it can be said that the MRMT series are particularly dependable datasets, representative of the total resident population of Switzerland. There are subtle methodological differences between the MRMT editions, for example routing (using the screen, in real time) was only introduced in 2010. Previous estimates in 2000 and 2005 used distance estimations uttered by the participants themselves. We made very parsimonious use of MRMT1994, because of more important methodological difference.

4.1.2 Sub-databases

The 62'868 individuals in MRMT2010 are attached to 59'971 households, so around 4.8% of all target persons come from a household where another family member is also a target person (whereas in MRMT2015, only one person per household could be interviewed). The table below sets out the seven most important datasets. Because all written information in the databases is in German, we will be using some German expressions for the sake of clarity. In order to facilitate comprehension for certain readers, we are suggesting alternative names in English and in French, as can be seen in the table below.

The six other datasets (not shown) refer to rarely made trips or excursions (*Reisen 1a, Reisen 1b*), to variables that would only have been useful if a detailed GIS

analysis had been carried out (*Verifikationspunkte*), detailed information about vehicles (*Fahrzeuge*), or trips within country borders (*WegeInland*) which are very similar to the total trips carried out (*Wege*), which was analysed in detail in this research project. The names of the databases are lowercase versions of the German name, with the suffix .sav (*Wege* information is therefore in wege.sav).

Data	Observations	Variables
Households / Ménages / Haushalte	59'971	99
Target persons / Personnes-cibles / Zielpersonen	62'868	214
Home trips / Boucles / Ausgänge	85'436	36
Trips / Déplacements / Wege	211'359	87
Stages / Etapes / Etappen	310'193	116
Routes / Routen	285'529	4
Segments / Segmente	10'064'058	2

Table 4-1. Overview of the main databases in MRMT2010

Some cantons, including Geneva and Vaud that are the primary research areas for this thesis, paid extra to have a higher number of citizens sampled for MRMT2010. Also, different numbers of people responded on different days of the week. These are only two of the sampling differences between regions and population segments, which are compensated through a complex weighting system expressed through a single variable called *Personengewicht*, abbreviated *wp*. There was only one type of weighting for all MRMTs 2000-2015 (a complex system of 6 alternative weightings existed in MRMT1994, this is one of the reasons why we used that dataset a lot less).

All the results related to MRMT datasets presented in this thesis were corrected manually by using the *wp* term in SPSS. There are several hundred possible weights in the database, their values varying between .07 and 3.83, so this correction proved very important. All the more so that the direct reporting of non-weighted data is not allowed according to the confidentiality agreement that we signed with the federal authorities. Unless mentioned otherwise, for all the information given, the weighting correction is included.

In order to move information from one place to another in MRMT2010 – e.g. the walking distances needed to be transferred from the stages database (*etappen.sav*) to the database with individual characteristics (*zielpersonen.sav*) – unique identifiers were created in SPSS and variables were amalgamated or averaged (as necessary) before being transferred from one database to another.

4.1.3 Basic demographics

The 62'868 people in the MRMT2010 database were 53.7% female and an average age of 45.5 years (SD: 21.9). Education level was as follows: 19.3% compulsory

education, 55.3% apprenticeship or secondary education, and 25.3% higher education. Slightly over half of the sample (54.3%) was professionally active. Revenue was assessed using a 4-point scale and obtained a good response rate (82.5%), given the fact that there were children in the sample. Since Switzerland is a multilingual country, the interviews for MRMT2010 were carried out in the 3 national languages: German, French and Italian. Respectively 7.1% and 8.5% of the sample come from cantons Geneva and Vaud.

MRMT contains detailed information only for a single day, for each survey participant. It therefore yields excellent data at population level, but results for individuals need to be interpreted with caution. Indeed, a person who walks 5 km on a given day may well walk twice that amount – or not at all – on another day of the same week.

Each respondent has a reference day, usually the day before the telephone interview. Regarding their distribution within the year, the first reference day was 31st January 2010 and the last was 27th February 2011. We checked that no single day during the year accounted for more than 1% of the total sample, so it can be concluded that MRMT2010 gives a good idea of what went on during an entire year, with the caveat that it was not from January to December 2010 as initially believed. These reference days are also distributed throughout the week. We identified the fact that Friday and Saturday are slightly under-represented, but all days are present at least at the 11.5% level and none is higher than 17.1% (Sunday). This is one of the systematic differences in the database which makes it necessary to use weighting.

4.1.4 Trips and home trips

The diagram below shows how home trips (*Boucles / Ausgänge*) are split into trips. Home trips always start and end at home. Several trips combine to form a single home trip, and each trip has a destination and a motive. In the case shown in the diagram below, the first trip is to go to work, the second is to go to a place of leisure and the third is the return home. It should be emphasised that each trip may have one or several transport modes associated with it (see next paragraph). If several modes are present in a single trip, a main mode is defined (*hauptverkehrsmittel*). As might perhaps be expected, a person walking to take the bus or to get into a car will be given "bus" or "car" as a main mode.

Figure 4-1. A home trip, subdivided into trips (Source: ARE/OFS)

4.1.5 Walking stages

As can be seen in the next figure, the trips can be subdivided into one or several stages, each of which has a single transport mode associated with it. If there is only one stage (e.g. a person rides her bicycle to work), then the trip and the stage will be identical. However, it is common for trips to have several stages and at least one of these stages is often walking (walking to or from the bus stop, to or from the car park, etc.). The nomenclature is not always easy to handle for non-German speakers, since all the file names and variable names in MRMT are in German. Throughout this work, I have tried to use the term stages to refer to *Etappen*/étapes.

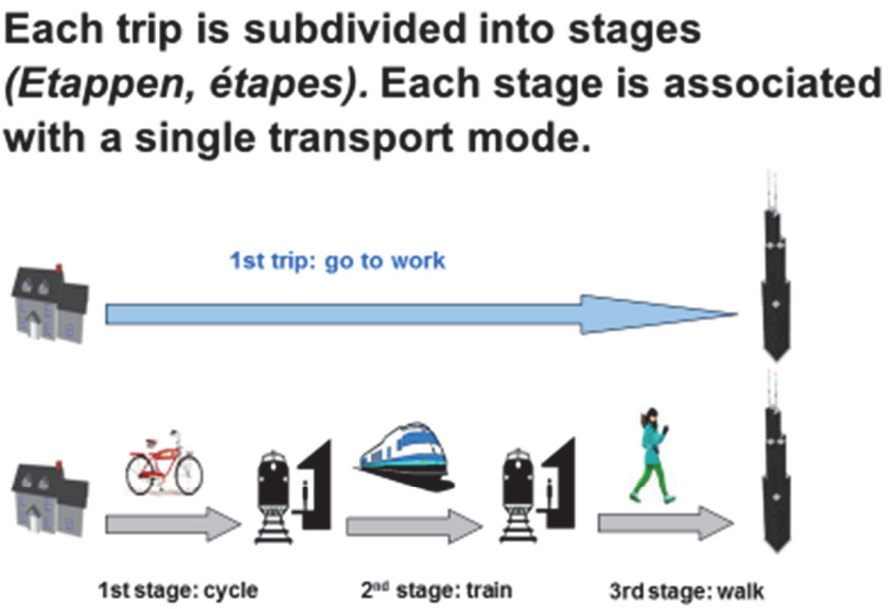

Figure 4-2. A trip, subdivided into stages (Source: ARE/OFS)

4.1.6 Database architecture and walking

As we have seen, in MRMT each home trip is subdivided into trips, which in turn are composed of stages which each have a single transport mode. This database architecture has an important consequence: the mode share of walking is likely to be very different if one looks at trips or at stages. If a person walks 100 metres to his or her car and then drives off to work or another location, this will count as 1 walking stage + 1 car driving stage, but only a single trip which will be attributed automatically to car driving. In the Results part of this Quantitative section, it will be seen that walking stages are indeed more numerous than walking trips. Furthermore, some summary travel statistics are given in the database on individuals (*Zielpersonen.sav*) but in this database the walking and cycling data are amalgamated into a single variable (*Langsamverkehr*).

4.1.7 Total travel distances

At a general level, analysis of MRMT2010 shows that each resident of Switzerland covered around 35 km on the reference day (without counting trips abroad). This corresponds to a travel time of around 1 hour and 25 minutes.

	Daily distance (estimate) Total	Daily distance (estimate) Inland	Daily distance (Routing) Total	Daily distance (Routing) Inland	Daily travel time Total	Daily travel time Inland
N	62868	62868	62868	62868	62868	62868
Mean	48.4	36.4	45.6	34.7	86.9	82.2
Median	15.2	15	13.3	13	61	60
SD	242	60.2	----	58.2	97.4	86.5

Table 4-2. Total travel distances and times (MRMT2010). Inland: in Switzerland.

However, as can be seen in the table above, the distances travelled on the reference day can be estimated in various ways. Unsurprisingly, the estimated daily distance (*Tagesdistanz-Schätzung*) is higher than the estimated distance travelled only within Switzerland (*Tagesdistanz-Schätzung-Inland*) because it excludes almost all trips done by aeroplane (the average is 48.4 km, versus 36.4 km). Comparable distances obtained using the routing method are slightly lower: 45.6 km per day in total, and 34.7 km for inland trips only. The time spent travelling (*Tagesunterwegszeit*) is 86.9 minutes in total, of which 82.2 minutes are inland, i.e. within Switzerland.

We found substantial differences between socio-demographic groups. No doubt due to the large size of the database, all differences tend to be statistically significant (any non-significant differences are explicitly labelled as such). For example, men cover 11 km more per day than women. And people living in households with a monthly income over CHF 14’000 cover distances 2.5 times greater than people living in households with incomes under CHF 2000.

4.1.8 Mode shares

Usually expressed as percentages of all trips, mode shares are a classical way of analysing and presenting transportation data. However, for people coming from other fields this way of thinking may not be immediately obvious: indeed, a trip of 25 metres or 25 kilometres will carry exactly the same weight.

In the figure below, it can be seen that walking represents around 44.5% of all stages. Of course, many of these stages will be linked to stages using other modes. In the figure, it can be seen at one glance that walking and car driving account for a majority of all transport stages. Public transport only amounts to 13.2% and cycling to less than 5%. This may come as a surprise to people not acquainted with Swiss transportation research, but cycling is only noticeable in the largest cities in Switzerland, and even there it is nowhere near the levels reached in the Netherlands or Denmark, which are the countries in Europe with the highest levels of cycling (Eurobarometer, 2014). This may partly be due to topology, but perhaps also to a certain degree of competition between walking and cycling, which will be covered in the general Discussion section.

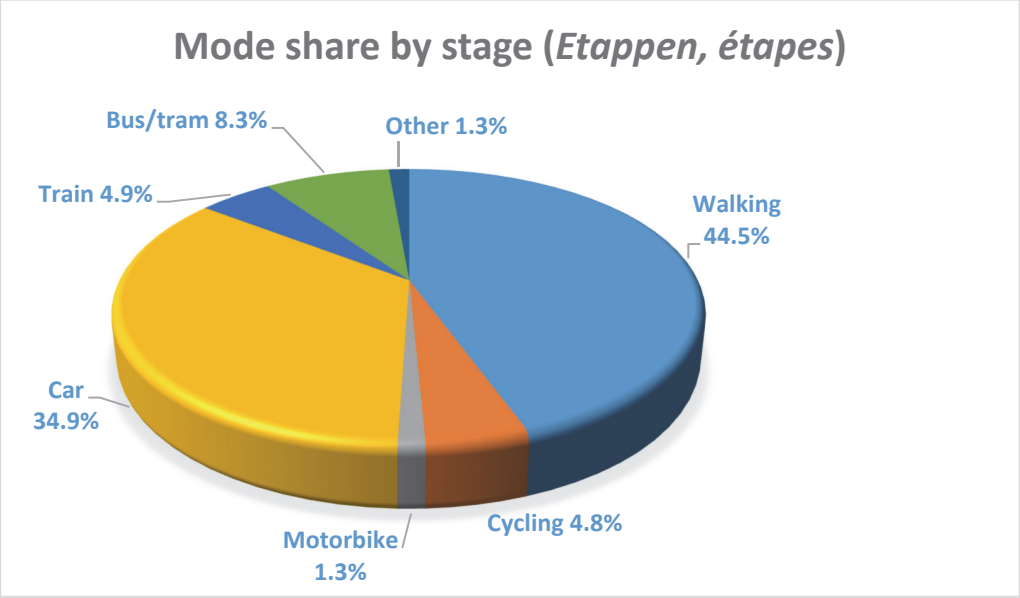

Figure 4-3. Mode share by stage (MRMT2010)

The situation regarding trips is very different from the analysis of stages, because the analysis of trips rests on the examination of the variable *hauptverkehrsmittel* (main transport mode) which as its name suggests involves discounting the walking element often included in a trip. So, if a person walks 100 metres before getting into their car, then the whole trip will register as "car".

Nevertheless, it can be seen from the figure below that walking remains at a high level in Switzerland, at over 30% of all trips. The share of cycling increases slightly, from 4.8% of stages to 6.2% of trips, while personal motorised vehicles increase their share from around 36% to around 49%. The share of public transport remains similar, around 13%.

An explanation is that almost all people who take public transport have to walk more than 25 metres to get to the bus stop or train station. So, it appears that the 14% of so of walking that disappeared between the stages and trips analyses has been distributed into a slight increase in cycling and above all an increase in the use of motorised vehicles.

It should not come as a surprise that many people need to walk more than 25 metres to get to their car. What is surprising, however, is that many people are able to use their car without having to walk in public space in order to get to it. This element will be investigated further in the section dedicated to mobility groups.

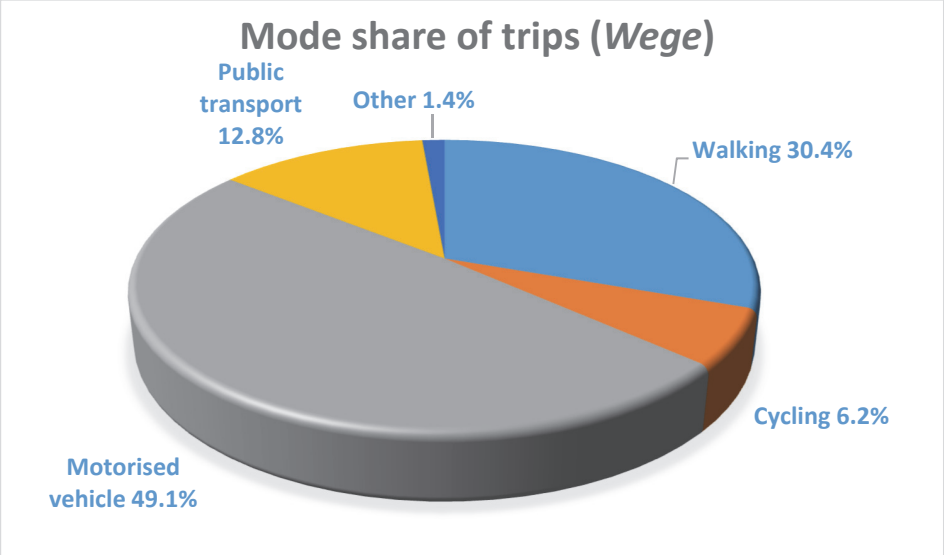

Figure 4-4. Mode share by trip (MRMT2010)

4.1.9 Distances covered in stages in 2010

When investigating total distances covered each day, it clearly makes more sense to use Stages rather than Trips. This is because a Trip done by car might contain, for example, 200 metres of walking (to the car park), 9.5 km of car driving, then a further 300 metres of walking to the final destination. If the data used were from the Trip file, then the whole trip would register as 10 km of "car" and the information about the 500 metres of walking would be lost (as well as the distance covered by car being overestimated).

However, just looking at the average Stage will give us a skewed vision of how much walking people do, because the data will contain very many small walking stages, some of them connected with other modes. For example, a typical day might involve a person walking to the tram stop in the morning, taking the tram, then walking to her office; then she might walk to a restaurant for lunch before walking back to work; then in the evening she may walk to the tram stop, take the tram and walk home; but then she may walk to the car park later in the evening to pick up her car, etc.

The table below shows the average distances for stages for each of the main transport modes. It can be seen that the average distance for walking is 900 metres. Unsurprisingly, this distance is shorter than for other modes.

On foot	Cycling	Motorbike	Car as a driver	Car as a passenger	Train	Bus/tram	Other
0.90	3.3	8.9	13.8	17.9	29.8	3.7	146

Table 4-3. Average distance per mode in km, based on stages (MRMT2010)

Although the average walking stage is around 900 metres long, this average should must not be considered a "typical" walking trip. This is because the distribution of walking distances is far from normal, as can be seen in the figure below, where it can be seen that the distribution is strongly skewed towards the left, due to a high number of very short walking stages.

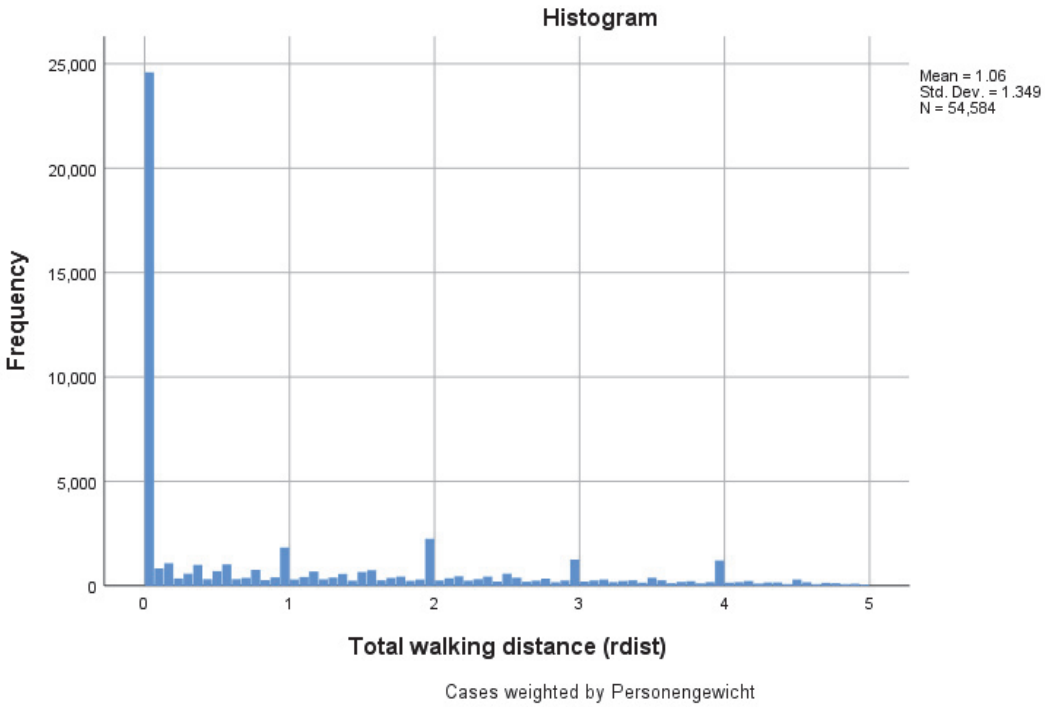

Figure 4-5. Histogram of distances walked per person per day

The histogram above (directly extracted from SPSS) shows a number of remarkable things about the distribution of walking distances in MRMT2010. First, that most people walk very little: by far the largest group is made up of people who do not walk at all. Second, there are more values measuring exactly 2.00 km, 3.00 km, 4.00 km, etc. than in-between those values. This is the effect of self-declaration and also shows the limits of modelling on a screen what people have done on the ground. Indeed, there is no reason why there should be more trips measuring 2 km than 1.7, 1.8 or 1.9 km combined. Nor should there be more walking stages weighing in at exactly 5 km rather than 3.5 or 4.5 km (which themselves are more common than 3.6 or 4.4 km). Finally, the graph shows very clearly how walking "peters out" as soon as distances go above a few kilometres. This will be analysed in detail in a later chapter on the distance-decay and time-decay of walking.

4.2 Where people walk

Information in this section was presented at the Conference "Mountains of Our Future Earth", which took place in Perth, Scotland, in October 2015 (Christie et al., 2015c).

The objective of this part of our research was to investigate whether walking was more common in cities or in Alpine resorts. This was for two reasons. First, the title of the conference mentioned above required a focus on mountain settings. Second, in a previous conference, a researcher had asked us whether the high levels of walking noticed in Switzerland might be due to the presence of numerous mountain resorts. So, we decided to compare walking levels across different types of areas, as defined by the Swiss statistical office.

The main result of this analysis was that walking was about as popular in alpine resorts as in city centres, with an average of 2.3-2.5 km per person and per day. Levels in these two areas were higher than in suburbs, outer suburbs and rural areas (all around 2 km). Intriguingly, we found that people living in alpine resorts drive individual motorised vehicles much more and use public transport much less (around 3 times less) than people living in cities. So mountain and urban areas display similarly high levels of walking but are very different regarding the use of other modes.

4.2.1 Given reasons for walking

Part of the information in this section was published as a book chapter in the *Routledge International Handbook of Walking* (Christie et al., 2018).

As can be seen in the table below, the given reasons for walking are mostly not related to leisure, which accounts for less than one-quarter of all walking trips. However, returning home is an important given reason, also accounting for almost one-quarter of all walking trips, and it is possible that some of those returning trips might be counted as leisure (either returning from a leisure trip or leisure destination, or deliberately extending a return home in order to benefit from a more pleasant route). Nevertheless, the general message is clear: most walking trips are related to getting somewhere (22%) or to accessing another travel mode (28%).

In response to a question asked by one of the editors of the *Routledge International Handbook of Walking*, we investigated the relative importance of dog walking. We found that it corresponds to 7% of all walking trips and around 31% of leisure walking trips. We used the MRMT2010 item “Non-sport outdoor activity (e.g. walking with the dog)” these may even be overestimations (Christie et al., 2018). In a nutshell, walking in Switzerland is to a very great extent urban and not leisure-motivated.

	Access another mode	Commute to work	Commute to study	To shop	To access services	Return home	Leisure	Other
% of walking trips	28.0	8.1	4.5	8.9	3.1	22.4	22.6	2.4

Table 4-4. Given motives for walking trips (MRMT2010)

4.2.2 Focussing on conurbations

This thesis focuses on the conurbations of Lausanne and Geneva. It is therefore interesting to compare the mode share of walking in these two urban areas to the shares in the three other large urban areas in Switzerland (see table below).

Conurbation	Men	Women	All
Zürich	28%	33%	30%
Genève	34%	40%	37%
Basel	29%	35%	32%
Bern	29%	34%	32%
Lausanne	28%	34%	31%
Average 5 conurbations	30%	35%	32%

Table 4-5. Mode shares for walking trips in 5 Swiss cities (MRMT2010)

From the table above, it can be seen that Lausanne and Geneva have shares of walking trips that are comparable to Basel, Bern or Zürich. This is an important finding, because many believe that people in French-speaking Switzerland walk less than in the German-speaking part of the country. A word of caution, however: levels of public transport use and cycling are higher in the three Swiss-German cities than in Lausanne or Geneva.

Interestingly, levels of walking are slightly higher in Geneva than in Lausanne. This may be due to more efficient public transportation in Lausanne, with two metro lines, against a dense but slow network of buses and trams in Geneva. Also, levels of cycling are extremely low in Lausanne (< 1% of all trips) due to its very hilly topography (the 4 other main cities are relatively flat, by Swiss standards).

Another interesting comparison is the choice of walking when a car may be available as an alternative. The following table shows the mode shares of walking trips, in relation to availability of a car.

Conurbation	Car always available	Car available after discussion	No car available	Average
Zürich	23%	29%	37%	25%
Genève	29%	39%	55%	32%
Basel	25%	32%	44%	28%
Bern	26%	31%	37%	28%
Lausanne	23%	33%	49%	26%
Average	25%	31%	44%	27%

Table 4-6. Mode shares of walking trips in relation to car availability (MRMT2010)

It can be seen in the table above that, more than a difference between conurbations, it is access to a car that is associated with the likelihood of walking. There is a clear dose-response relationship between “Car always available” (25% mode share of walking”) and “No car available” (44%) with “Car available after discussion” occupying an intermediate position.

In epidemiology, a *dose-response relationship* can be viewed as evidence for causality (Hill, 1965; Mente et al., 2009). In this instance, it is likely that arrangements for having access to a car were made before selecting a transport mode for a particular trip, thus adding *temporality* – another criterion of causality. However, relationships between variables that may or may not be explained by causation are complex, as shows a recent investigation of the influence that health may have on residential location, or vice-versa (Duncan et al., 2014). Therefore, we would err on the side of caution: association does not imply causation. People tend to walk less if they have access to a car, but do not necessarily walk less on a given day *because* they have access to a car. Indeed, they may have access to a car *because* they would rather not walk.

Walking is concentrated not only in urban areas but *within* urban areas, i.e. central areas have more walking. For the illustrations underneath, we are indebted to our colleague Sébastien Munafò, who plotted walking stages in the 5 largest conurbations in Switzerland. The illustration uses straight lines, so the objective is not to see exactly through which neighbourhoods people are walking. Darker areas correspond to places where more walking takes place, lighter areas to those where there is less walking. For ease of reference, larger versions of these maps can be seen in the Appendix.

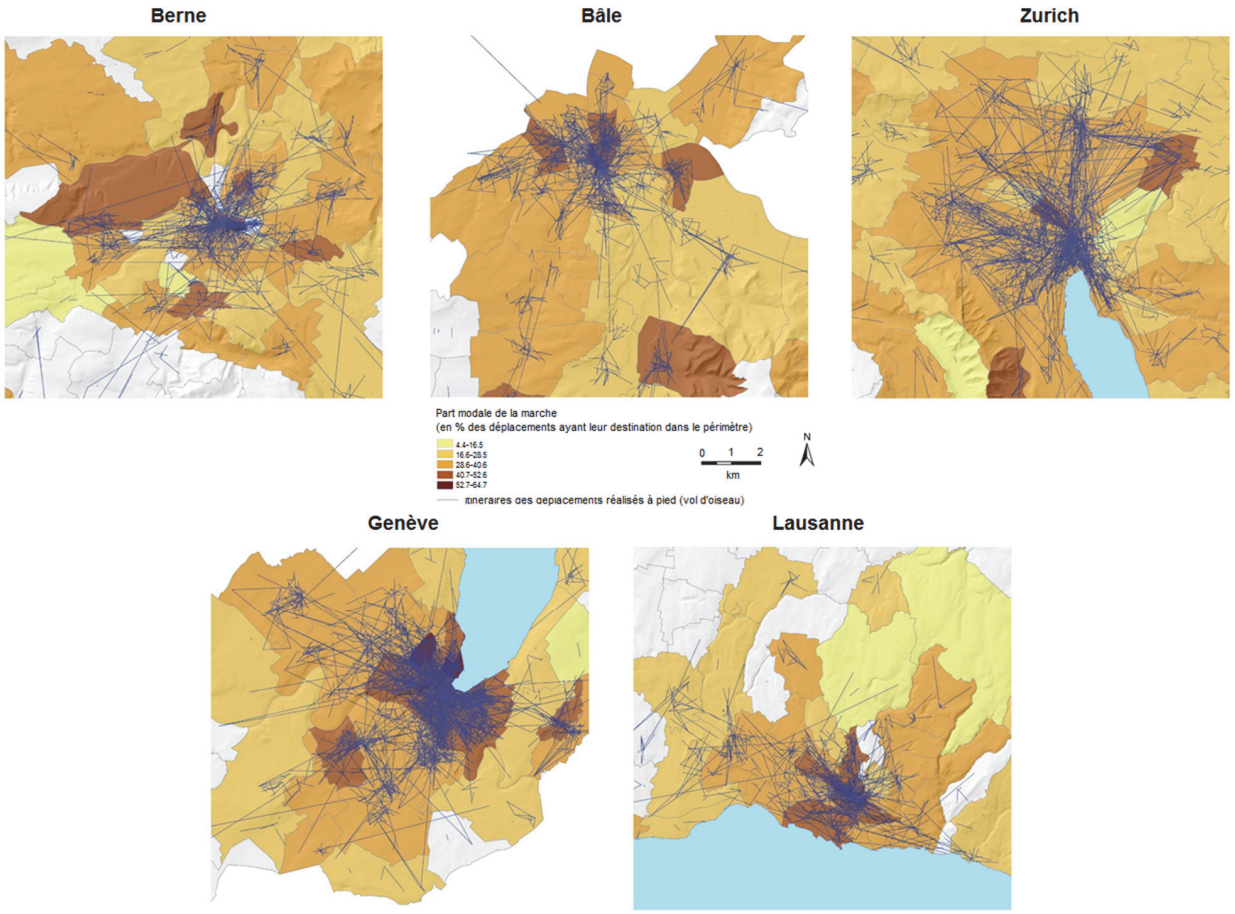

Figure 4-6. Walking stages in 5 Swiss cities (MRMT2010). Courtesy: S. Munafò (published in: Ravalet et al., 2014).

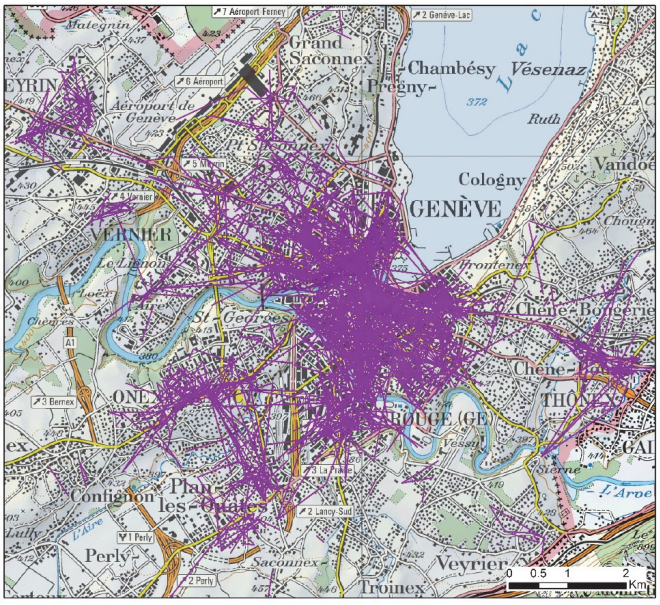

Figure 4-7. Walking bouts in Geneva (MRMT2010). Courtesy: S. Munafò

The concentration of walking in central Geneva is highly relevant, because air pollution levels remain hazardous in that area. In order to demonstrate that this is the case, we obtained maps from the canton of Geneva authorities for 2010 (year of the MRMT2010 data collection) and 2016 (the most recent available). In the maps below, darker colours correspond to the more heavily polluted areas.

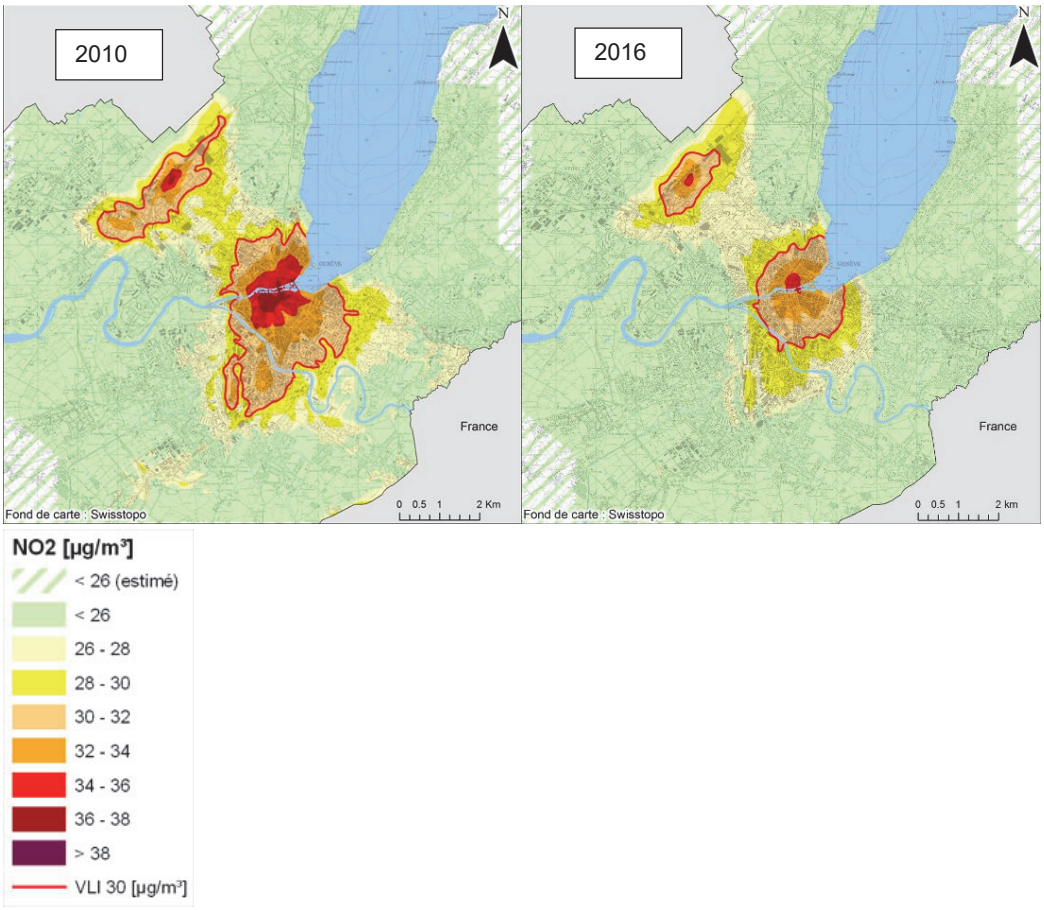

Figure 4-8. Air pollution level (NO^2 annual average) in Geneva for 2010 and 2016. Credit: canton GE, modified
The red contour line (VLI) corresponds to 30 micrograms per cubic metre of NO^2, an annual average level that should not be breached according to Swiss federal legislation.

As can be seen in the maps above, the situation has improved between 2010 and 2016, however the levels remain hazardous in central Geneva where a lot of the walking gets done. In fact, the highest levels in 2016 correspond to the area between the train station and the city centre, where a lot of walking is done because this is the access to the (pedestrian) footbridges crossing the Rhône. It is remarkable that people wanting to use public transport to access the city centre on foot should be exposed to the highest level of pollution in the region (the second most polluted area, to the northwest of the city centre, corresponds to the airport).

4.2.3 Focussing on individuals

Part of this research has been presented at the Swiss Transport Research Conference (STRC) on two successive years (Christie et al., 2015d; Ravalet et al., 2014).

Mode shares are interesting in their own right. They form the basis of many analyses and decisions in transportation research. However, they have drawbacks. For example, they focus on the number of trips and not their length or duration. Furthermore, the fact that two trips may have been done by the same person or by two different people is of paramount importance for our research project.

Focussing on individuals while looking at quantitative data is rare in the transportation literature: often, while much is known about the proportion of trips done with different modes, little is known about the people who have done them. This is surprising because it is clearly not the same if, say 5 trips were done by a single person while 4 people stayed at home or if the 5 trips were done by 5 different people. One of the reasons for this lack of information in the international literature may be linked to technical difficulties. In the case of MRMT2010, as mentioned previously the information on walking is in a different database from the information on personal characteristics, so is not accessible to researchers who do not have full access to the baseline data. As we will see, the combination of both levels of information brings considerable insights.

When shifting from mode shares to the distribution of walking per person, the change of perspective is considerable. The first thing we noticed is that the distribution of walking in the Swiss population is not a normal distribution at all. Total walking distance per person and per day displayed a mean of 2.10 km and a median of 800 metres. The standard deviation was very high (3.39) as well as its skewness and kurtosis. This can best be visualised using a histogram, where we regrouped distances walked per person as follows: zero corresponds to <1 km; 1 corresponds to between 1 and 2 km; 2 corresponds to between 2 and 3 km; etc.

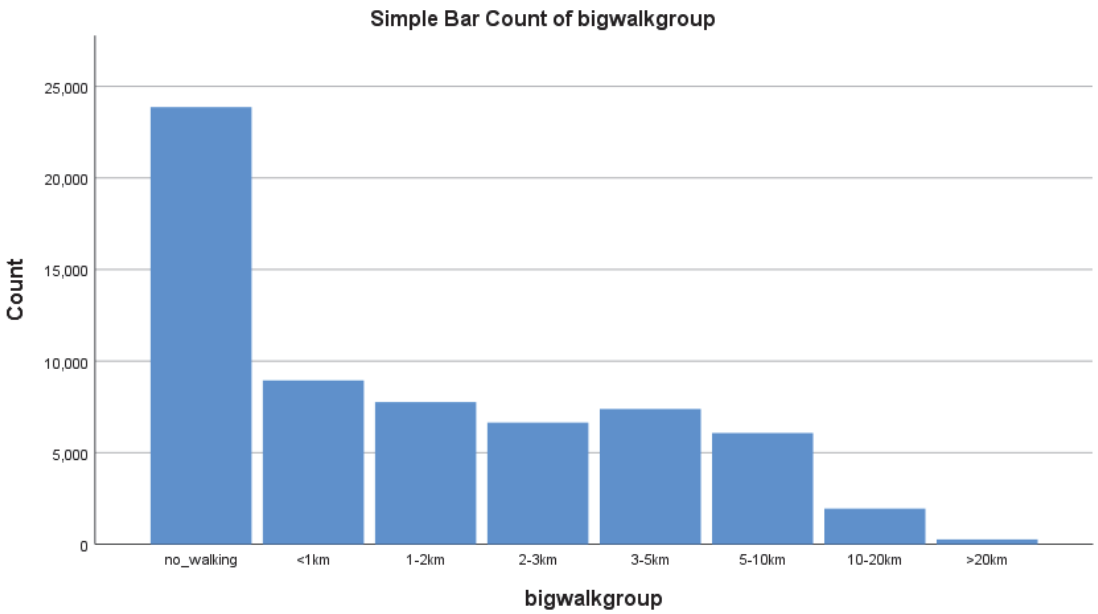

Figure 4-9. Bar chart showing total walking per person per day, in km (MRMT2010)

4.3 Defining potential frequent walkers

As explained in the general Introduction to this thesis, we have defined frequent walkers as walking 5 km or more on most days of the week. In order to adapt this criterion to the single-day status of MRMT2010, we define *great walkers* (some of whom should be potential frequent walkers) as being those who walked between 5 and 20 km on the reference day.

The highest amount of walking declared in MRMT2010 was 64 km (for the whole of the reference day), while the longest single walking bout was 60 km. It was difficult to decide which of the walkers should be considered to be extreme walkers or potential outliers. One approach might have been to exclude the top 1% (those declaring most walking) but this would have implied an upper limit of around 15 km per day, which seems objectively low. So the upper limit for 99.9% of the sample was sought. Here, the limit was 29.91 km. After consulting the scientific and sports literature, it was decided to set a cap (upper limit) of 30 km per day. This approach left a total of N = 62817 people in the dataset, implying that only 51 individuals were thus excluded from the analysis. After careful consideration, we nevertheless dropped this upper limit down to 20 km, because the difference between the two limits (20 km and 30 km) was not very great. Especially, we thought our statistical corpus of frequent walkers would be more coherent if it were not influenced by extreme values.

Conditions in MRMT2010	Potential frequent walkers		Not frequent walkers	
N = 62868	n	%	n	%
Walked more than 5 km	7496	11.92	55372	88.08
Walked at least 5 km	8284	13.18	54584	86.82
Walked more than 30 km	51	0.081	62817	99.92
Walked at least 5 km but no more than 30 km	8233	13.10	54635	86.90
Walked between 5 and 20 km	8018	12.8	54850	87.25

Table 4-7. Choice of criteria for potential frequent walkers (MRMT2010)

Using the operational definition for frequent walkers as having walked at least 5 km but no more than 20 km on the reference day gave us a dichotomous variable: whether the person was or not a great walker. The table below gives the results under the assumption that there is no correlation between walking behaviours in the same person on different days of the same week.

Frequent walkers	Walked 5-20 km on reference day
Number in database	8018
Extrapolated to number in Switzerland	1.003 million
Proportion of population	12.8%
Mean km walked on ref day	8.05 km
Standard deviation	3.08 km
Median km walked	7 km
Minimum	5 km
Maximum	20 km

Table 4-8. Great walkers in MRMT2010

Underneath, the histogram of walking distance for great walkers only is cut off at the 5 km level because that is our entry criterion for this category of walkers. Similar to the histogram shown previously for general walking stages, we can notice higher levels around precise values, such as: 8 km, 9 km, 10 km, 12 km, 15 km, etc.

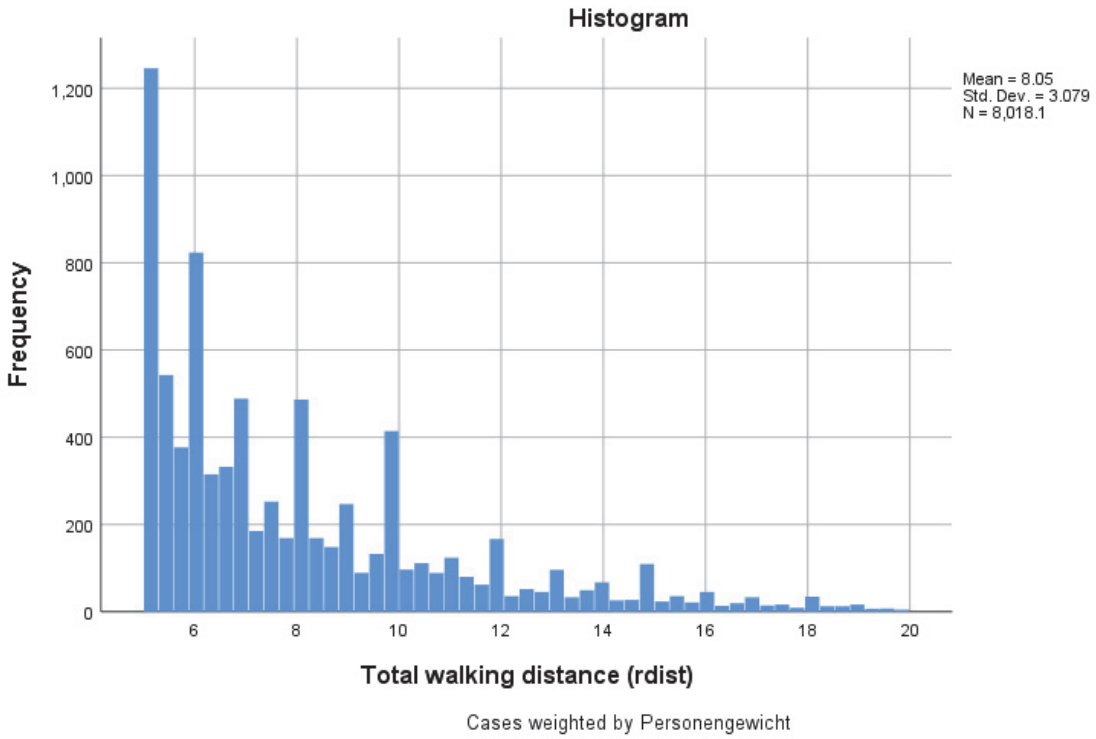

Figure 4-10. Histogram of walking distances among potential frequent walkers (MRMT2010)

Seeking to define great walkers, gender was one of the first categories examined. We found that 13.3% of women can be considered great walkers, against only 12.2% of men. Age hardly has an effect at all, with all age brackets registering between 12% and 13.8% of great walkers. The age category with the highest proportion of great walkers was aged 50-64 years.

In order to get an idea of the distribution of great walkers (potential frequent walkers, in our view) in Switzerland, we investigated where they were living, compared to people who were not great walkers. We found that the cantons with the highest proportions of great walkers were mainly small rural cantons in the German-speaking part of the country. Appenzell (Innere Rhoden) came first with 25.5%. Glarus was a close second at 22.3%, followed by Uri (16.6%) and Zug (16.1%).

This result prompted us to look at linguistic regions, where we found a high prevalence of great walkers of 18.4% in the reto-romantsch part of the country, which is mainly mountainous and rural. The German-speaking part was also over average, at 13.3%, with the other two regions being two percentage points lower (11.4% for the French-speaking area and 11.2% for the Italian-speaking area).

When we looked at the 50 officially registered conurbations in Switzerland (some of them quite small), we found a complex picture. Conurbations with more than 15% great walkers were mainly German-speaking and either central (Bern, Grenchen) or

south-eastern (St-Gallen, Chur). Tourist centres Interlaken and Luzern came in with 14.7% each (the same value as Basel).

The main cities (other than Basel) tended to have average values: 13.8% for Zurich, 13.5% for Bern, 13.3% for Geneva, but only 11.5% for Lausanne which was the only large conurbation to fall under the national average of 12.8%. Conurbations with less than 10% levels of great walkers tended to be in southern or eastern regions. In Ticino, Chiasso-Mendrisio and Bellinzona had less than 10%, but Locarno or Lugano had higher levels. Some of the lowest values were found to the north-east of the country, near Lake Constance, with Buchs (SG), Kreuzlingen and Romanshorn all clocking in under 10%. In the Valais, French-speaking Sion and Monthey-Aigle were also under 10%, while German-speaking Brig-Visp boasted a solid 15.1%. Finally, the category "not in a conurbation" registered a low score: 11.1%.

Type of region of residence	Walked 5-20 km	Count	In total pop. CH
City centre (centre of a conurbation)	15.2%	2695	337'349
Other communes in central part of the conurbation	12.6%	1116	139'652
Other communes in a conurbation (but not in its centre)	12.0%	2356	294'922
Isolated town	13.8%	73	9080
Peri-urban rural communities	10.7%	1446	180'988
Alpine resorts	14.3%	65	8109
Peripheral rural communities	12.8%	269	33'639
Total	12.8%	8020	1'003'739

Table 4-9. Where great walkers live (MRMT2010)

The figure above shows that great walkers are over-represented in city centres, isolated towns and Alpine resorts, and tend to be under-represented in rural areas. In absolute numbers, the situation is more remarkable since far more people live in conurbations (using the definitions of the Swiss statistical office) than in rural areas. As seen before, there are around 1 million great walkers in Switzerland (numbers differ slightly between tables due to missing values and rounding). Around 77% of them live in urban areas. This may seem a lot, but in Switzerland 73.5% of the population live in conurbations (this statistic was derived from the same MRMT2010 dataset, for the sake of comparability).

4.3.1 Comparing great walkers with other mobility groups

As we have seen, comparing great walkers to the rest of the population brings some interesting insights. It is also intriguing to see how this sub-population compares to other mobility groups. In this section, we compare frequent walkers to other groups that we have defined ourselves: people who stayed at home on the reference day, those who cycled without any walking, those who drove a motorised vehicle without

walking, and little and medium walkers (respectively under 2 km and between 2 and 5 km). Less significant groups, in terms of numbers, are extreme walkers (> 20 km walking) and those who did not walk, cycle or drive but managed to travel anyway. This mixed group contained people who managed to take a bus that stopped in front of their house (<25 metres distance) and in front of where they wanted to go, or used unusual forms of locomotion. In the following tables they are amalgamated with people who stayed at home for the sake of simplicity.

Mobility group (behaviour on ref. day)	Number of people in MRMT 2010 (weighted)	Approx. number in Switzerland	Percent
Stayed at home	6885	862'000	11.5
Cycled, did not walk	1650	207'000	4.0
Non-walking drivers (car or motorcycle)	14965	1'873'000	22.5
Little walkers < 2 km	16702	2'091'000	26.6
Medium walkers 2-5 km	14016	1'755'00	22.3
Great walkers 5-20 km	8018	1'004'000	12.8
Extreme walkers (walk > 20km)	266	33'000	0.4
Travelled, but did not walk, cycle or drive	367	46'000	0.6
Total	62868	7'870'000	100

Table 4-10. Groups based on behaviour on the reference day (MRMT2010)

The table above shows the values found using MRMT2010 data. We believe that such comparisons between groups are important, because just comparing great walkers to the general population implies lumping together people who may expend even more energy in their daily mobility (cyclists), people who stayed at home and those who drove without walking, all in the same control group. Proof that this distinction between groups makes sense is in the considerable between-group variation of the self-declared body-mass index (BMI), as we realised when we presented our research at the Swiss Public Health Conference in 2015 (see next section).

To compare the mobility groups with each other, we looked at mean and median age. We are dropping standard deviation and other measures for the sake of readability – it can be inferred that SD is high if the mean and median are far from each other.

Mobility group	Mean age	Percent male	Percent female	Percent married	Percent not married
Did not walk, cycle or drive	50.9	40.3	59.7	49.4	50.6
Cycled but did not walk	36.9	59.2	40.8	42.5	57.5
Drove car or scooter, did not walk	44.3	56.6	43.4	56.4	43.6
Small walkers < 2 km	41.6	48.4	51.6	44.6	55.4
Medium walkers 2-5 km	40.9	45.8	54.2	41.8	58.2
Great walkers 5-20 km	43.4	46.8	53.2	46.5	53.5
Extreme walkers >20km walk	45.2	60.1	39.9	49.2	50.8
Total	43.2	49.0	51.0	47.3	52.7

Table 4-11. Basic characteristics of mobility groups (MRMT2010)

Potential frequent walkers (described as great walkers here) tend to be a bit older than people in other groups, except for people who stayed at home who were older and those who cycled who were younger. Regarding gender, it is interesting to note that women are more likely to stay at home during the reference day. Great walkers are slightly more likely to be female (around 53% are women), although extreme walkers (> 20 km of walking on the reference day) are more likely to be male.

To investigate the civil status of the participants, we simplified matters by comparing "married" to all the other categories. This is because "married" was by far the most common category, and people in registered partnerships amounted to less than 1% of the whole sample. The other categories in MRMT2010 were: single, widowed, separated, legally separated, and in a terminated registered partnership – i.e. they could be united under the single heading "not married". Great walkers were only slightly more likely to be married than single. The more interesting element is that all 4 categories of walkers had more single than married members. The opposite was true for non-walking drivers.

Mobility group	Driver's licence* (car)	Driver's licence* (motorbike)	Car or motorbike licence*	Public transport pass (any)
Did not walk, cycle or drive	57.0%	19.6%	57.4%	47.1%
Cycled but did not walk	63.4%	27.9%	63.7%	59.9%
Drove car or scooter, did not walk	87.2%	35.9%	87.6%	39.7%
Small walkers < 2 km	68.2%	24.9%	68.5%	58.3%
Medium walkers 2-5 km	62.1%	20.8%	62.4	67.2%
Great walkers 5-20 km	69.6%	26.4%	70.0	65.6%
Extreme walkers (>20km walk)	73.2%	34.6%	73.8	64.0%
Total	80.8%	30.3%	81.1%	55.8%

Table 4-12. Mobility groups: driving license or public transport pass (MRMT2010)
(*if 18+ years old)

Regarding the choice that people may or may not have to walk or use another transportation mode, we investigated who had a relevant driver's licence and who had a public transport pass. In our table above, people under 18 years of age are not taken into account regarding driving licences, but they are when considering public transport passes. Of interest is the fact that adding the substantial proportion of motorcycle drivers to the car drivers makes a very small difference, i.e. almost all motorcycle drivers also have a car driver's licence. Only 70% of great walkers have a driving license, which is 11 percentage points under the population average for adults.

Regarding public transport passes, we amalgamated the many different varieties listed in MRMT2010 into a single metric. Around half to three-quarters of the sample had at least one of these passes, the value being highest for medium and great walkers and lowest for non-walking drivers. Great walkers often had at least one of these passes. We also ascertained that holders of any public transportation pass walked on average 2.4 km per day, against 1.6 km per day for people with no such pass. The fact that having a such as pass is associated with walking 800 metres more per day may be of interest to public health researchers, and will be discussed in the Conclusion of this thesis.

4.3.2 Availability of a car

The availability of a car did not seem to be particularly relevant to being a great walker: as can be seen in the table below, less than 10% of them could not access a car. This is an important result because it shows that frequent walking is unlikely to be linked to lack of access to a car, and opens up a whole range of other possible reasons why some people walk so much – a question that will be investigated in the Qualitative section of this thesis.

Mobility group	Always available	Available on condition	Not available
Did not walk, cycle or drive	76.2%	16.3%	7.5%
Cycled but did not walk	65.5%	27.4%	7.1%
Drove car or scooter, did not walk	90.5%	8.2%	1.3%
Small walkers < 2 km	77.0%	17.4%	5.6%
Medium walkers 2-5 km	70.0%	21.6%	8.4%
Great walkers 5-20 km	71.5%	21.5%	7.0%
Extreme walkers (>20km walk)	75.7%	18.0%	6.3%
Total	78.2%	16.4%	3.7%

Table 4-13. Mobility groups relative to availability of a car (MRMT2010)

4.3.3 Travel complexity

In the light of our project hypotheses, it is important for us to know whether the travel behaviour of potential frequent walkers – on the reference day – is more complex than the behaviour of other groups. We use the median rather than the mean in order to smooth out the effect of air travel.

Mobility group	Total distance (km routing) incl. abroad	Number of stages (Etappen)*	Number of trips (Wege)*	Minutes in travel*
Did not walk, cycle or drive	0	0	0	0
Cycled but did not walk	11.0	4	4	50
Drove car or scooter, did not walk	33.5	3	3	60
Small walkers < 2 km	19.0	6	4	62
Medium walkers 2-5 km	16.8	6	4	95
Great walkers 5-20 km	20.5	6	4	146
Extreme walkers (>20km walk)	39.7	4	3	282
Total	49.1	4	3	92

Table 4-14. Total travel times, stages, trips and time in transport (MRMT2010)

The last column in the table above shows to what extent great walkers spend more time in transport than other people (only extreme walkers spend even more time). It is interesting to see that the car drivers and small walkers verify the Zahavi conjecture that suggests historical stability in travel times but not necessarily distances (Zahavi & Talvitie, 1980). Indeed, their daily average for all forms of transport is around one hour. However, the effect of walking can be seen in the progression from one hour (small walkers) to one-and-a-half (medium walkers) and up to the two hours or so clocked up by great walkers. It should be mentioned that these statistics include waiting times so may be slightly different from what is reported elsewhere.

In the table above, it can be seen that the three groups of walkers have more complex travel programmes than other groups, with a median of 6 stages against 3 or 4 for the other groups. This demonstrates the multimodality of the three main groups of walkers, all the more so that the number of trips (*Wege*) is not much greater than in other groups, i.e. a higher number of stages are integrated into a similar number of trips. This is perhaps easier to understand using an example.

A typical person has 3-4 trips in a day, say one to go from home to work, one at lunch time (an average of 0 or 2 trips on any given day), one to go back home, and another one or two in the evening (an average of 0 and 2 on any given evening, 0 being more frequent in this case). For a cyclist or car driver, the number of stages is similar to the number of trips, because essentially each trip uses a single mode. For walkers, it can be seen that each trip requires around 1.5 stages.

As we have seen, great walker status comes with an increase in all-mode travel time. It also comes with a relatively high average distance, as can be seen in the table below. However, because the general average (including travel abroad and therefore also air transportation) is at around 49 km per day, frequent walkers are slightly below this limit with around 46 km per day.

Mobility group	Walking and cycling (inland, km)	Motorised vehicles (inland, km)	Public transport (inland, km)	Other transport modes (inland, km)	Total transport (inland and abroad, km)
Did not walk, cycle or drive	0	0	0.31	0.84	9.3
Cycled but did not walk	10.3	12.2	0.77	0.57	24.7
Drove car or scooter, did not walk	0	52.0	0.50	1.10	71.8
Small walkers < 2 km	1.57	25.2	9.54	0.93	57.4
Medium walkers 2-5 km	3.57	15.2	16.7	0.72	42.2
Great walkers 5-20 km	8.53	15.8	16.4	0.92	46.4
Extreme walkers (>20km)	26.5	21.7	17.0	0.93	73.4
Total	2.82	24.35	8.59	0.89	49.1

Table 4-15. Mean distance on reference day, per mode and mobility group (MRMT2010)

It can be seen from the table above that more walking is associated with less driving, but the cut-off point is not where it might be expected to be. In fact, the use of private motorised vehicles and of public transport is almost the same in medium and great walkers. The main difference seems to lie in between small walkers (who drive around 25 km per day and use little public transport) and the combined group of

medium and great walkers (who drive around 15 km per day and use much more public transport). The last column summarises not only the 4 other columns (which could only be estimated for trips within Switzerland) but also any travel abroad. All in all, great walkers are almost as mobile – in kilometres – as the population average, and take a lot more time to do it.

4.3.4 Proportion of frequent walkers in the population

The proportion of frequent walkers on a given day of the week can be estimated from MRMT2010 data for different days of the week. The differences are not very high, ranging from 11.7% on Mondays and Wednesdays to around 13% on Fridays and Saturdays. Only Sundays stick out from the crowd, with over 15%. The chances of walking 5 km or more on most days of the week cannot be derived directly from these data because we have only one day's worth of data per person. However, if we admit a fair number of assumptions, we can obtain an approximation of the minimum value.

The first assumption is that the sample is essentially the same – i.e. representative of the general population of Switzerland – on each day of the week. The second assumption is that there is no statistical link between behaviour on one day of the week and behaviour on another day of the same week. We know that this is not true, however the literature clearly states that the correlation is a positive one. Therefore, our calculation should yield a lower threshold for the estimated prevalence of frequent walkers in the population.

So, we calculated the probability of a person walking at least 5 km on most days of the week, as a combination of R walking days among N total days, R being 4, 5, 6 or 7 and N being 7 (the number of days in a week). Our result was 0.68%. If people who walk on one day of the week are two or three times as likely to walk on another day in the same week, this value is likely to be a lot higher. Since day-to-day travel behaviour is positively correlated, it is safe to say that 0.68% represents a minimum value for the proportion of frequent walkers in Switzerland, i.e. it is unlikely for their true proportion to be much lower than 0.68% of the total population. At the other end of the spectrum, their proportion cannot possibly exceed 12-13%, since this is the proportion of "great walkers". So, we can estimate that the true proportion of frequent walkers in Switzerland lies somewhere between 0.7% and 12.8%.

4.3.5 Association of variables with great walker status

The next step was to investigate which variables might be associated with great walker status. This was done using the following explanatory variables: gender, age, education level, employment status, household revenue (adjusted for type of

household), residential structure, and whether the person had access to a car and/or a public transport pass. Because the information in the MRMT2010 is extremely detailed, it was necessary to select one among several metrics for each of these types of variables. Then it was usually necessary to either regroup or split the numbers of categories so that each did not have more than 5 values. The selected variables and their values are shown in the table below (first two columns), together with the results of the logistic regression (last three columns).

We then carried out the logistic regression, using the "ENTER" procedure on SPSS, which compares each value to a reference value. By default, SPSS considers the last category of each variable to be the reference. For example, regarding age, all other values would have been compared to "65+". This is not necessarily the best option. Opinions on the matter vary, but it is often considered better to choose either the middle value or the most represented value. After careful consideration of several options, we decided to select the middle value for age, education level and household revenue, but the most common values for most of the other variables.

Variable	Values	B	S.E.	Exp(B)
Gender	Man	-0.096	0.04	0.908 *
	Woman (Ref)			
Age	< 20 years	-0.688	0.207	0.502 ***
	20-34	-0.073	0.055	0.930
	35-49 (Ref)			
	50-64	0.141	0.052	1.152 **
	65+	-0.015	0.101	0.985
Education level	Compulsory education	-0.153	0.089	0.858
	Secondary/apprenticeship (Ref)			
	Higher education	0.131	0.043	1.140 **
Employment status	Working (Ref)			
	Student/apprentice	0.254	0.111	1.289 *
	Unemployed	0.140	0.154	1.150
	Not in employment	0.119	0.096	1.126
	Retired	0.453	0.094	1.573 ***
Household revenue	Low income	-0.143	0.065	0.867 *
	Middle income (Ref)			
	High income	0.079	0.044	1.082
Residential structure	City centre	0.247	0.055	1.280 ***
	Suburban	0.035	0.052	1.036
	Isolated town	0.338	0.209	1.402
	Countryside (Ref)			
Car availability	Always	-0.278	0.074	0.757 ***
	Sometimes	0.101	0.078	1.107
	Never (Ref)			
Public transport pass	Yes	0.418	0.084	1.520 ***
	No (Ref)			
Constant		-2.182	0.123	0.113 ***

Table 4-16. Logistic regression with great walker status as the explanatory variable (MRMT2010)

*: $p < 0.05$
**: $p < 0.01$
***: $p > 0.001$
The complete model is highly significant (chi-square = 298.2 with 19 degrees of freedom, $p < 0.001$).

In the table above, women are the reference value and men are compared to them, resulting in a negative value for B and an Odds Ratio, expressed as Exp(B), lower than 1. This means that men are less likely than women to be great walkers. Regarding age, we chose the middle value (35-49 years) as the reference, so all other categories are compared to that value. The result is that people aged less than 20 or over 65 are less likely to be great walkers (but these results are not significant), whereas people aged 50-64 are significantly more likely to be great walkers. Likewise, people with higher education are more likely to be great walkers than those with secondary or apprenticeship-level education. Students, apprentices and retired people are more likely to be great walkers than people who are in regular employment, who are the reference value for this variable. However, people who are

unemployed (i.e. receiving unemployment benefits) or not in employment are no more likely to be great walkers than the reference value.

As can be seen in the table and in the box below, there is a significant association between frequent walker status and all 8 investigated variables, and the general model is valid at a high level of significance ($p<0.001$). Although this is a broad-brushed picture, these results suggest that great walkers are more likely to be female, between 50 and 64 years old, more educated, urban, without easy access to a car, professionally active, and public transport pass holders with relatively comfortable earnings.

It is possible to use the odds ratio (or its inverse value) to quantify differences between categories. Thus, we see that women are about 10% more likely than men to be great walkers. But the largest differences can be seen elsewhere. Students or apprentices are almost 29% more likely to be great walkers than people in regular employment – and this value climbs to 57% for people who are retired. This is all the more remarkable that the unemployed and people not in employment are at the same level as those in employment, as regards great walker status.

Compared to living in the countryside, living in a city centre makes it 28% more likely to be a great walker. This difference is not reflected in suburban settings, which have a proportion of great walkers similar to the countryside.

Not having access to a car makes it 32% more likely to be a great walker, compared to those who have easy access to a car. Interestingly, having partial access to a car (after discussion or on demand) seems to exert no effect: this category has levels of great walkers similar to those with no access to a car. Finally, having a public transport pass (of any type) is strongly and positively associated with being a great walker: +52%.

It is important to note that these often strong associations between variables do not imply causality. Based on these results, it is impossible to say whether walking leads to public transport use, or the other way round, or whether both behavioural choices result from another set of reasons or variables.

Likewise, it is tempting to believe that having one's own dedicated vehicle is a major impediment to becoming a great walker. But it might be that great walkers tend to give up their cars or that both behaviours are linked to other causes. There are many ideas that might emerge from the analysis of such a table. Sadly, it is not possible to compare these results with the literature since potential frequent walkers have never been investigated before.

4.3.6 Evolution of walking

While the analysis of MRMT2010 sought to investigate associations between variables, the objective of including other issues of MRMT is to obtain a general picture of the evolution of walking over the twenty-year period between 1994 and 2015. Due to the timing of the release of information by the Federal Statistics Office, MRMT 2015 was not available during the Quantitative phase of this PhD project. However, since these data became available in June 2017, during the write-up phase, it was decided to add some basic analyses using these data, in order to assess whether there had been any substantial shifts in the amount and/or distribution of walking and of walkers in the Swiss population.

MRMT2015 covered 57'090 people, i.e. slightly less than in 2010, due to fewer German-speaking cantons investing in increasing their numbers of respondents. In 2015, 42.2% of all stages were done using walking, slightly less than the 44.5% recorded in 2010. Only 28.5% of trips were attributable to walking, against 30.4% in 2010. Regarding distances, the average walking stage was around 900 metres long. Since the average walking stage was also 900 metres in 2010, we conclude that walking trips have not become shorter, only less frequent. At the general level, there were few changes over the 2000-2010 period, with total distances travelled inching up from 35 km in 2000 to 35.2 km in 2005. Between 2010 and 2015, the distances travelled were similar, with the all-modes average moving from 36.7 to 36.8 km. So as can be seen in the table below, the only real increases seem to have been between 1994 and 2000 (+12%), and then between 2005 and 2010 (+4%) for a global increase of around 18% between 1994 and 2015.

Regarding travel times, it can be noted that after a jump from 1994 to 2000, total travel time has remained relatively stable with even a slight decrease over 2005-2015. It follows that average speeds have crept up from 22.7 km/h in 1994 to 24.4 km/h in 2015. This corresponds to a 7.4% increase over the entire 1994-2015 period – however, almost all this increase occurred between 2005 and 2010, which witnessed a jump from 21.7 to 24.0 km/h.

The table below shows how walking times and distances evolved over the 1994-2015 period. It can be seen that mean walking times are similar in 2015 to what they were in 2000, and that mean walking distances increased very slightly over the same period. It is not known why walking seems to have increased in Switzerland from 1994 and 2005, and why it seemed to flatten out afterwards. To our knowledge, this question has not been addressed in the scientific literature.

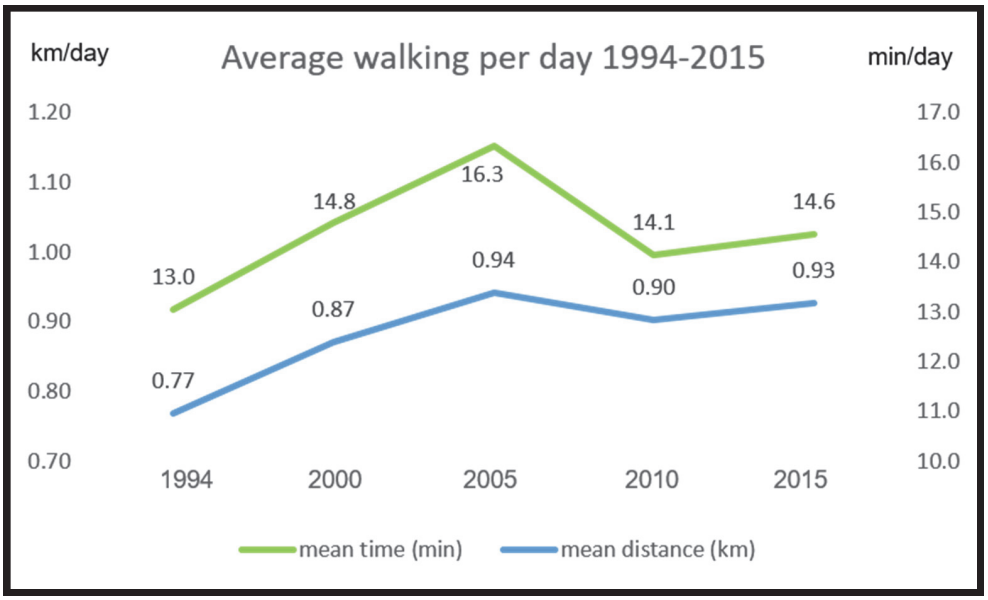

Figure 4-11. Walking times and distances 1994-2015 (MRMT)

These time series are compatible with the insight that walking increased in Switzerland over the 2000-2005 period, in parallel with increased research interest in the topic (Lavadinho, 2011). However, by comparing over a longer period we can now see that the increase between 2000 and 2005 was either short-lived or encompassed in a general stagnation of walking levels in Switzerland.

Of course, walking levels are not spread equally across the territory, neither at the level of Switzerland, nor within each city or conurbation. We have already seen that great walkers are more common in city centres (Table 4.9). Now, we will have a look to see how common they are in our study area. In order to be able to draw comparisons, we compare Geneva and Lausanne to the three other (relatively) large cities in Switzerland. By doing the analysis for the entire conurbations and for the city centres, we can show that great walkers tend to be concentrated in city centres.

	Genève	Lausanne	Bern	Basel	Zürich
Conurbation	13.3%	11.5%	15.5%	14.1%	13.8%
City	17.3%	16.1%	18.0%	15.4%	17.5%

Table 4-17. Percentage of great walkers (5-20 km) residing in 5 Swiss cities and conurbations

The table above shows that the levels of great walkers are systematically higher in cities than in the corresponding conurbations. This fits in with the notion that walking is a mainly urban lifestyle. Both Geneva and Lausanne have proportions of great walkers in their city centres that are comparable with the three largest Swiss-German cities. However, in the conurbations, Geneva and especially Lausanne have fewer great walkers than Zurich, Basel or – especially – Bern which has the highest levels all round.

4.3.7 Evolution of potential frequent walkers

We investigated to what extent the proportion of great walkers might evolve over time. So we went into MRMT2015 and separated the participants into 8 mobility groups, as we had done for MRMT2010. As can be seen from the table below, the proportion of great walkers (category 6 in the table) went down between 2010 and 2015 by around one percentage point. It is also of interest to record that the total proportion of people who walked any distance at all on the reference day (groups 4-7 in the table) went down from 61.6% in 2010 to 58.5% in 2015.

The people registered as "Travelled, but did not walk, cycle or drive" declared trips (and therefore have a travel distance greater than zero) but no walking, cycling or driving. Some of them succeeded in taking public transport without any walking > 25 metres, presumably because they have a bus stop directly in front of their home and another directly in front of where they needed to go. Others used rare forms of transportation, not covered by the 3 traditional headings (motorised and non-motorised transport, public transport).

We also investigated the proportion of potential frequent walkers using MRMT2005 data, but this was difficult because there was no routing in 2005. The only indications of distance were as-the-crow-flies, which we decided not to use because we felt it was not sufficiently relevant, and estimated distance. On balance, we decided to do the analysis for 2005 using estimated distances. With this caveat, the analysis was repeated for 2005 and 2015, thus putting the situation in 2010 into perspective.

Mobility group (behaviour on ref. day)	Percent in MRMT 2005	Percent in MRMT 2010	Percent in MRMT2015	Evolution 2005-2015	Evolution 2010-2015
1. Stayed at home	10.9	11.0	10.9	0	-0.1
2. Cycled, did not walk	3.0	2.6	3.1	+0.1	+0.5
3. Non-walking drivers (car or motorcycle)	24.7	23.8	26.5	+1.3	+2.7
4. Little walkers < 2 km	25.9	26.6	24.6	-1.3	-2.0
5. Medium walkers 2-5 km	21.3	22.3	22.1	+0.8	-0.2
6. Great walkers 5-20 km	12.9	12.8	11.7	-1.2	-1.1
7. Extreme walkers (walk > 20km)	0.6	0.4	0.4	-0.2	0
8. Travelled, but did not walk, cycle or drive	0.6	0.6	0.7	+0.1	+0.1
Total	100	100	100	0	0

Table 4-18. Evolution of mobility groups 2005-2015 (MRMT)

A quick look at the table above shows that the proportions are remarkably stable over time. People staying at home are at 11%, non-walking cyclists around 3%, non-walking drivers around 25%. The groups of walkers evolve very little, by no more than one percentage point from 5 years to the next 5 years. The reduction in little

walkers and great walkers is only partly compensated by the increase in medium walkers. Indeed, as can be seen in the table below, the total proportion of walkers on the reference day (total of groups 4-7) is substantially lower in 2015 than in 2005. It was not feasible to do the same calculations for 1994 and 2000 due to very different packaging of the base data.

For 2000 (but not for 1994) it proved possible to assemble the walking stages in the *etappen* file, thus yielding interesting time series over the 2000-2015 period. An important caveat is that distances in 2000 and 2005 rely to a certain extent on self-declaration, because routing (the interviewer visualises the trips on screen while speaking to the interviewee on the telephone) was only introduced in 2010.

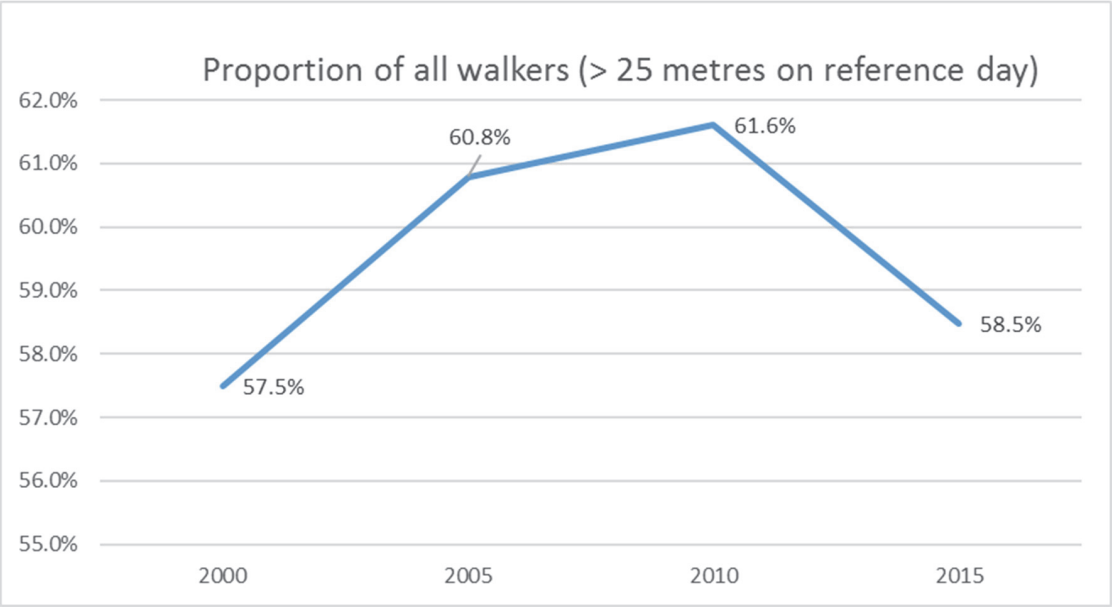

Figure 4-12. Proportion of all walkers 2000-2015 (MRMT)

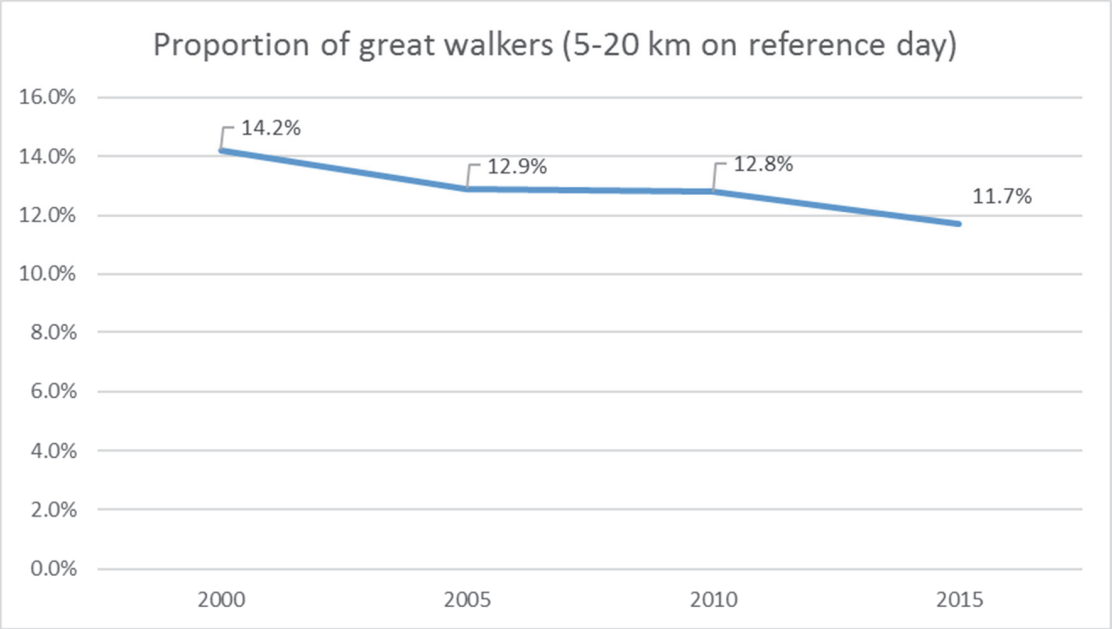

Figure 4-13. Proportion of great walkers 2000-2015 (MRMT)

In the two tables above, it is interesting to see that the reduction in the total proportion of walkers (any distance) on the reference day is paralleled by a reduction of the proportion of great walkers. However, whereas the proportion of all walkers seems to have gone up between 2005 and 2010 before going down again in 2015, the proportion of frequent walkers seems to have steadily declined, except between 2005 and 2010.

Detailed information on walking in the Geneva and Lausanne conurbations could be obtained for 2005-2010-2015, enabling us to evaluate the evolution of potential frequent walkers over ten years in the study area. In the Geneva conurbation, the proportion of great walkers fluctuated from 12.6% in 2005 to 12.4% in 2015, with a high point at 13.3% in 2010. In the Lausanne conurbation, the level stayed stable at 12.5 in 2005 and 12.7 in 2015, however 2010 was a trough rather than a peak, at only 11.5%. It is difficult to draw strong conclusions from these data, beyond the fact that fluctuations do occur and that the general level is similar to the national average across the 2005-2015 period.

4.4 Complementary analyses

This section describes several analyses that explored various quantitative aspects related to walking. The first was inspired by an article that investigated the apparent limitation of walking distances. This is important because such measures are used to estimate how far people are prepared to walk, to a bus stop for instance. The second relates to body-mass index and its relationship to walking. This section concludes

with reflections on the limitations of the quantitative data used, and on the (limited) data available via the Swiss Health Survey.

4.4.1 Distance-decay and time-decay of daily walking

This part of the PhD thesis was presented in poster form at the 2018 Conference on Active Living Research, in Banff, Canada.

With a view to understanding after how much distance or time walking ceases to be a major mode, we decided to investigate MRMT2010 data on this topic. This is something that had already been done in Canada and the USA, and the objective was also to compare Swiss data to the situation in these two countries. Such distance-decay or time-decay figures are important, because public authorities use them to assess distances between bus stops, for example.

In Switzerland, among the 66'090 identified single-mode walking episodes in the dataset, 45% were leisure-related. Mean and median values differed considerably due to negative exponential distributions. Mean values were around 550-930 metres for most types of destination; only leisure-related walks were significantly longer, at 1.8 km (overall average: 1.3 km). Mean walking time was 20 minutes, strongly influenced by leisure-related walking whose duration (33 minutes) was 2-3 times higher than for other motives. Mean walks to work took six-and-a-half minutes, over 581 metres; shopping-related walks averaged 9 minutes for 613 metres.

In Halifax, a county-sized municipality in Canada, a mean value for single-episode walking of 9 minutes for 670 metres was found (Millward et al., 2013). The 25th, 50th (median) and 75th percentiles were 3, 6 and 12 minutes, for respectively 230, 480 and 860 metres. Corresponding values in Switzerland were 5, 10 and 20 minutes, for 300, 600 and 1500 metres, respectively. Investigation of USA-wide travel survey results (Yang & Diez-Roux, 2012) yielded mean and median walking distances (all purposes combined) of respectively 1.13 km and 800 m, with mean and median durations of around 15 and 10 minutes, respectively. However, the USA data included walks originating and finishing at home, which tend to be longer.

	Switzerland	Canada	USA
Mean walk	1.3 km	670	1.13 km
Mean time	20 min	9 min	15 min
Median walk	10 min, 600 m	6 min, 480	800 m
Median time	10 min, 600 m	6 min, 480	10 min
.25	5 min, 300 m	3 min, 230 m	--
.50	10 min, 600 m	6 min, 480	--
.75	20 min, 1500 m	12 min, 860 m	--

Table 4-19. Comparison between 3 countries (MRMT2010, Millward et al. 2013, Yang & Diez-Roux 2012)

We conclude that, despite limitations linked to methodological differences between the three surveys, average walking distances and durations appear to be higher in Switzerland than in the two North American examples chosen for comparison. Despite these differences, it can be seen across all three countries that walking times and distances peter out very quickly, with the exception of walks done for leisure. Even when leisure is included, half of all walking trips are under the 500-800 metre mark and last less than 6-10 minutes. This research suggests that most walking times and distances are short at population level, especially in North America. The inclusion of leisure-related walking trips such as hiking or round trips (originating and terminating at home) in transportation data may somewhat conceal this fact. The suggested policy implications are as follows. Up to now, the global walking-promotion agenda has concentrated on increasing mode shares. This research suggests that emphasis should also be put on increasing walking times and distances, especially for non-leisure destinations.

4.4.2 Association of body-mass index with walking

This part of the research was presented at the Swiss Public Health Conference (SSPH+) in Geneva, in September 2015 (Christie et al., 2015a).

The objective of this analysis was to investigate whether body-mass index (BMI) was associated with walking in our sample. Indeed, it is remarkable that a transportation survey such as MRMT should contain data on respondents' height and weight, which allows such a calculation according to the formula BMI = weight / (height*height) in kg/m^2. Recommended BMI levels are in the range of 18.5-25 and people with a BMI over 25 are considered overweight. As can be seen in the graph below, BMI was lowest in non-walking cyclists, intermediate in walkers, and highest for people who stayed at home and non-walking drivers. Differences between groups were significant (t-test, $p<0.05$). Further analyses found that the 20% of the sample who used public transport on the reference day had a significantly lower BMI than the rest of the sample: 22.9 versus 23.8 for non-users. A significant negative correlation was found between BMI and distance travelled using public transport, and with distance travelled on foot. A significant positive correlation was found between BMI and distance travelled by car. Attempts to isolate public transport users from walkers failed because, although a significant proportion of the sample walked without taking public transport, almost none took public transport without walking. This shows to what extent public transport use and walking are related. Taken together, walkers and public transport users had a mean BMI of 23.2 against 24.3 for near-exclusive car users (defined in this case as having driven at least 10 km, with no public transport use and < 1 km of walking).

These results supply evidence that a higher BMI is associated with increased use of non-renewable energy for transportation, at population level. Because energy use is

highest for cars, intermediate for public transport (much of which is electric in Switzerland) and very low for walking, it is reasonable to posit a dose-response relationship between energy use in transport and BMI. We suggest that policy campaigns should target the population groups most likely to use mechanised modes and least likely to walk or use public transport. According to our data, these tend to be males aged 20-64 years, and especially males aged 30-39 years. Further results are shown in the figure below.

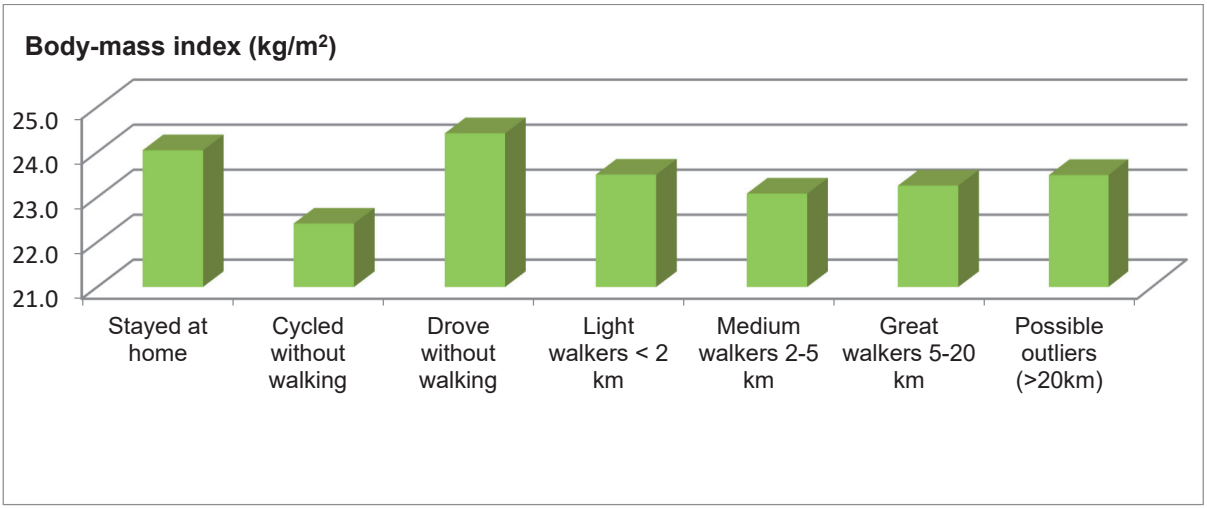

Figure 3.8. Body-mass index by mobility group (calculated using MRMT2010 data)

4.4.3 Limitations of MRMT

Although MRMT is a very powerful set of databases, it has its limitations. The most obvious is that all the answers are based on self-declaration: there is no tracking and all interviews are carried out by telephone. There may therefore be a self-selection bias, although the Swiss federal offices and their partners (most of the interviews were carried out by private agencies on mandate from offices such as the OFS/BFS) have been careful to limit these as much as possible. The response rate is in the range of 61%, which appears to be relatively high, given that it is a general population based survey. Other limitations, of a more technical nature, are that trips < 25 metres are not taken into account. Trips within buildings or facilities are not taken into account either. So a person going three times round a large shopping mall or university campus would register no movement at all. Unknown to many researchers, running, skating and skiing are also taken into account. However, we have verified that these activities account for negligible proportions in the databases. According to several authors (Spissu et al., 2009), the use of one-day data limits the ability to understand temporal variations. This is because there is an implicit assumption that transportation decisions on a given day are independent from the decisions on another day in the same week.

Specifically, single day analyses implicitly assume uniformity in activity decisions from 1 day to the next. Recent studies on multi-day travel surveys have shown that there is a relationship between behaviour on different days of the same week in a given person, although there is also significant heterogeneity (Xianyu et al., 2017).

4.4.4 Swiss Health Survey (SHS 2012)

This official Swiss-wide survey, which is considered to be at a similar level as MRMT2010, turned out to be rather disappointing for this project, because it contained very little information on mobility behaviour. We think this is surprising because many questions in the same survey sought to describe the participants' behaviour regarding nutrition and sports. We therefore extracted a limited amount of information from this survey, which we think is useful at a general level to put our results into perspective. First, the definitions used by the Swiss federal government are interesting for whoever is interested in walking. Three levels are defined:

- Active: at least 150 minutes per week of medium-intensity physical activity, or an intense physical activity at least twice a week
- Partly active: 30-149 minutes per week of medium-intensity physical activity, or an intense physical activity at least once a week
- Inactive: less than 30 minutes per week of medium-intensity physical activity, and no intense physical activity

Only 10.7% of the population aged 15 and above are considered physically inactive according to this survey, but there is a large gap between men (8.7% inactive) and women (12.7% inactive). Between 2002 and 2012, the proportion of the population who followed the minimal recommendations (150 minutes per week) increased in all age groups, going from 62% to 72% of the total population. When we obtained access to SHS 2012 core data, we realised that its interest regarding walking revolved around a single question, set out here in English (our translation): "For your daily trips, e.g. to go to work, to go shopping or for leisure, do you use the following modes? (three answers permitted)". It is interesting to note that, although 3 answers were allowed (e.g. walking, public transport and public car), less than half of all respondents declared that they used walking. This can be seen in the table below, where the gender differences seem to be stronger than in MRMT2010. Due to the vague nature of the question in SHS2012, it is not possible to draw a direct comparison regarding these differences.

	Walking	Cycling	Public transport	Motorised vehicle
Men	37.6	18.2	23.0	62.0
Women	49.8	18.8	28.2	52.8
Total	43.8	18.5	25.6	57.3

Table 4-20. Regular use of transport modes, in percent (SHS2012)

4.5 Discussion of the quantitative phase

As discussed in the Methodology section, this phase did not seek to answer the research question or the project hypotheses, but to describe walking in Switzerland at the aggregate level. In order to discuss the results of this phase, we will concentrate on one recently published article, for comparison, and on 4 core questions: gender, age, residential location and socioeconomic level. These 4 cross-cutting issues – and others – will be analysed again in the general Discussion section at the end of this thesis. This Quantitative discussion section will conclude with a few key points, presented as "take-home messages".

The article we selected for comparison (Panter et al., 2017) concentrates on 3 urban settings in the UK: Southampton, Cardiff and Kenilworthy. These urban areas are roughly equivalent in population to Geneva, Lausanne and Montreux, respectively. For the 3 UK areas, median walking levels were reported to be at around 2.5-2.8 hours per person and per week. The equivalent median value for our Switzerland-wide data is 0.8 hours per person and per day, i.e. around 5.6 hours per person and per week. This is around twice the level found in the 3 UK towns. To make sure this was not an error, we limited our MRMT2010 data to the 3 official conurbations of Geneva, Lausanne and Vevey-Montreux. The result was a median of 1 km walking per person and per day, so even less than the Swiss average (the mean value was 2 km per day). Using this information and the comparison established with the USA and Canada in this chapter, we can conclude that levels of walking in Switzerland are generally high. And by Swiss standards, walking is particularly prevalent in the Geneva area, with an average of 2.1 km per person and per day (median: 1 km).

One of the advantages of the study by Panter et al. (2017) is that data was obtained from the same people (albeit via a postal survey) for 7 days and for 3 years in a row: 2010-2011-2012. These researchers noticed that most people tended to keep the same behaviour from one year to the next, despite the introduction of new walking infrastructure in the 3 towns (the study had been devised to evaluate the effect of this new infrastructure on walking). People whose level of walking was "consistently low" (less than 2 hours per week) were in a majority, representing 62% of the sample. People whose level of walking was "consistently high" represented 4.2% of the sample and walked for 12-14 hours per week on average, which can be expressed as 1.7-2 hours per day. Although there are many methodological differences, it is tempting to consider this figure of around 4% as a possible estimate of the proportion of frequent walkers in the British sample. Such a figure is compatible with our consideration that frequent walkers are probably somewhere in between 1% and 12% of the population.

We also sought a comparison with the Dutch National Travel Survey for 2010-2012, which includes 74'465 individuals surveyed over a single day and is therefore very

similar to MRMT2010. The authors of a recent analysis of these data (Fishman et al., 2015) note that 57% of the sample failed to record any walking or cycling at all. The corresponding statistic in MRMT2010 is 35%. Here again, the Swiss population seems to be more active. However, due to methodological differences we consider this a general indication rather than concrete proof of a higher active transportation level in Switzerland.

We have insisted on the highly skewed distribution of daily walking in the Swiss data. We are therefore very interested in the Dutch data that seems to point at an even more skewed distribution: in the Netherlands, 38% of the population exceed recommended physical activity levels using walking and cycling alone, while over half of the population do not actively move at all on the reference day. We suggest carrying out a similar analysis using Swiss data and will argue for this in the general Conclusion at the end of this thesis.

Gender issues are cross-cutting in this Quantitative phase. Women walk slightly more than men on average (a mean of around 2.1 km against 2.0 km per day, respectively) and are more likely to be great walkers (around 13.3% against 12.2%, respectively). Regarding the proportion who did no walking or cycling at all on the reference day, the figure computed for the sake of comparison with the Dutch data (see paragraph above) was exactly 34.6%, but the true values were actually 33.2% for women and 36% for men. The Dutch survey also registered a mean average of 28 minutes of active travel for women against 24 minutes for men, of which walking represented respectively 13 and 10 minutes (due to topological and cultural differences, there is more cycling in the Netherlands). So, we can say with confidence that women tend to be more physically active for transportation in Switzerland.

Age issues are another interesting way of looking at the results that we have obtained. We have noticed that much of the public health literature concerns itself with aging and walking speed, rather than with aging and walking itself. This is because walking speed is seen as a key marker of the subjective and objective effects of aging (Himann et al., 1988; Stephan et al., 2015). We are more interested in the amount of walking done, according to age, and there is less literature on this aspect.

A recent systematic review (Pollard & Wagnild, 2017) looked into the combined effects of gender and age, revealing that there are higher levels of walking for errands and walking for leisure among women. An age-related pattern in gender differences was found: at younger ages, women walk more for leisure than men do. Then this difference declines and reverses: in older age groups there is more walking for leisure among men. We noticed in MRMT2010 that walking tends to decrease from around age 20 to around age 50 before going up again. This is in keeping with the published literature.

Residential location is one area in MRMT2010 where the results show the clearly urban nature of most of the walking that occurs in Switzerland. A review of evidence from Australia found consistent cross-sectional evidence that people living in high density neighbourhoods do more walking than those in low density neighbourhoods. There was also "relatively consistent cross sectional evidence" that higher residential density is positively associated with active transport modes. This is in keeping with our finding that walking is more prevalent in city centres.

Take-home messages from the Quantitative section

Based on national survey data, we can state that walking is a very common transportation mode in Switzerland. There is evidence that general walking levels increased in Switzerland from 1994 to 2005, but then stagnated or slightly decreased between 2005 and 2015. Walking is more common among women than among men and is especially prevalent in urban centres, even when they are highly polluted as in Geneva. The concentration of walking in city centres may be due to high densities of inhabitants and of economic and cultural activities, but does not seem to be linked to walkability. The great walkers (potential frequent walkers) identified in this phase are multi-modal and display complex organisation plans. They can be found across all demographics but have a tendency to be urban, female, highly educated and over the age of 45. They often have access to a car but do not necessarily own one themselves. They usually have a public transport pass.

5 QUALITATIVE INTERVIEWING

This section probes the daily practices of frequent walkers – especially walking motivation, skills and behaviour. It is based on a series of 41 semi-directive interviews. It also investigates attitudes towards walkability and sustainability as well as elements of their character and social behaviour that might make the study participants able or willing to convince others.

5.1 Introduction to the qualitative phase

The objective of this phase is to understand who frequent walkers are, what they do, why they do it, when, where, etc. These are people who, potentially, are the obedient followers of internationally approved recommendations such as the 10'000 steps per day. Or maybe they are fervent environmentalists, who have ditched all forms of transportation in order to save the planet. Maybe none of this is true, and they merely walk to save money or because they don't mind wasting their time. Have they felt empowered to walk because their local area has become more walkable, or has something else changed in their environment?

We are being a bit provocative, but for a reason: we have tried to approach these interviews with a totally open mind. We were ready to hear all sorts of attitudes and justifications around the frequent walking behaviour. We are not pretending that we had no preconceptions whatsoever: anyone familiar with social science research knows this is practically impossible. Our viewpoint was that we were willing to consider a whole range of possible justifications and organisation plans, because in our view there is no single or overarching reason for walking.

This project phase includes the Qualitative but not the Spatial (GPS) parts of the project. We have decided to present these results separately because they occurred at different times and – especially – because they had different objectives. The objective was to acquire first-hand information, by carrying out face-to-face audio recorded interviews, with a range of potential frequent walkers – most but not all of whom were from the study area. This Qualitative phase can therefore be viewed as a stepping-stone between the Quantitative phase, where we had no knowledge about any individual frequent walkers, and the Spatial phase where we followed them using GPS technologies.

The Qualitative interviewing phase has clear advantages compared to the Quantitative (transportation data) phase as regards its ability to address our research questions and hypotheses. Indeed, we devised our semi-directed interviews to cover aspects such as motivation, skills, sustainability and a possible pioneer effect.

Walkability was only a minor concern in this phase, since it can be addressed in far more detail in the subsequent Spatial (GPS) phase. Some of the people who participated in the qualitative interviewing were also in the GPS tracking phase. Both phases used qualitative interviewing, although the former was more wide-ranging in its questions and the latter concentrated on understanding the participants' mobility behaviour as visualised on a screen. Some of the results from the qualitative section were subsequently backed up or modified thanks to information from the Spatial analysis. Whenever this has occurred, we have endeavoured to make a note of it, for the sake of clarity.

5.2 Qualitative methods

5.2.1 Recruitment of project participants

A separate phase including qualitative interviewing techniques but not (yet) GPS tracking was not foreseen in the plan submitted to the FNS, but was carried out because little was known about frequent walkers and it was not yet certain that we would be able to recruit significant numbers of them. When the project proposal was drafted in 2012, we had suggested recruitment strategies at two levels: meeting frequent walkers in the field, and snowballing techniques. Since both strategies failed – for fascinating reasons, as we shall see – we fortunately were able to implement alternative strategies.

An initial difficulty was identifying frequent walkers in the first place: a person seen walking in public space is not necessarily accomplishing a long walking stage. Another difficulty was that the people who did seem to be frequent walkers and who were approached and given a business card or project flyer did not contact us. Several attempts were made, mainly in Lausanne in the sector directly north of the train station (Petit-Chêne, avenue Ruchonnet and avenue de la Gare, including the many outdoor staircases in that area). Others were approached in Geneva, in the string of parks leading from the main train station towards the United Nations office area. In all, we approached around 60 people who we thought might be frequent walkers. After exchanging a few questions with them about their walking schedules and habits, we were able to give at least 50 of them either a business card or a copy of the informed consent form. To no avail. Only two people ever sent us a text message or e-mail. One of them cancelled the three successive interview dates that we proposed to her, and the other only participated in a prior interview and then opted out of the research project.

As regards snowballing, it rapidly became apparent that most frequent walkers do not know each other, making it impossible to achieve any significant recruitment in that way. Here again, there was only one counter-example (only one of our frequent

walkers was able to refer us to another frequent walker). Actually, this is an interesting example of an unformulated hypothesis: we had mentioned snowballing as a recruitment method in our grant proposal to the FNS, thus implying that we thought that frequent walkers probably knew each other and communicated with each other. This unformulated hypothesis was proved to be false.

Faced by the failure of two major and trusted recruitment methods, we searched for alternative ways of encountering frequent walkers. This was done by approaching people who had participated in a Canton de Vaud health promotion campaign entitled *ça marche avec mon podomètre*, (a play on words meaning alternatively "I walk with my pedometer" or "I am OK with my pedometer"). This campaign which was on its 3rd edition in 2015, is based on the collective self-declaration of steps collected via mechanical pedometers. In practice, small groups of colleagues (only state employees of Canton Vaud can participate) carry a pedometer for a couple of weeks and insert their walking scores into an online system (each person carries their own pedometer). Then, prizes are distributed to the winning teams – and some other prizes are distributed at random, since the idea is to encourage people to walk, not to break records.

In 2015, initial contacts were taken with the organisers of this programme – the *Ligues de la Santé* of canton Vaud. After several meetings, they concluded that they had no ethical or organisational reservations about putting us in contact with their participants. They accepted to send an e-mail on our behalf, with a brief project description and our e-mail address, to the programme participants who had declared an average of at least 10’000 steps per day during the two weeks covered by the programme in 2015.

On 18 January 2016, a total of 378 e-mails were sent by the *ça marche* programme organisers to the aforementioned subset of participants. No demographic information was available for the recipients, beyond the fact that they were all employees of the canton Vaud administration. Responses mostly came in within one week. When potential participants asked if they fulfilled the study criteria, we responded in an open and standardised way, saying that we were looking for people who walked for an hour or more outside of buildings on most day of the week. If the respondents said they felt they did not fulfill the criteria, we respected their decision; if they said they were not sure we encouraged them to participate.

In total, 49 people responded positively and were enrolled in our study: 48 who had participated in the programme and one who had the e-mail forwarded to him by someone who had received it (who apparently was not interested in participating). Confronted by such a high amount of potential participants, it was decided to go ahead with preliminary interviews. A guide for this was created (see Appendix) and updated periodically during the 10 months that this phase lasted. It should be emphasised that although these interviews were not specifically mentioned in the

FNS proposal, they were included under the umbrella of “interacting with frequent walkers”. These were semi-directive, structured interviews. The interview guide is available among the annexes to this work. The objective was to probe and understand the following aspects:

- Life history: had the participant always walked or was this a relatively new behaviour linked to a major life transition?
- Actual walking behaviour at present, on weekdays and on week-ends
- Other mobility behaviours (cycling, car driving, use of public transport)
- Other types of physical activity (running, gym/fitness, sports)
- How and why the participants had come to this daily and/or weekly organisation that included much walking
- In particular, we wanted to know whether a “conversion” had taken place, and if it had, in what circumstances
- To what extent the routines were regular or subject to change at short notice
- What paths were chosen: the more direct or the greener, more pleasant ones?
- Any other aspects that might be relevant (clothing, shoes, health, values, attitudes, etc.)

Regarding the methods used for analysing these interviews, no quantitative methods (e.g. counting occurrences of words) were used. This is because we fully intended to use mixed methods in this project, but in a sequential design. This qualitative part comes after the quantitative phase but before the GPS tracking phase, and uses qualitative methods.

As described in the Methodology section, there were 74 participants in the combined Qualitative and Spatial/GPS phases. They had a total of 89 audio-recorded interviews: 41 prior qualitative interviews and 48 GPS follow-up interviews. There were 15 participants who had both types of interview: these were people who had been particularly convincing during the prior qualitative interview as to their status as a frequent walker, and who accepted to participate in the Spatial/GPS phase (sadly, some declined at this stage). Each interview, whether prior/qualitative or spatial/GPS took an average of nearly 1.5 hours. So, the total audio data available for analysis was in excess of 125 hours.

The table of participants for the Qualitative interviewing phase is given below. It mainly includes people who live in the Lausanne area and surrounding canton de Vaud. We knew that almost all of them were in employment, so rather than asking them for their employment status we asked them whether they worked full time or part time (thus yielding the column with the percentages). It is interesting to see that around one-third of the participants in this phase work part time, although working time is usually over 50%. According to official Swiss statistics, among people in employment around 60% of women and 17% of men work part time (OFS, 2017b). It should be borne in mind that working time in Switzerland is higher than in many other

countries in Europe: around 42 hours per week in the private sector and 40 in the public sector.

N.B. In the last column of the table overleaf, the column entitled "Meet others" gives the answer of our sample to the question: "Would you agree to meet other frequent walkers?" The answers given are discussed together with the other Qualitative results, in the following pages.

ID	Pseudo	Age	Sex	Place	Recruited	Work (%)	Household	Meet others
1144	Donna	31	F	Geneva	Direct	70	Couple	No
1165	Kevin	44	M	Lausanne	ça marche	80	Couple + children	Yes
1483	William	44	M	Lausanne	Direct	100	Couple	Yes
1582	Magnus	49	M	Lausanne	ça marche	100	Couple + children	No
1773	Dustin	56	M	Lausanne	ça marche	100	Couple	n.a.
2144	Tiffany	49	F	Morges	ça marche	90	Couple	Yes
2267	Beyoncé	48	F	(abroad)	Direct	self-employed	Couple	Yes
2270	Dawn	56	F	Lausanne	ça marche	60	Living alone	No
2601	Tamara	38	F	Lausanne	ça marche	70	Couple + children	No
2647	Matthew	43	M	Lausanne	Indirect	50	Living alone	n.a.
2886	Nancy	62	F	Vaud, rural	ça marche	100	Couple	n.a.
3066	Denise	52	F	Geneva	Direct	70	Couple + children	n.a.
3162	(Couple)	53/50	M/F	Vaud, rural	ça marche	100	Couple + children	Yes
3655	Prescott	35	M	Lausanne	ça marche	100	Couple	n.a.
4007	Whitney	47	F	Lausanne	ça marche	90	Couple	No
4028	Lisa	54	F	Lausanne	ça marche	60	Couple + children + dog	Yes
4277	Norma	49	F	Lausanne	ça marche	100	Couple + children	n.a.
4547	Quinn	47	M	Vaud, rural	ça marche	100	Couple + children	No
4608	Deborah	60	F	Lausanne	ça marche	60	Living alone	n.a.
4640	Xenia	46	F	Lausanne	ça marche	40	Couple + children	n.a.
4661	Luisa	45	F	Lausanne	ça marche	60	Couple + children	Yes
4815	Nadia	37	F	Lausanne	ça marche	70	Couple + children	Yes
4840	Hugo	42	M	Vaud, rural	ça marche	100	Couple	No
4964	Graham	51	M	Lausanne	ça marche	100	Couple + children	Yes
5034	Dorothy	43	F	Vevey	ça marche	60	Couple + children	No
5389	Keisha	52	F	Lausanne	ça marche	100	Single + children	No
5538	Henry	55	M	Vevey	Direct	100	Couple + children	Yes
5864	Edmund	46	M	Lausanne	ça marche	100	Couple + children	Yes
5908	Tabatha	50	F	Lausanne	ça marche	90	Living alone	No
6760	Taslima	38	F	Lausanne	ça marche	100	Couple	n.a.
7226	Paul	28	M	Geneva	Direct	100	Living with parents	Yes
7586	Duncan	61	M	Lausanne	ça marche	100	Couple	Yes
8158	Dan	53	M	Lausanne	ça marche	100	Living alone	No
8194	Kathleen	27	F	Lausanne	Direct	80	Couple	Yes
8208	Owen	28	M	Fribourg	ça marche	100	Living alone	n.a.
8527	Trisha	25	F	Lausanne	ça marche	100	Living alone	No
8771	Kenneth	49	M	Vevey	ça marche	100	Couple + children	Yes
9061	Elina	62	F	(abroad)	Direct	100	n.a.	n.a.
9188	Timothy	44	F	Lausanne	ça marche	100	Couple	Yes
9354	Daniela	49	F	Nyon	ça marche	80	Couple + children	Yes
9500	Sidney	60	M	Lausanne	ça marche	100	Couple + children	Yes

Table 5-1. Participants in the Qualitative phase ($N_1 = 41$)
n.a.: no answer or not applicable

5.3 Qualitative results

Here, we present the various themes that emerged from the prior qualitative interviews and the GPS follow-up interviews. Quotations are taken from all relevant participants, including some who only participated in the GPS phase, but who answered "qualitative" questions during those interviews. Double brackets ((example)) are used to show questions asked by the interviewer, while simple brackets (example) are paraphrases inserted to make the quotation easier to understand or to protect confidentiality. For example, “I live in rue de Bourg” might become “I live in (central Lausanne)”. Another use of simple brackets is to give the original French word, in italics, whenever it is felt that it might be helpful. There would be many different ways of presenting the results of the Qualitative phase, the main problem being the very large amount of relevant themes that came up. A preliminary list of themes is given in the table below, that can be linked to the Action and Maintenance phases of the trans-theoretical model of stages of change (see Methodology). This makes sense because the idea was to recruit people who already display the behaviours of frequent walkers and are not merely considering them. Almost all the respondents are in the Maintenance phase, i.e. became frequent walkers more than 6 months before the interview took place. However, many of the respondents had significantly increased their levels of walking over the two years preceding the interviews.

Stages of change	Facilitators	Obstacles
Action (retrospective)	Receiving or buying a pedometer. Nordic walking. Health (overweight/obese, back pain, heart condition). Good public transport (usually: train). Bad public transport (usually: bus). Car broken down or less available. Dog. Maps (usually on-line).	Cheap, easy parking close to workplace. Change of home and/or workplace. Accidents (sprained ankle). Pregnancy. Green spaces/pedestrian areas not on most useful travel routes. Feeling alone and “different”.
Maintenance (at present for most participants)	Pleasure and well-being. Getting up early. Motility incl. local knowledge. Fast walking (for confidence and reduced travel time). Partly flexible daily routines. Different routes in/out. Specific clothing/shoes. Dog. Financial incentive (save on parking/bus fare). Smartphone (music, calls). Hiking. Enjoying being alone. Not caring about being different.	Long traffic lights. Narrow pavements. Bad weather. Tobacco smoke. Car traffic (noise, fumes). Physical barriers (fences, enclosures). Steep slopes. Sweating. Green spaces/pedestrian areas not on most used travel routes.

Figure 5-1. Results presented as facilitators and obstacles in phases of the trans-theoretical model

The fact that many participants had recently increased their walking substantially is important but unfortunately cannot be quantified, for several reasons. First, for most people the change was gradual: even among those who had changed their behaviour quickly, the action phase took several weeks or months; even among the minority who had experienced an “Aha” moment, they did not recall its precise date (the circumstances were more important to them – and to the researcher – than the precise moment). Even among the small minority who professed to knowing exactly when their behaviour changed, such information is notoriously associated with recall bias, to the extent that a recent article suggested that “memories of mood, emotions, and behaviours are not purely unbiased retrieval, but more similar to reconstructions based on current opinions, positive or negative experiences associated with the memory, and how a person believes they would have felt, thought, or acted” (Ross & Wing, 2017). Furthermore, so-called recall bias is only one of the biases associated with the collection of retrospective data (Schacter, 1999) and accurately remembering events that happened over one month ago seems to be rare in human populations (Schmitt & Abbott, 2014). For all these reasons, and because defining whether the frequent walker was in the Action or Maintenance phase was not a mainstay of the project, we are considering most of the sample to be in the Maintenance phase, with very few exceptions.

We present the 50 or so Qualitative themes that came up during the interviews under 10 headings, to make it a little easier for the reader to come to terms with the rather extensive quantity of information. We would like to recall the fact that our research design was deliberately open-ended with many open questions, with a view to covering all relevant aspects of frequent walkers and of frequent walking. In fact, the initial results emerged in a much less organised manner: in order to show the research results as they emerged and before we attempted to organise them, we are including a table in the Appendix.

The headings that we are using here include motivation for frequent walking (6 items), themes related to health (5 items), skills (3 items), accessories (3 items), the environment (4 items), types of walking (12 items), obstacles to frequent walking (8 items), facilitators to frequent walking (2 items), relations to other transport modes (3 items) and social/individual aspects (5 items).

These headings and items can be seen in the table overleaf. We have tried to organise them from the inside to the outside of the socio-ecological model, while taking some liberty with this model. Indeed, our "classification" proceeds from the inner workings of the individual (motivation, health) through skills and accessories up to the physical environment. It concludes with the social environment because, in this last section, while discussing social aspects we come full circle and end up with the individual level again. We realise that the results could have been presented in a different order, or differently, but after careful consideration this seemed to us to be the best option. This is because the results follow to a significant degree the order of

the research hypotheses: Motivation, Skills, Walkability, Sustainability and Pioneer effect.

Finally, the reader will notice that although we have an extensive list of participants (the 41 in the table above as well as those who participated in the GPS-based interviews), we do not cite all of them. This is for two reasons. First, there is considerable redundancy in the sense that many themes that came up were confirmed by other participants. Second, there were some participants who walked much more than others, and others who although they walked more than the average of the population may not have been bona fide frequent walkers according to our rather strict definition. For example, Sidney 9500 cheerfully said to us that he walked 6000 paces per day during the week and caught up on the week-end to achieve his 10'000 paces average (using the Health app on his iPhone). Rather than exclude such people, we have used their information to improve the questionnaire and verified what they have said with people more likely to be "real" frequent walkers.

Theme	Items	Comments
Motivation	Well-being Pleasure Conversion process Recollections of Action phase No walking for the environment Walking is cheap	Well-being and pleasure have often been associated with walking in the scientific literature. The "conversion" and Action phases related to the trans-theoretical model, rarely used in conjunction with walking. The environment is rarely mentioned as a motivator and this was unexpected.
Health	Self-assessed health Weight loss Walking against stress Walking dependency Adverse effects	Walking and health are very often investigated together in the literature. Our data suggest intriguing differences between men and women that merit further investigation (men may be more likely than women to walk for weight loss).
Skills	Motility Multimodality Skills specific to walking	Our frequent walkers are multimodal and display many complex skills in navigating the urban environment. They are not always conscious of the skills that they have.
Accessories	Pedometers Mobile phones Shoes, clothing, equipment	Pedometers and mobile phones are important accessories for many members of our sample. Shoes, clothing and other equipment are more rarely mentioned.
Environment	Walkability Built environment Natural environment Choice of residential area	Our sample is interested in its surroundings, especially the built environment and the view over the lake. But walkability does not explain walking in our sample: the relationship is neither straightforward nor strong.
Types of walking	Choice of routes Routes in morning and evening Walking for transport Walking for leisure Walking the dog Routines As an alternative to sport Integrating sport Nordic walking Walking inside buildings No walking for no reason Days without walking	Nordic walking and dog walking are entry points into frequent walking for some participants. The establishment of walking routines is critical to establish frequent walking behaviour, but often includes variations in routes, e.g. a direct route in the morning and a scenic one in the evening (or the other way round). Most participants have at least one day in the week when they stay at home and/or hardly walk at all. And many would not dream of walking "for nothing".
Obstacles	Physical obstacles Traffic lights Pavements (sidewalks) Personal safety Conflicts with other users Cigarette smoke Air pollution Traffic noise	Many of the obstacles are physical, others are linked to environmental concerns: air quality, noise, access to space. The appearance of tobacco smoke at such a systematic level (over half of our sample mentioned it) was unexpected. Conflicts with other road users were very rare and usually not serious: this was also unexpected and was specifically probed during the interviews.
Facilitators	Policies in favour of walking Positive evaluation of urban settings	Our sample found it harder to pinpoint facilitators than obstacles; they found recently introduced urban design features favourable to walking, especially in Lausanne.
Other modes	Walking and cycling Walking and cars Walking and buses	This heading compares walking with 3 other modes. The most negative comments were not for bicycles or cars, but for urban buses. This was also unexpected.
Social aspects	Walking as an internal activity They don't know each other Social interactions Outsiders express surprise Converting others	The internal and individualistic components of walking were far more present in our sample than the openness often described in the literature on walking. This has a direct bearing on the answer to our research question: at present, our frequent walkers have no desire to convert others.

Figure 5-2. Results from the Qualitative phase

5.3.1 Motivation

One of the first questions that we put to all study participants was why they walked so much. Their answers were broadly similar to each other, with pleasure and wellbeing being the most common responses. Health was also present, but much less so than pleasure or wellbeing. Some people claimed that health and well-being were more or less the same thing, while others vehemently opposed the idea, saying that they walked for their own enjoyment and that better health was only a by-product of their behaviour.

5.3.1.1 Well-being

For Kevin 1165, the situation is very clear in his mind: “(Walking) makes me feel good, quite basically. It’s a way of evacuating stress, of emptying one’s head, a way of moving, quite simply. Tamara 2601: “Sometimes if I feel frustrated for whatever reason, I like to take a little time to go for a walk – generally that evacuates a bit of the stress. It allows me to move on to something else.”

Keisha 5389 pursues along a similar vein: “Because it’s easy. It’s an activity that you can really… I tried cycling, I can’t do it. I tried going to the gym, I got backache. I am not thrilled at the idea of going into a gym room. I took out subscriptions regularly, that turned out very expensive for a single session. Even at home, I try to force myself to do a few exercises – I can’t do it. As for walking, it integrates itself completely into your daily activities.”

There was evidence that, for some participants, a bout of walking played the same role as the time spent in the car for other commuters. For Kevin 1165: “Some people say that, when they are driving home after work, the car is like a safe place (*un sas*) for them, distinct from work and home, for example. As for me, I would feel rather miserable in a car. Or in public transport, we are all squeezed together which isn’t much fun. Whereas when walking, we are free, it just feels great”. For Diane 1144: “Why do I walk? Because I enjoy it. (…) I don’t have a car because I don’t like being in traffic. That’s also why I don’t cycle – I don’t like traffic. So, the practical thing to do when you don’t like traffic is to walk, that’s all!

5.3.1.2 Pleasure

Pleasure was mentioned specifically (without prompting) on many occasions. Such as by Kevin 1165: “What I have discovered little by little is the simple, silly pleasure of walking, it’s that simple. Just move yourself along. It’s a natural rhythm, because running is much harder for me, it requires more motivation." The pleasure of walking can have both “internal” and “external” components, which are combined in the case of Georgina 5290. “More than anything, I think it’s a way of doing something enjoyable. In fact, it’s linked to this idea of living in a beautiful area and, yes, it’s a way of being active.”

Kathleen 8194, who commutes by train between Lausanne and another Swiss city, mentions several aspects of the pleasure of walking, some of which are developed further under other headings (e.g. health, quality of urban spaces). “I enjoy walking, it’s a moment that I have just to myself, usually. And I like being out of doors, whereas most of the time – for work, and also to go to work – I am in a confined space. And then, I think it can be good for my health as well. And, well, I really enjoy walking in the city. Since I live in Lausanne, quite close to the city centre, I find that accessibility on foot is fantastic – so I make the most of it!”

Commentary

Walking has often been associated with well-being and pleasure in the literature. Most of the scientific articles discussing this topic concentrate on leisure walking (see our section on Health for a discussion of this aspect).

The author Rebecca Solnit is one of the best-known proponents of walking for pleasure, although her wide-ranging book *Wanderlust: a history of walking* also covers the political, aesthetic, social and many other aspects of walking. The word "pleasure" appears 60 times in her book, for example when she reaches back to Wordsworth's times to underline "the pleasure of being in the landscape" or when she mentions a route "going nowhere useful" and which therefore "could only be walked for pleasure".

In our sample, the pleasure of walking is pervasive and expressed in very many different ways. Our qualitative data confirm the importance of pleasure in walking, and that this is a subjective and often aesthetic experience – hence the frequent references to beautiful aspects of the natural and built environment.

As pointed out by American researchers Michelle Segar and Caroline Richardson in a short and brilliantly clear text, "the traditional prescription over the last 30 years emphasizing medical, health-related benefits as the primary purpose for physical movement has not persuaded most people to adopt physically active lifestyles". It is therefore necessary to develop autonomous, intrinsic or internal forms of motivation. The authors even go so far as to suggest "branding" walking as a hedonic pursuit, as a way of experiencing "subjective pleasure and meaning" (Segar & Richardson, 2014).

5.3.1.3 Conversion process

Some of our participants had an “aha” moment that they clearly remember. With the necessary caveat of recollection bias, we feel it is important to quote these experiences, which occurred in one or several stages depending on the person.

For Graham 4964, the moment was unforgettable. “My entrance into the world of walkers was a present that I received from my brother 3 years ago: a pedometer, with an app on my mobile phone. And that made us challenge each other about the number of steps – that’s how it began – and starting from there I changed quite a few behaviours. And it really does me a lot of good to walk. I really feel the positive

effects of this practice, so I carry on doing it! (…) Ever since I was given that thing (a fitbit) I really changed behaviour. I changed behaviour in the sense that I seize every opportunity in my timetable or schedule to do some walking."

Keisha 5389 is adept at describing how her relatively recent change took place: "There is a progressive realisation, then suddenly a breaking point (*rupture*) where I say to myself: let's go! And there, as far as walking is concerned, I don't think there is any looking back."

For Frank 6415, becoming a frequent walker was linked to several successive decisions over several years. "Around 5-6 years ago, I stopped cycling because I found it too stressful. Afterwards, I did walking and public transport and now since several months ago I hardly take the public transport anymore, and I didn't renew my public transport pass. Because… well, I walk everywhere. (…) It's only when I'm really in a hurry that I take the tram or the bus. (…) I got rid of my car 2-3-4 years ago now. If I need to, I take my partner's car." Later, he gave more details about the various phases of his conversion: "Letting go of the car was really environmentally motivated, because I don't feel comfortable polluting the air for all the other city-dwellers. I dropped the bicycle because it was stressing me out, and public transport for health reasons. The objective is really to do some physical exercise every day, and I don't have the time to go to the gym. I prefer to walk, it's more in keeping with my character.

Henry 5538 transited from running to walking, mainly for medical reasons. "A few years ago I used to do a lot of running, on a regular basis – during the week a couple of times, every day on week-ends. On Saturday and Sunday, I would go for a reasonably long run. I've basically given up on that now, the walking has replaced that. It's meant to be better for my back, and also because I take up so much time with my walking I can't really justify to my (family) that I spend time doing exercise at the week-end as well."

Because he was a runner he is used to timing and he finds this helpful now that he is a walker: I know that I need to be walking by three minutes past six to be there one minute before the train arrives (laughs). I know at how many minutes past the hour I need to be at certain landmarks along the route, (such as) various bus stops."

For Kirk 4468, the conversion process began some 30 years ago (he is retired now). "My health insurance company came over with a van with an (exercise test) inside. And there they told me I was in very good shape. And that encouraged me (…). It stimulated me because I was doing "walking" at the time (he uses the word *walking* in French), not Nordic walking but walking, in the sense of going as fast as possible without running. Fast walking. It wasn't Nordic because I didn't have the batons."

Although Nordic walking is relatively common in Switzerland, this is not the case everywhere and definitions may vary. Here, we are using the generally accepted definition that it is brisk walking using specially designed poles that that help actively involve the whole upper part of the body. Nordic walking has been shown to have a range of health benefits, in particular on blood pressure and resting heart rate (Tschentscher et al., 2013). Although one of the longer term aims of Nordic walking may be to promote regular walking without the poles in people who were initially sedentary, we are not aware of any studies that have specifically looked into such a gateway effect. However, our research review was done in English so there may be publications in other languages that we may have missed. In any case, it would be useful to see if participation in Nordic walking programmes can have medium- to long-term effects such as increased daily walking for transport.

5.3.1.4 Recollections of the Action phase

For almost all participants, frequent walking has been a way of life for over six months. However, some remembered times when they had been walking a lot less. With the necessary caveat of recollection bias, it is interesting to record what the study participants have to say on this subject:

Now a young father, Kevin 1165 accepted to go through his personal history for us: "As a child, I didn't walk around so much. As a teenager, you're a bit lazy. I remember crossing the city by bus all the time. (Walking) wasn't common at all. At the time, and I'm in my forties now (…) people walked less, I think. It was not very common – especially in the city where it was quite polluted. And then today it's true that there's a good public transportation system, at least in Lausanne. I have the impression that it is more pleasant to walk around in town, the smell isn't so bad, the fumes…"

Commentary

It is a challenge to find appropriate examples of people "becoming" walkers in the international literature, so we turned to other fields where the trans-theoretical model has been used. For example, a research team used a survey in healthcare setting, to evaluate where people were distributed along the stages of change regarding advance care planning. The survey asked the participants to identify their own perceived barriers and facilitators, which were then integrated into an agent-based model (Ernecoff et al., 2016). Also using the trans-theoretical approach, a French team developed a qualitative methodology to study facilitators and barriers to physical activity in people with chronic low back pain (Boutevillain et al., 2017). Carrying out physical activities with professionals (supervision) or with peers (group practice) was pinpointed as a facilitator. Perceived barriers came under 3 headings: physical, psychological and socio-environmental, but the most commonly mentioned barrier was lack of time.

5.3.1.5 No walking for the environment

Another unexpected result is that almost all participants said that they did not walk for environmental or ecological reasons. This is not to say that they were not interested in the environment, but that that was not why they walk.

Tiffany 2144 is the person who gave us the clearest indication about this: “Yes I do have (an interest in the environment) but I don’t do it for environmental reasons. My walking is because it’s part of me, it’s practical for me, but I don’t think about my environmental footprint.” Kathleen 8194 answered our questions about environmental motivation in a similar way: "Maybe indirectly, but it’s not my main motivation. In any case, I have never thought about it.”

Keisha 5389 has a similar opinion, with some nuances: "The environment? I would like it to take up a bit more space in my life, but I find it complicated… I try to do a few small things (…) That’s not the reason why I walk, that’s for sure. It’s funny because really, in retrospect, now that I am really set on this track – I am still in the process of change, but I can feel that it is really taking shape – I realise that on top of all that, walking is good for the environment. But it’s not in that sense that I did it, not at all."

5.3.1.6 Walking is cheap

Everyone knows that walking is, in principle, cost-free. It was nevertheless interesting to probe whether our participants valued this as something important, and if they did, what they would associate it with. Conviviality was one of the topics that Keisha 5389 associates with walking being free: “There are lots of people who complain about not being able to have any leisure pursuits because it’s expensive – but walking costs nothing. And that’s pretty cool! ((She uses the word *cool* in French.)) It costs really almost less than a normal day, because if you take a picnic with you – and picnics are cheap – you can have a really fun time. I really enjoy conviviality.

In fact, the cheapness of walking did not come up very often in our discussions. This may be due to the relatively affluent nature of the study area, to the fact that almost all the sample was in stable employment with no apparent financial difficulties. It may also be influenced by cultural factors (Swiss people are reluctant to discuss money, especially with strangers). Indeed, the participant who was the most interested by the savings that he was making by walking instead of taking the bus was of foreign origin.

5.3.2 Health themes

There were several aspects linked to health, most of them self-assessed. We are using this term "self-assessed" for a very important reason. We asked each participant whether they found it normal to be asked health questions in an interview on walking – they all answered yes, with no exception. But when we asked them if

they had ever talked about walking with their doctor: the answer, with only one or two exceptions, was no. So, our participants are convinced that walking and health are strongly associated with each other, but their main contact with the world of public health and health promotion would not talk about it with them.

5.3.2.1 Self-assessed health

Self-assessed health is an important component of the motivation to walk in some participants. For others, it is merely a welcome add-on. However, it is difficult to distinguish from other motivations and of course health itself includes a range of somatic, psychological and sociological aspects. For Keisha 1389, “It started because of health, but now if I continue… it is really intertwined, I don’t really know which is first, between pleasure and health. Likewise, for Kevin 1165: “Honestly, I have the impression that I was in worse shape before than I am now. I am sure that walking is one thing that helps me achieve this balance.”

Several participants were aware that fast walking brings the best health benefits. Frank 6415: "I even try fast walking. Regarding the health question, the idea is to do fast walking (…). The idea is to increase your heart rate." Tamara 2601 agrees: “I enjoy fast walking. It’s also an exercise that keeps me in good health. If I have more available time, I may go a little further or do a few digressions so I can walk a bit more. But I will not walk any slower, usually.”

5.3.2.2 Weight loss

Although not necessarily distinct from subjective health, weight loss deserves a separate heading because it played an important role in motivating several frequent walkers, almost all of them men.
Graham 4964 had been keen to say it was the gift of a pedometer that made him start walking seriously, but after a little probing it became clear that something else was also at stake. “We met up again as brothers. We hadn’t lost touch but we had had far fewer contacts. So, the truth is that the trigger was clearly (our) overweight. We were both seriously overweight. And then (…) my brother gave it to me and said, I suggest we look at when we can start budging ourselves. And then we can follow the evolution of our respective weights. Because on the interface you share your paces, your distance, your stairs. And then you can open it up to body parameters such as your estimated kilocalorie consumption.”

For William 1483, who was seriously obese before becoming a frequent walker, the realisation was even more dramatic: he was at a friend’s birthday party and suddenly had a vision that if he didn’t get his weight under control the next gathering of friends might be on the occasion of his own funeral

For Owen 8280, who makes sure that he does his 11'000-12'000 steps per day, weight loss is a very important part of his life. When we met, he had a BMI of 27.15

which he himself qualified as "catastrophic" (he had put on around 4-5 kg during the Christmas season). His experience shows some of the interactions that occur between the various themes in this Qualitative section: his mother has a dog and walks very extensively. She bought a pedometer (Garmin) for herself. When she found that it worked well, she gave one to her son (Owen 8280) who does not have a dog but who now arranges to walk more in the context of his daily commute. So in the same interview, we have weight loss, pedometers, walking for leisure and walking for transport.

Commentary

We have noticed that, in our sample, more men than women said they had started or increased walking in order to lose weight. The fact that the person doing the interviewing was a man may have had an effect, in the sense that it may be more comfortable for a person to talk about weight problems to someone of the same gender, especially because there is evidence that the adverse social consequences of overweight and obesity are more pronounced among women than men (Pudrovska et al., 2014).

Nevertheless, given this possible trend in our data, we looked at the scientific literature for indications of any differences between men and women regarding walking for weight loss. We found a review of 49 high-quality studies (randomised controlled trials) pertaining to weight loss in men and women concluding that there is "little evidence" that men and women should adopt different weight loss strategies. "Current evidence supports moderate energy restriction in combination with exercise for weight loss in both men and women", write the authors (Williams et al., 2015). Of the 11 reviewed studies that registered a difference between weight loss in men and women, 10 reported that men lost significantly more weight. However, none of these studies looked at the effect of exercise in isolation; it was always combined with dietary measures (diet was studied in isolation, but never exercise in isolation).

Interestingly, another systematic review, of using pedometers to increase physical activity and improve health (but not specifically for weight loss), found that 85% of the 2767 participants in the 26 studies analysed were women. Despite this finding, the issue of gender was not investigated in this review (Bravata et al., 2007). Finally, a secondary analysis of a 24-month randomised controlled trial in the USA provides evidence that women are more likely than men to use organised weight loss programmes. The authors write that "it remains unclear if weight loss maintenance behaviours are similar in men and women outside of maintenance-focused interventions" (Crane et al., 2016). We believe this opens up the possibility that men may be more likely to organise their weight loss programme on their own, and this could include more walking.

5.3.2.3 Walking against stress

Stress is a cross-cutting theme. Here, we attempt to regroup quotations that deal with stress explicitly. For example, Kathleen 8194, who walks extensively for transport and leisure, finds that she also walks against stress: “It happens to me from time to time, when I’m in stressful periods, to force myself to go out for a few minutes, just for a short walk by the lake (…). Go out, walk for two minutes, get some fresh air and go back inside, to clear your mind a bit (*se changer les idées*).”

For Deirdre 6603, stress management is one of the main reasons why she walks. “For me, it’s a double thing. To have a physical activity, but also from the mental point of view. I must avoid being locked up in a tram. I need to move at another rhythm, to have a transition, in fact, between when I leave and when I arrive. I need these transition moments, so I can leave private things behind me, and then afterwards to leave my work things behind me. It’s really something that I have set up in terms of stress management.”

In the words of Kevin 1165, “Walking is natural, you can go at any pace you want. You can walk faster, slower, it’s really neat. And when I can’t do it, I miss it. It’s true that you get used to it, and on a day when I have to get home faster, or if I’m in a hurry and I have to take the bus, well I miss it a bit.”

Frank 6415 is convinced that walking is more natural than practicing a sport. "I would feel really strange, walking into a fitness centre. It would eat up my time. Because walking is natural and I can see what is going on around me. And I'm interested in that."

5.3.2.4 Walking dependency

We hesitated before using this heading, but we feel that this aspect needs to be presented and discussed because it came up quite often. We of course do not mean an addiction or dependency in the pharmacological sense of the word. It is more descriptive of a behaviour that, however natural, becomes part of the person’s habit to an extent where any change may seem threatening.

Kevin 1165 has thought about this aspect as well: “I have the impression that, the more you walk, the more pleasure you have, so you want to walk more and it becomes a need.” Likewise, William 1483, who started walking to lose weight: "You have to use up the same amount of energy that you ingest, to lose weight. So to change that balance, you have to increase your physical activity. So why not walk, it's the easiest solution and you can insert bits of it more or less at any time. Then afterwards, I became a bit of an addict, I admit. At the beginning, it wasn't as strong. ((Do you feel addicted to walking?)). Ah well, now I really need to do it."

5.3.2.5 Adverse effects

No approach including public health should discard the notion of adverse effects. So we made an effort to include questions on this topic. Adverse effects were very rare, indeed there is only one that we can mention here. Wanda 6283: “At a certain time, I used to walk a lot, even with the laptop. And once I got an inflamed tendon on my foot. And I think it was because I was walking too much with a load on my back. So now I am careful when I am carrying stuff not to walk too much, you know.”

Commentary

One study on over 700 walkers in the UK investigated group walks in natural versus urban environments, for mental well-being, perceived stress, depression and positive/negative affect. They found environment type to be non-significant for depression or positive affect. However, walking in farmland or along green corridors (e.g. river paths) relieved perceived stress and negative affect significantly more compared to group walks in urban environments (Marselle et al., 2013).
Another UK study, on nearly 2000 men and women aged 60-64, found that participation in leisure-time physical activity and walking for pleasure were positively associated with mental well-being, but not with free-living physical activity – this category includes walking for transport and other activities such as household chores. This finding opens up the possibility that the type and context of walking play a key role in mediating the effect of walking on health, especially mental health (Black et al., 2015).

5.3.3 Skills

Here, we list the various quotations that seem to us to be related to skills and to motility, in the general sense of mobility capital. It can be seen that in many cases, our frequent walkers confess to having considerable skills, but the information is not always given spontaneously. Indeed, in several cases, we heard participants claim that they have a poor sense of orientation. We found these claims rather difficult to believe when listening to the ensuing descriptions of complex travel plans. These questions were to a great extent cleared up when we started the GPS tracking phase, where we saw that all study participants were able to “juggle” with various transport modes. They merely vary in their ability – or willingness – to describe their skills.

But there are exceptions. For example, Kevin 1165 cheerfully admits to knowing his way around town: “I also know the bus network very well. Depending on where I am going, I plan ahead and then I say to myself: hey, I am going to this place so I will find the best travel route."

Diane 1144, a bona fide *Vaudoise* from the Morges-Lausanne area, is also very positive about her ability to combine walking and public transportation. “I always try to

optimise my time. So, I take a look at how I am feeling. If I feel in the mood… if the weather is good and I feel like sitting on a bench alongside a hedge or under a tree – if I find one along my way, well I will stop and sit down. And if I find nothing to do, for example I will take the train to Morges. There I will make the most of it to do a little shopping, but only what I can put in my rucksack. No more than that. Because, precisely, the ((supermarket)) in Morges is not far from the station, I know it takes 5 minutes to get there. I use up my 30 minutes in the ((supermarket)), I come back and hop onto my bus. Voilà!"

Wanda 6283 says she enjoys walking and public transport, but in that order: “Once I am on my way, if I’m in a bus that is going to my destination, I tend to stay in it. I already did that when I lived in Onex and worked in Rive ((part of central Geneva)). I walked part of the way, then I took the bus, rather than the other way around." In our view, this implies that there may be a "price" associated with waiting for a bus and getting on it.

When asked about combining walking and public transport, Keisha 5389, who had taken up frequent walking about one year before her prior interview, replied: “That is where I am still learning. (…) The best way, I think, is to incorporate walking into trips made by public transport. You need to identify the best moment to get off the vehicle and walk to your destination, or see if you should start with the walking. That’s the sort of choice you have to make from the beginning (of your trip).”

5.3.3.1 Multimodality

This heading also deals with skills, but concentrates on participants who use more than two modes on a daily basis. Indeed, while a majority of our sample used walking with either public transport or a motorised vehicle, a substantial minority used all three of these modes.

Graham 4964 has perhaps the most complex organisation plan seen in this study, starting by the fact that he lives in a remote village and works full-time in the Morges-Lausanne area. “My typical week (has) 3 days by car and 2 days by bicycle and by train. On my bicycle days, I obviously walk at all the public transport interfaces. On the days that I have the car, I have developed strategies where I leave the car at the edge of the city, or I always leave it at a certain distance from the meeting venue. I have found that I can introduce 10-15 minutes of walking before a meeting, quite easily. But it demands a certain discipline: sometimes you can get a bit sweaty, sometimes you have to run a bit, but well, that’s the way that I do it. For example, in the different towns that I go to, either by public transport or by car, now I have acquired quite a lot of geographical knowledge: I know where to leave my car, and how to get there. And then what is absolutely fantastic is that you realise that distances on foot for example in Lausanne are really tiny. I always leave my car by

the lake and then any point in the city, you can reach it in 20-25 minutes on foot, no problem."

Teresa 6940 also displays a complex and multimodal organisation, with a great deal of flexibility. She lives and works in Geneva, where she has two places where she can spend the night and three places where she can work. She uses public transportation, car driving and walking daily, but does not cycle for safety reasons. During her GPS interview, she explained: "I took the tram home, to pick up my car. When I go out in the evening, I prefer to have my car in case I get back late (…). I hate waiting: 5 minutes in my day, that's 5 minutes. I'm always doing things. And since I consider that walking is good for my health, if I have to walk for 5 minutes because the bus isn't there – I look at the billboard, it's due in 6 minutes – I walk to the next stop. Then at the next stop, I have two bus options rather than one and I take the first one that turns up. You see, it's always a bit like that, flexible, dynamic, making the most of the opportunities. ((But in this case, you spent 5 minutes waiting at a bus stop.)) So? I probably used that time to make a phone call!"

These two examples show us that multimodality is a hallmark of some of our frequent walkers – but not all of them. Such information will be used to inform the establishment of profiles, in the Spatial/GPS section of this thesis.

5.3.3.2 Skills specific to walking

Skills are such a wide-ranging topic that we found it expedient to dedicate a chapter to those that might be considered specific to walking. Again, Kevin 1165 has one of the best examples: "You've got to get the knack of the traffic lights. There are places where I know that if the traffic stops then I'm going to get a green light. After a while, you just know it. You don't even realise it, but you know that if the cars stop then I'll get a green light in 30 seconds, so I know I can get to the traffic light in time. If it is red, then maybe there's another one that is green so I'll take that one. These are little tricks. The basic idea is not to stop walking. There's something to it: if you want to enjoy walking, you have to keep a regular pace. If there are traffic lights every 50 metres, that's not much fun. You end up standing around in the exhaust fumes."

Tiffany 2144 displays impressive timing abilities: "I (buy my train ticket) on my iPhone, usually when I am on the platform. ((Why?)) – I'm moving, so I can't type my code in while I'm walking – I walk quite fast, you know. And then my timing is tight in the morning, because I don't leave home 3 minutes ahead of time." As for Frank 6415, a Genevan who only participated in the Spatial/GPS phase, he readily admits that he has detailed geographical knowledge related to navigating the urban environment on foot. Speaking about central Geneva and Carouge, he said: "I know all those streets really well. So I take one more or less by chance. (…) If I am going along a route that I use every day, it is much more standardised and I am on automatic pilot." As emphasised in various places in this thesis, some of our frequent

walkers claim not to have specific skills related to orientation and organisation in time and in space. We believe this is untrue in most cases. The sheer fact that they think about their skills and believe that they could be better is indirect proof that they possess them to a significant extent. Kathleen 8194 is a case in point. “It often happens to me that I leave 10-15 minutes early and I say to myself: in fact, I don’t have enough time at all, and I start walking really quickly, then I get to my destination and in fact I’ve still got some time in hand. So, it’s true that I am not always good at evaluating time correctly.”

There may be a cultural element here: Swiss people are often described as conscientious and introverted, and a wide-ranging international comparison published in *Science* pinpointed French-speaking Switzerland as scoring very low in extraversion (Terracciano et al., 2005). It is therefore possible that some of our study participants – almost all of whom are of Swiss nationality – have downplayed their skills because they believe it is socially acceptable to do so.

The best example of this attitude is 9131 Renato (who, despite his name, is 100% French Swiss), who only participated in the GPS tracking phase but who we would like to quote here. After having described his extremely complex travel plans, that take up between 4 and 5 hours every day (because he commutes into Lausanne by train, as well as his walking and occasional jogging), he gleefully said to us: "I have no sense of direction and a very bad memory." His GPS tracking information shows that he covers impressive distances on foot and knows his way around very well, as can be seen in the figure below. In fact, he is uniquely able to combine walking for transport, walking for exercise and walking for leisure, as can be seen by his numerous and highly diverse routes – some of the them along the lake or through the countryside, and others along main roads. Such complex mobility plans must be linked to impressive skills that for one reason or another are not expressed. It would be interesting to investigate whether frequent walkers in other cultures, countries or settings also display such a behaviour.

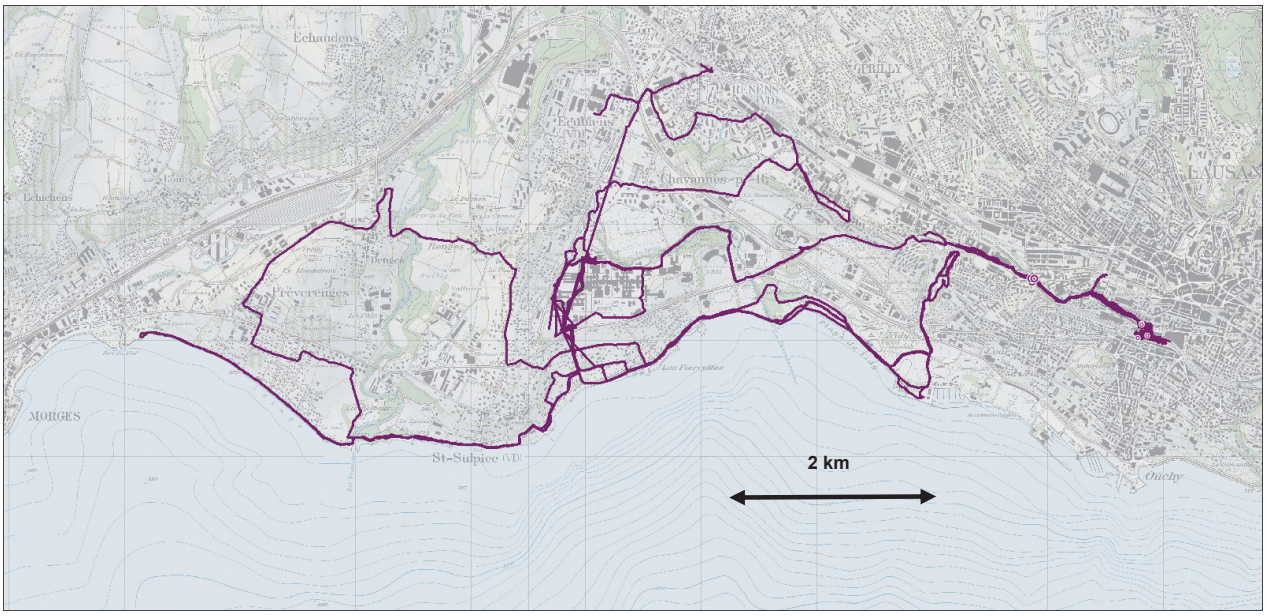

Figure 5-3. Extensive walking in western Lausanne, over a 10-day period, by Renato

For William 1483, who walks 2 hours per day, time management might have been a problem, but he found his own solution. "Well, time is a problem because it takes more time to walk than to take the bus. So I get up earlier in the morning and I finish later. It's as simple as that."

As mentioned in the Introduction, one of our aims is to apply the concept of motility to frequent walkers, to find out whether the potential to walk is of value to the individual, or whether the walking activity has to be carried out – operationalised – in order to reap the benefits. The question may seem straightforward from the public health point of view, but in sociological terms it is important to know whether walking can be considered a form of capital, in the same way that a car parked nearby may have value just by being available. For example, a decent pair of shoes and access to a safe environment are necessary for walking (Cass et al., 2005) but do not guarantee that any walking will actually take place. We were not able to find specific quotations to back up this idea of walking potential, but the fact that almost all our frequent walkers spend one day or so per week at home and/or not walking at all is suggestive of there being a "frequent walker" status that can be operationalised or not – and in different ways – on different days of the week.

5.3.4 Accessories for walking

In the Action phase of the trans-theoretical model, objects such as pedometers (or pedometer apps loaded on mobile phones) or programmes such as *ça marche avec mon podomètre* or Nordic walking are likely to help people become frequent walkers. At least that is what very many of our study participants have noted in their own particular cases. The pedometer was the most prominent accessory, usually but not always integrated into a mobile phone. It is tempting to think that participants

recruited via the pedometer-using programme might have been biased towards such technology. But we found no evidence of such a bias. On the contrary, several participants who wore a mechanical pedometer during *ça marche avec mon podomètre* did not have a corresponding app on their phone and had no interest in having one – nor in carrying around a mechanical pedometer for any significant time.

5.3.4.1 Pedometers

Mechanical pedometers are discussed here, and pedometer apps are discussed in the following section. Several of the participants in this Qualitative phase were recruited in connection with the *ça marche avec mon podomètre* programme rolled out for public-sector employees of Canton Vaud, which played an important role for some of them. For Kevin 1165, participating in the programme was an eye-opener: “We did an action like that at work, and that’s where I was surprised to see that I actually walked more than I thought, usually in the range of 10’000 steps per day. Well, there may be a bit of a “pedometer effect”, where you say to yourself, hey maybe I’ll take the long way round or I’ll walk a bit longer than usual.”

For Keisha 5389, who also participated, the pedometer forms an essential part of her walking behaviour and played a part in her “conversion”: “By integrating the programme in Canton Vaud and having this pedometer, it really made me realise the tiny number of paces I was doing. I had a sudden realisation when I left the group where I was working. There, I drove to work, took the lift up, sat down at my desk; I worked all day, took the lift back down and got into my car. At the time, I think I did around 500 steps a day, on average. And I changed jobs partly for that reason. I was starting to get back pain, and I could feel I was getting older, ever so quietly. I said to myself: I have to get moving, and this sedentary job just will not do. So I changed jobs precisely to get a job that is more mobile, to start with. And then by joining the pedometer programme, there I really realised where I was standing. I didn’t have this telephone yet ((she shows her smartphone)) so it was not easy to follow. Then I really realised that I had to get moving.”

For Keisha today, the pedometer remains an essential tool. In trans-theoretical modelling terms, we might say that the mechanical pedometer played an important role in the Action phase, while the one on her smartphone remains useful for Maintenance. Indeed, to this day, she always aims to do her 10’000 steps: “It’s true that I force myself, it makes people laugh. I got out again in the evening if I have to, I take the long way around. ((Who laughs at this?)) The people who laugh think it’s crazy to let yourself be guided by a tool that’s called a smartphone and not be capable of… There are people who are a bit critical or who laugh at me, saying: you’re not capable, you need that thing (*béquille*) to support you? You can’t tell, on your own, if you’ve walked enough or not? (…) I find it very complicated to know how much walking you have done and not done, during the day, because it is not continuous. It’s not, we go off in the morning and walk for two hours and that’s it for

the day. It's little bits and pieces during the whole day and it's really complicated to get a full understanding of what one has accomplished during the day.

Commentary
Many intervention studies have investigated the capacity of pedometers to increase walking, although the target has usually been leisure walking rather than all-purpose walking (Kolt et al., 2012). The sheer fact of counting one's paces has been shown to increase levels of walking; this has been confirmed across many populations and settings (Al-Kuwari et al., 2017; Bravata et al., 2007; Lubans et al., 2009; Marigliano et al., 2016), although some researchers are convinced that there is a lack of high-quality randomised controlled trials (Freak-Poli et al., 2013).
It is therefore not surprising that some of our sample either used pedometers or pedometer apps for the Preparation or Action phase (Kevin) or the Maintenance phase (Keisha).

5.3.4.2 Mobile phones

Mobile phones were an essential part of the walking behaviour for some participants, and totally superfluous for others. Matthew 2647 not only used his mobile phone to count his steps but also had an app called *Pomodoro* (https://cirillocompany.de). This time management device helps people carve up their day into chunks of solid work interspersed with regular pauses; Matthew used these pauses to integrate extra walking into his schedule. Graham 4964 uses his mobile phone to carry out work-related tasks while he is walking. "When I park my car in the morning, it's a moment that I use… I walk, I make phone calls. It's really become a habit to walk 20-30 minutes before sitting down at my desk. You move a couple of things forward. (…) I use the time very much. During the walking time, I listen to all my messages and I call people back."

Graham was the only one, among all our study participants, who used his mobile phone to correspond with other frequent walkers. He had a *fitbit* application that allowed him to see how many paces other members of his group were doing and they occasionally exchanged messages with each other. Since all his correspondents lived in other countries, he didn't ever meet them or plan on meeting them. He viewed this application as an amusement more than anything else.

A handful of our walkers used headphones and music as a regular feature of their walking activity. They tended to be younger men. Benjamin 6819 is one of them: "especially to unwind a bit, like that, after a day's work I put some music on. In the evening, what's nice is that there aren't too many people around on the streets, so it's a bit quieter (…). Generally, when I discover a new singer, I download the whole record and put it on my phone. So I can listen to it in the evening while I'm walking." Super-walker William 1483 uses his headphones all the time. "I always walk with music, yes, with headphones. So in fact the outside environment – the view and my

surroundings – doesn't interest me that much." Prescott 3655 would agree: he invariably wears his headset, in order to avoid the "useless din" (*brouhaha inutile*) of his surroundings.

5.3.4.3 Shoes, clothing and equipment

Most of our participants did not have any particular clothing for walking, with a few interesting exceptions. Keisha 5389: “I have never been very dress-and-high-heels, so I didn’t have too much trouble in that respect. That’s why I know that walking is something that I’m going to keep. I don’t need to have a change of clothes in my rucksack, which I had to when I was a cyclist.”

Graham 4964 takes his walking equipment very seriously. “My equipment is always with me. Since I don’t know exactly how the day is going to evolve, I always have with me these fluorescent gaiters (he uses the old Swiss military term *gamaches*) that I put round my ankles. Round my ankles, so in the headlamps of a car you really see the two things that are walking. And then I very often have my fluorescent jacket (…) Yes, it’s yellow. (…) When you’ve been really scared a couple of times, you realise that you are walking at times and in places where car drivers don’t expect to find a pedestrian.”

A rucksack is a common enough piece of equipment, and Graham 4964 is adept at explaining its usefulness. “I have a rucksack because walking with something that’s only on one side… well, I like it when it’s evenly balanced. It’s true that I’ve changed quite a few things in my life. If I look at the practical aspects, with my 12’000 steps per day it’s true that I like to have my load spread evenly across my back, and not on one side (he laughs wholeheartedly).”

Nothing in particular came up regarding shoes, despite specific questions on that topic. This is worth noting, because it was somewhat unexpected. Shoes are such a fundamental asset and condition of walking that a structured argumentation about them might have been expected from at least some participants. Most of the them wore what might be described as "no-nonsense" shoes during the interviews: there were very few instances of high heels and no flashy colours at all. Several of the women wore light, low boots (*bottines*) which had style but were otherwise unremarkable. Almost none of the women and very few of the men wore trainers (running shoes). All in all, it is the near absence of trainers that best defines the shoeware in our sample.

This is interesting, because the choice of "reasonable" shoes and clothing helps frequent walkers blend into the background and makes them difficult to identify. But there is an emerging international market for walking shoes and clothing, to which most of our sample is oblivious. Since the majority of our participants were in employment, it was important for them to be able to wear the same shoes at work as

those with which they commuted to work. And most of them had no desire to be visually identifiable as "sporty" just because they were walking to work or on other errands.

5.3.5 Environmental themes

This heading brings together several topics, encompassing the built environment and the natural environment. It contains a special section on walkability, however it should be clear that none of the study participants actually used that word.

5.3.5.1 Walkability

Walkability exists as a measurable unit in various publications, but here we are remaining true to a qualitative approach and simply ask our participants how they experience the various routes that they walk along on a regular basis. It should be said that all participants were seen to walk on various types of road during the course of the qualitative and GPS interviews, so it made sense to ask them how they experienced the various routes. Several participants emphasised that they used heavily-trafficked roads not out of choice but because they happened to point in the right direction (e.g. towards their workplace). There was a fair amount of resignation, but not necessarily bitterness, as can be seen in the following extracts. For Kevin 1165: "There's quite a lot of traffic, but it doesn't disturb me that much. It's true that if there was a perfectly green route through a forest I would love it. But unfortunately, well, we are in the city so it's normal… If there are parks around, I always try to walk through them and otherwise, what's left is the large thoroughfares." For Tamara 2601: "I like the neighbourhoods that lie a bit away from the main roads, where you have little paths, little stairways, passages. Sometimes, really, places that you can't see from the street but that are really nice."

5.3.5.2 Built environment

The choice of separate headings for the natural and built environments is due to the importance of these two factors for frequent walkers. Indeed, there were very many quotations around these two themes. Some are mentioned under other headings (e.g. walkability, choice of routes, motivation). The quotations listed here are mostly about urban quality (or lack of quality), including but not limited to the visual and/or perceived architectural quality of buildings.

Examples of places that walkers would rather avoid sometimes also included references to the built environment. For example, Kevin 1165: "There's this little street (…) But unfortunately, in fact, there's nothing. It's stuck up against the railway tracks. And it's a street where almost all the windows are boarded up. There are old warehouse doors on the left, on the right there are quite high, very grey buildings. You can see that the inhabitants themselves are not interested in that side, because of the noise. So that is a little street that, for me, is the ugliest possible.

Likewise, for Graham 4964: “There are certain places that I avoid. I don’t know, if I think of the Valentin, what’s the name of that street that slopes down in Lausanne? (it is indeed rue du Valentin). There are certain things that, really it’s in the air you breathe, the noise, the limited space that you have, you sometimes have narrow streets or places where I really don’t like walking at all.”

Tiffany 2144 has a positive attitude towards the built environment, in Lausanne. “Working here (…) we are on the outskirts of the city, and if I took public transport I would be in a bubble. That means: I get on the bus, I work, I go home and I see nothing of the city. As for me, I like to do a bit of walking in the city. Because you have various billboards – hey, what’s on at the theatre, what’s on at the cinema? You see shop windows, so that provides a bit of animation for my day. And I like the feeling of the old town, that’s also why I walk to work. It’s not so much that I enjoy walking, it’s just that… for me, it’s more practical and I can see the city, I don’t feel locked up in a bubble like here at work (or) at home.”

Deidre 6603 enjoys the green spaces and historic buildings in central Geneva. "I enjoy the easy access to all the parks. I like all that area, the old St-Gervais (the part of the old town on the right bank of the Rhône). We also go quite often to that playground (*parc du Seujet*). ((What about the reputation of that park?)) I don't feel particularly disturbed by the presence of the (drug) dealers, it's not something that stresses me out really."

Specifically, when Karim 2593 walks in the area around Geneva University Hospitals, he often has a choice between two streets. He prefers the one that has a more *urban* character: "Sometimes I walk along avenue de la Roseraie, but it's not much fun, there's nothing to see. Here (on boulevard de la Cluse) there is movement, there are shops, there are people. On avenue de la Roseraie, there's nothing, only cars."

5.3.5.3 Natural environment

The choice of the Geneva-Lausanne area has implications linked to the quality of the natural environment: this was one of the first tourist areas to emerge over one century ago, thanks to the mountains, lakes and good public transport provision. Many of our frequent walkers were interested in having a good view, either of the lake, or of other key elements of the natural environment.

Wanda 6283 is partial to the view of the Rhône valley, downstream from Geneva: "I love the view from the Pont-Butin", she says. Kathleen 8194 prefers the view onto the lake from Lausanne: “There are several little places that… especially at certain times of day. In the evening, when there is a sunset, it gives you a wonderful view, very beautiful colours, landscapes.” In her GPS interview, she commented on a detour she once made onto the Montbenon esplanade in Lausanne: “It’s true that from

there, you have a very, very, very beautiful view. And since it was quite a nice day weather-wise… I love to see the lake with the Alps."

Keisha 5389 finds she can only appreciate the natural environment when she is in the mood: "It really depends what I am worrying about on that particular day. But I can have nothing to worry about and just enjoy the scenery (*paysage*)."

Benjamin 6819, who lives in a small town between Lausanne and Geneva, makes a point of walking along the lakeside in the morning, as part of his walking commute towards the local train station. "In the morning, I also like walking through the port area (…). I like the lake; I like the view onto the lake (…). And it's not too much of a detour after all." Deirdre 6603 has a similar relation to the lake, but the setting is central Geneva: "It's prettier and more fun to walk along the lakeside. Before, I wasn't able to organise it because I couldn't leave home early enough due to the children. Now, since I pass by (name of a shop) before going to the office, I can start work a bit later too, which allows me to walk along the lakeside. It's a route that I fundamentally enjoy and that I've always wanted to do. And it's really the fact that I was asked (to run an errand for the team at that particular shop in the morning) that I ended up walking along that way."

5.3.5.4 Choice of residential area

In keeping with preceding work by our group at EPFL, the choice of place of residence – and, indeed, the choice of workplace – has a strong effect on mode choice. In the words of our frequent walkers who have chosen to live in central city areas, where they also work.

For Tamara 2601, "It is perhaps most of all the position of the workplace compared to the home which makes it the most practical to go from one to the other. (…) I used to live in Lausanne and work in Neuchâtel. So afterwards I looked for (a job) in Lausanne. And then we got a place for our youngest (child) in a Kindergarten (…). Then we tried to move to a place not too far from the Kindergarten. (…) I think that for us it was a choice not to drive to work. So it's also for that reason that we chose to live in Lausanne. Because I think it's a better standard of living to walk to work or to use public transport, rather than having to drive every day."

Commentary

As other researchers have claimed, the literature can be said to be "coalescing" around the consensus that the built environment is important for walking. However, the eventual positive effects of the so-called 5 Ds (density, land-use diversity, pedestrian-oriented design, destination accessibility, and distance to transit) on walking may be heavily influenced by socioeconomic, gender and racial/ethnic factors (Freeman et al., 2013). And at least some aspects of the built environment are not relevant everywhere: land-use mix and street connectivity were found to be

unrelated to walking in Hong Kong – a very dense city nonetheless confronted by rising physical inactivity levels.
Furthermore, as recently pinpointed in a critical review (Casazza et al., 2015), almost all studies on the built environment and obesity are observational and cross-sectional, so causal language should not be used in their conclusions: it is usually not possible to claim that people walk *because* of the quality of their environment.
To round off our discussion about walkability and the built environment, a study in the city of Cuernavaca, Mexico, even found an inverse relationship between walkability and levels of walking (Salvo et al., 2014).
For walkers in our sample, walkability (although that term was never used) seemed to be a pleasant add-on rather than a determining factor. Although we were rather surprised by this fact when we began to notice it during the interviews, we now realise in the light of recent publications that walkability seems to be in need of a fundamental revision. It might not be faulty as a concept, but may refer too strongly to the North American context. Indeed, proponents of the walkability approach have themselves determined that international variations in residential, intersection and park density are staggering, amounting respectively to 38, 5 and 18-fold differences from one country or one city to another (Adams et al., 2014).
In our view, these differences show that walkability and built environment themes, however important, cannot on their own explain the massive increases in physical inactivity that have swept across the world. In the Discussion and Conclusion, we will plead for more qualitative research to try to understand what it is in people's minds and in people's lives that can make them become physically active or inactive in various settings and conditions.

5.3.6 Types of walking

It was clear to all study participants that not all walking is equal. Some of our frequent walkers made it clear that they chose their walking routes according to practical criteria such as simplicity and directness. Others were more interested in discovering little-known short cuts. Others again would be more direct in their approach when walking in the morning to go to work and more inventive and circuitous in the evening, when they felt they had more time. In this section, we investigate several of these aspects, trying to order them into coherent sub-themes.

5.3.6.1 Choice of routes

Whenever possible during the qualitative and spatial interviews, we asked the participants why they chose one particular route rather than another. The choice of different routes for the morning and evening commutes is handled in a later chapter. Here, we concentrate on the choice between routes having various characteristics related to walkability. One of the key results of our thesis is that participants often did not choose the most pleasant walking route. Here are some of their explanations for this behaviour.

According to Kevin 1165: “Since the timing is usually a bit tight, I go along with… let’s say the more rational route. Not necessarily the prettiest or the greenest. Diane 1144: The part where I walk the most is the last part of the commute, between Lausanne station and the place where I work which is right at the top of the city of Lausanne. I never look at my watch; I am not in a hurry when I am walking. I take the time that I need. So, I do it in around 30 minutes, but it can be 35 or 40, I don’t know, to walk the way up. And on the way down it can be faster, really fast in 20 minutes, or sometimes I take the time to daydream or to check out other streets and it can take longer."

The establishment of routines is well explained in the context of arriving at a new home or workplace, by Diane 1144: “In the beginning, during the first weeks or months after arriving in a new place or if I have a new job, the route is very irregular. Or I try to change a bit every day and test different routes. I try to do this to get to know the places, the city, and then to find the route that seems to be the most direct or the most pleasant, etc. And then I know them well, and I can choose the one I want. And then, I usually have my preferred route and that’s the one I take every day. (…) At first, I went along the direct route. I tried to follow the bus line, or the tram line if I was in Geneva. I said to myself: let’s start like this so I’m sure not to get lost. Then I tried to get lost by little bits and pieces, to explore. Let’s say that the bus line is the most direct, but then I adapted it to pass through a slightly more pleasant area. So I follow the bus line, with a nice little diversion.”

However, it should not be assumed that straight routes are always heavily trafficked and that pleasant routes are always longer. Some participants would even claim the opposite. For Keisha 5389, “when I want to get a few more steps done, I walk along the main road. When I want to be efficient, I go down a side-street.” Graham 4964 subscribes to this way of thinking: "I look for the direct route, the shortest one. It is often more pleasant. (…) These shortcuts, that are either pedestrian or pedestrian/cyclist, are often a trick for cutting between main roads and (are) not on along a main thoroughfare heading into the city of Lausanne. There are several that I have discovered, and they are really, really neat (*très chouettes*).”

5.3.6.2 Different routes in morning and evening

An important result of this project is the very common occurrence of people having a limited number of routes linking two common destinations, typically home and the workplace. Most of the people displaying this behaviour would choose the more direct route in the morning and the longer, more pleasant one in the evening. Here are a few examples.

For Kevin 1165, who lives in the lower part of hilly Lausanne: “In general, in the morning since it’s uphill I take the bus. And in the evening, I always manage – well,

whenever I can – to walk home, which takes me half an hour. And there, it's also the best time of day to walk a little more."

Kathleen 8194 tells a similar story. She also lives in Lausanne, but uphill from the train station where she takes the train every day. For her commute, she walks downhill for around 20 minutes in the morning, and then uphill from the station in the evening. The two walking bouts are very different in her eyes: "If I am going from my house to the station, I take the most direct route: it is important to optimise time use, to avoid missing the train. But on the way back, that's where more variability comes in." She also values her morning and evening walking-for-transport differently: "It wakes me up in the morning, and it helps me unwind in the evening."

5.3.6.3 Walking for transport

Although walking was often experienced as a combination of walking for pleasure, for leisure, for exercise and for transportation. At least one quotation clearly refers to the latter classification, according to Tamara 2601, who lives and works in central Lausanne. "For me, walking, in those cases (she is referring to her morning routine, where she takes her children to school and then goes to work, all on foot) really isn't a leisurely stroll. It is really to get from one point to another quickly and I walk quite fast. (…) For me, it's the most practical way of getting around town. Especially since I'm with the children, so I couldn't do it by bicycle."

5.3.6.4 Walking for leisure

Most of our participants walk for transport and/or exercise, a great deal of the time. Which does not mean that they do not walk for leisure, on the contrary. Walking for leisure can be further subdivided into walking the dog (next heading) or "pure" walking for leisure. It is interesting to see how people who do a lot of walking for transport view their leisure walking. For some people, the two types of walking are quite different.

A good example is Kathleen 8194, who does her purposeful walking alone and her leisure walking with her partner: "Having a stroll, you mean really for the pleasure of having a stroll? (The word used was *promenade.*) Sometimes we go up to Romanel-sur-Lausanne or the Sauvabelin woods, or down to Ouchy by the lake, and come back up through the EPFL campus, etc. It's very variable, very improvised too, it's as if we were drifting." (The word in French is *dérive*.) For her, there is also a temporal difference between the two types of walking: "During the week, it's really utilitarian travel, to get to the station or to go back home. Whereas on week-ends, it's just for travel's sake, for the pleasure of walking; likewise, during the holidays."

Leisure rhymes with pleasure for Teresa 6940: "Walking, for me, as a daily activity, is simply a transport mode that I enjoy. But I travel a lot and during my trips I love being

active on foot, so it’s especially when I’m travelling ((abroad)) that I walk in a contemplative way.”

Walking for leisure is distinct from urban walking for William 1483, because it does not have the same objective: "It's true that it's better to walk where you have less cars, it's better to walk along a wide pavement, it's better to walk along the lakeside. But it's absolutely clear to me: I draw a distinction between when I walk during the week and when I go off hiking. Because hiking precisely means being on the lookout for a beautiful landscape, a well-kept path, a forest during summer, and all those other things. Of course."

5.3.6.5 Walking the dog

Dog walking may seem mundane, but various researchers have investigated this idea because it is a way of increasing levels of walking across age groups, particularly in families. The topic figured in the recently published *Routledge International Handbook on Walking,* where a review (Iwasaki, 2018) shows that dog walking is become increasingly popular globally and has demonstrated positive biomedical and psychosocial effects.

Several of our participants have a dog. David, who lives on the outskirts of Geneva with his wife and is now semi-retired, was “prescribed” a dog by his doctor because he had a heart condition. For him, as for most of the dog owners in our sample, dog walking represents almost all the walking that he does. For Edmund 5864, who lives with his family in the countryside north of Lausanne, taking out the dog also represents most of the walking that he gets during his working day. "I try to conform to the recommendations that came out a few years ago, saying we should do 10'000 steps per day. It's true that I was far from that score to begin with. But now I have a dog, since about a year ago, so that helps me get those 10'000 paces (laughs) (…). I would say I have reached my goal (laughs). Because I don't know if I would go out as much without another objective. Taking your dog out is an obligation. The dog didn't ask (to come into your family). If you're going to leave him indoors and never take him out there is no point. So when I decided to take a dog, I know it would make me go out more."

For Noëlle, recently retired and widowed, who lives on the outskirts of Geneva, taking her dog out is a key moment in her day. Whereas David, Edmund and other dog walkers in our sample tend to walk around their home, Noëlle always drives her car into the countryside to walk her dog. The fact that she is not doing it around her home does not make Noëlle's dog walking any less socially useful. Since she usually goes to the same spots, where letting a dog without a leash is permitted, she tends to bump into the same people with whom she has social interactions that are very important for her.

Commentary
Dog walking is the subject of much research, because of the ongoing obesity epidemic and because having a dog is not necessarily associated with walking extensively. Recently reviewed by a team in the UK (Westgarth et al., 2014), the evidence suggests that dog walking should be encouraged by targeting dog owners in order to increase their sense of obligation to walk the dog (by reinforcing the dog-owner relationship) and by the provision of physical environments that make dog walking easier and more pleasurable. The same team conducted a qualitative study on the dog-owner relationship, finding that "social relationships, even with non-human others, can impact physical activity behaviour, through engendering a sense of responsibility to another and shared pleasure" (Westgarth et al., 2017).
Since we found very low levels of dog walking in the Quantitative section of this PhD, this may be an area where more focused interventions would be useful. Specific areas for dog walking (*parcs à chiens*) are common in the Lausanne-Geneva area (there are 21 of them in the city of Geneva alone), but they are not necessarily *attractive* to dog owners – nor to dogs. This is one of the reasons why one of our study participants drives a car into the countryside every day to walk her dog.

5.3.6.6 Routines

Much of the walking that was discussed during the qualitative interviews and then visualised in the spatial/GPS phase was concerned with routines: the same routes tended to crop up again and again, often at similar times on the same days of the week. Although it is difficult to quantify, we would estimate that around half of all the walking that we observed in our sample was routine, and around half was not. Obviously, some walkers were more routine than others, but we did not observe anyone who walked only on certain routes or who never repeated a walk. Rather than trying to decide who was more or less of a *routinier*, we decided that was more interesting to discuss with each of them the routine and the non-routine aspects of their walking.

As well as the morning/evening aspects covered in the section above, we found that most of our frequent walkers had relatively set routines, coming with a level of variability which was usually highly controlled. In a nutshell, the routine could be said to include variations around a central theme. As well as this routine/semi-routine core, almost all participants had "exceptional" walking trips or errands. Almost every single participant claimed that we had settled on an exceptional week for our GPS tracking, and some were hard pressed to find a "typical" walking bout although it was quite clear in their minds what it was.

For Kevin 1165: “The route is determined by the programme (of the day), a sort of organisational routine. I am used to do certain things in certain places at certain times during the week. So, the routes are more or less always the same. (…) Sometimes, I vary things. If I’m fed up with walking down this street, then I try to find

an alternative. Given time, there are little variations that you get to know about, and that you can choose – depending on how you feel as well. Precisely, if you want a bit more traffic, a bit less noise, well I know about a few quieter routes, perhaps a bit longer but that's the way it is. Or on other days I don't care and I just carry on."
One of the most interesting routines in our sample came from Catherine 3066, who lives on the outskirts of Geneva. Every morning at precisely 5:55, she takes her husband to his workplace that is about 1.5 km away – on foot. Then she walks back home, does a few exercises and has breakfast before sending the children off to school. Then she heads out to work – taking the tram this time. If the weather is good, on the way back from town she sometimes gets off the tram or the bus to walk part of the way back home.

Commentary
Rather than simple, repetitive behaviour, we understand routines as body–mind–environment assemblages that exceed the physical limits of the human individual (Schwanen et al., 2012). Routines are an important component of sociological analysis, particularly in the field of mobility studies (Middleton, 2011). However, qualitative studies on walking routines remain rare. One study in the UK used semi-structured telephone interviews to obtain feedback from 43 participants to an intervention that sought to increase walking through the structured use of a pedometer and handbook, with and without support from a practice nurse trained in behaviour change techniques. The participants mentioned having a flexible routine as one of the most important facilitators of increased walking, and inflexible routines as one of its most important barriers (Normansell et al., 2014).
We were not able to find any other examples where researchers had asked detailed questions about the routines themselves. This fits in with the comment by one of the reviewers for this project, who saw qualitative interviewing as a new approach in walking research (Reviewer 3, cf. Appendix).

5.3.6.7 Walking as an alternative to sport

Walking was often considered as a "partial" replacement for sport. It seemed clear in the mind of many that walking might represent sufficient physical activity, but that it was also a good complement (see also the following chapter, on sports activities).

For Kevin 1165, a young father living in central Lausanne: "When you can't do that much sport anymore, for example after the birth of a child, well, (walking) is an interesting alternative, to get moving, to get out of doors and get some fresh air."

Henry 5538 knows a lot about sports because he was a long-distance runner before becoming a frequent walker. This is what he has to say about walking in the context of sport: "I am certainly using it as a health activity, I wouldn't necessarily call it a sport. I'm not signing up to do a competition or anything, and I'm not sort of training for it. But I consider it good exercise and it's helping me stay fit, yes."

5.3.6.8 Integrating sport and other regular activities

Although fully aware of the physical activity represented by their walking, several participants also endeavour to go to a sports place at least once a week. This represents an occasion for investigating whether walking is also being used to access this type of activity.

For Matthew 2647 in Lausanne and Karl 2953 in Geneva, a visit to the gym is part of a routine, and they each do it at least twice a week. Since the gym is very close to where they live (between 0.5 and 1 km in each case), they usually go on foot. For Kevin 1165, the preferred activity is swimming: “There are also certain activities that make you go by foot or not. For example, I am accustomed to going to the swimming pool once a week – so I also go there on foot. (…) So I try to walk to the pool. But on the way back, the family organisation means that I have to take (public transportation). But I’ll do at least part of the route on foot."

Only a minority of study participants had a regular sports activity that involved them being indoors, and they were almost all men. Jogging and cycling were also the prerogative of a minority, but here the proportions of men and women partaking in such activities were more or less the same. Interestingly, none of our participants participated in team sports such as soccer, basketball, volleyball, etc. It would be tempting to draw a parallel with the tendency of our sample towards individualism and solitary pursuits. Before doing this, we checked the official statistics for Switzerland and found that around one-quarter of the total population belongs to a sports club (Lamprecht et al., 2017). So, since the corresponding value for our sample is zero or nearly zero, we can safely say that our frequent walkers are much less likely to belong to a sports club than the population average.

5.3.6.9 Nordic walking

This type of walking, usually with batons and using a technique involving the movement of the whole body, deserves mention because it participated in the conversion process of several participants. For some of them, Nordic walking may have played a role in helping them move from the Pre-contemplation phase to the Contemplation and Action phases. However, persistent Nordic walking was almost non-existent in our sample, suggesting that it may not be appropriate in the Maintenance phase.

For Edmund 5864, "Over the past 4 years, until September (around 6 months before the prior interview), I was in a group of Nordic walking. So we went every week to walk down by the lake, (…) whatever the weather around one hour of walking with batons along the lakeside. Sometimes we walked up into town as well, it depended a bit on the routes we decided to do. It's true that it helped me realise that, whatever the weather, nothing prevents us from going out of doors and walking. Often, we stayed by the lake. It was flat all the way, especially when we started up again at the

beginning of the year. And then, little by little, we made inroads into the city, so there were quite a few ups and downs sometimes."

Then he explains how he moved from Nordic walking to having a dog. "Since I was the person responsible for the group, I was the only one who had to be there every week (…). I realised that I was sometimes missing (other) opportunities, since it was a fixed day that couldn't be changed. There were sometimes invitations, other activities on those days that I couldn't participate in. The (Nordic walking) activity was interesting, I enjoyed it. But that constraint is what made me give up the group after 4 years, to someone else. And when I stopped, I really felt that if I didn't find something else to do I would reduce my weekly number of steps. In parallel, we had just redone our garden at home and we put a fence around it. I thought to myself that it was the right time to have a dog because he would have some space in the front yard. And then, I thought that by having a dog I would have to walk not only once a week but every day… I would be walking more, basically. So yes, there probably is a link between that activity that I was doing at first and what is going on now."

Commentary
A systematic review (Tschentscher et al., 2013) states that Nordic walking has "beneficial effects on resting heart rate, blood pressure, exercise capacity, maximal oxygen consumption and quality of life". According to its authors, "current literature unanimously identifies Nordic walking as a safe, feasible, and readily available form of endurance exercise training, which exerts a panoply of beneficial effects in a wide range of people with various diseases and the healthy". However, we did not find an investigation of the use of Nordic walking as a gateway into regular, frequent walking among healthy people, as we have evidenced in our sample.

5.3.6.10 Walking inside buildings

The GPS tracking phase could not take walking within buildings into account, for technical reasons. However, the qualitative interviews were well able to cover this important part of daily walking. We found that most study participants were well aware of the differences between indoor and outdoor walking: with only two exceptions, they were not annoyed that our study design did not cover indoor walking in the GPS phase. Most of them were keen to maximise their steps in both settings, thus demonstrating a positive attitude towards both types of walking, as can be seen in the following examples.

“Many of (my) steps are in buildings”, said Kevin 1165. “It’s true that I don’t necessarily walk 10’000 steps per day in the city, but a substantial part is done at work. Because there are long corridors, staircases. As far as possible, I will try to walk all the way to the photocopier or to go and see a colleague, or I’ll go down 3 flights of stairs – and up again!”

For Matthew 2647, the fact that walking inside buildings was not taken into account was a problem: as mentioned previously, he used an app called Pomodoro, which encourages people to take regular breaks during the day. He would then walk up and down the stairs, or just round the building. Most of this walking had to be removed during the GPS follow-up because it could not be distinguished from “noise”. For him, it was clear that the experimental set-up was not ideal.

5.3.6.11 No walking for no reason

An interesting and unexpected element is that most if not all of the walking bouts analysed in the Spatial/GPS phase seemed to have a purpose. Most often it was walking for transport, to get from A to B. Or it can be walking for pleasure, or to de-stress or to think about something. But the idea of walking for no reason at all did not appeal to our participants, so we think it is worth mentioning this under a separate heading.

Tiffany 2144 was even quite vehement about the concept of walking for no reason: “If my husband said to me, this Sunday we’ve got nothing much to do – so let’s go for a walk. To find myself here in town and have a little Sunday stroll, as they say, oh no, I am really not interested. I don’t want to walk for walking’s sake. But if it’s to go somewhere, to see friends who live 1 kilometre away, well I’d say: let’s walk over, let’s not take the car.”

5.3.6.12 Days without walking

Already during the prior interviews, we noticed that even very frequent walkers tended to spend 1-2 days per week doing hardly any walking, sometimes spending all day at home. This was confirmed in the GPS follow-up interviews.

In the words of Wanda 6283, who is a part-time writer among other activities: “I don’t do things half way. Either I walk a lot or I spend all day at home. When I have the day off, I like to dig in and just write." For Keisha 5389, who usually achieves between 10’000 and 15’000 steps a day, one day during the GPS follow-up only mentioned 76 paces on her pedometer. She laughs: “it was one of the Official Fasting week-ends (*Jeûne fédéral*), and I decided to lie in. I think I woke up around 2 p.m. (…) It feels good from time to time (laughs).”

5.3.7 Obstacles to walking

Obstacles can be of various natures. We have therefore tried to separate them out into groups, based on their physical and functional characteristics. A specific series of questions probed this item in the qualitative interviews and answers were wide-ranging.

5.3.7.1 Physical obstacles

For example, Keisha 5389 said that encountering physical obstacles had made her wary: "in urban areas, I trust less and less my desire for short cuts (…) I often end up in a dead end." And Daniela 9354 admitted to feeling annoyed at times: "Yes, sometimes I do get frustrated. The other day, I went over there and there were road works going on and I couldn't get through. And that annoyed me a bit. Anyway, I turned around and went the other way…"

Only Deirdre 6603 mentioned the presence of other people as an obstacle, specifically at the Coutance bus stop near Geneva main station, where 6 bus and tram lines stop in front of a major department store, on a narrow pavement. "I go there often but I don't like that part of town – Coutance. When I see that lots of people are waiting and that several buses are coming in, I go down rue Rousseau because it's such a bustle and I find it difficult walking there." ((Do you mean a bustle of human beings?)) – Yes."

Somewhat unexpectedly, Peter 4506 pinpointed the area around Geneva main station (Cornavin) as an obstacle to walking. He has developed a strategy for avoiding the station altogether: if he is on a local train, he gets off at a neighbouring, much smaller station (Genève-Sécheron), which is a further away from his usual workplace but he can cut through parks to get there. He has another strategy to cope with accessing the station when he has no other option: "Crossing Cornavin station is always a bit annoying. But the traffic is not the problem. What I do is that I cross the street (before getting to the station). And then, you always have the question when you arrive, whether you should take the underground passage or cross over the top on place Cornavin (…) It depends on the state of the traffic light. By the time I get to the traffic light, I know if it's worthwhile to go underneath or if I should wait. It's a practical question. Ideally, I would rather cross over on the surface and not have to go down and then up again."

5.3.7.2 Traffic lights

The topic of traffic lights comes up in several of the other headings in this section. We nevertheless wish to dedicate a separate heading to this important problem. In the view of our participants, traffic lights form one of the main impediments to walking – and especially frequent walking – in urban settings. The main reason seems to be that walking is experienced as a continuous activity, and traffic lights make it discontinuous.

Tamara 2601 agrees: "It is true that traffic lights always make you lose time, and I try as much as possible to go through places that don't have traffic lights. (…) I find it annoying to just have to stop and wait. Whereas if you carry on walking, you don't save time but at least you are still moving forward.

During her prior interview, Kathleen 8194 showed signs of irritation at a particular traffic light in Lausanne: “Often I would like to walk around it, but it’s not really possible, the red light at the Montelly crossing, which is extremely long. Because there it’s a really big road, with lots of roads crossing each other. And there, you often have to wait a bit and it breaks my walking rhythm (*ça me casse la marche*). It annoys me. So, I would like to find a way around it, but making your way around such a large place would mean losing even more time.” The same traffic light came up during her GPS interview: “There is a particular place where there is a traffic light that is absolutely annoying and you often wait for quite a long time. And it annoys me. It really is the x-point of my daily walking, it’s a real problem.”

Frank 6415 stands in broad agreement with Kathleen about traffic lights. "They are one of the problems, especially those where you have to press a button as well. So in fact I often cross over in-between the cars. When I'm alone, but never with my partner because she doesn't want to (…). On that day I think she was with me and that's why we stopped at the traffic light (laughs)."

A counter-example is Deirdre 6603. who does not allow herself to be annoyed by traffic lights. "If I'm not in a hurry, I always wait for the green light. I accept the wait (laughs) ((And why?)) Because I don't want to be taken in by these frenetic rhythms and I sometimes try to walk in full mindfulness. And these traffic light moments, well, they are often moments of..." (she doesn’t finish her sentence).

In Swiss cities, there often are pedestrian crossings with and without traffic lights, in relatively close proximity to each other. This is one of the main aspects of pedestrian crossings that came up in the interviews. In the words of Kathleen 8194: “Some of them don’t have traffic lights, which is good for me, I think, because I can impose my presence a bit, as a user of public space let’s say.”

This survey of attitudes towards traffic lights would not be complete without the rather extreme point of view of Owen 8208: "I hate traffic lights; I detest traffic lights. And I'm a very bad… well, if I want to cross a road I cross it, whether it's red or not. Anyway, the ones that I go through a lot, I have learned how to use them, to know when the cars go through and so on, to know when I can cross when the light is red."

5.3.7.3 Pavements

Like traffic lights, pavements (sidewalks in US English) are one of the main elements that frequent walkers are confronted with. Most of our sample have a positive attitude towards pavements, that are seen as empowering. As can be seen, there are very few negative comments about them, and contrary to our expectations very few people were critical. Whereas we were expecting remarks about their width, the quality of their surface or other technical elements, our sample seems relatively content with the present state of pavements in the areas where they walk. Although

most participants were favourable to 20 km/h, which don't have pavements, others welcomed a straight, uncomplicated pavement even if it was along a main road. Kevin 1165: "I prefer walking on a clearly delimited pavement, you don't have to pay as much attention to the various dangers that may occur."

For Owen 8208, the width of the pavement is the most important aspect: "the pavement has to have a certain width, otherwise it isn't a pavement." Tamara 2601 is a keen observer of all things related to pavements: "In the city, it's true that… I see really simple things that are done, such as when a small street joins onto a bigger street… and now in Lausanne I see that they are making continuous pavements (*trottoirs continus*). It's true that it's pleasant when you're walking – you know that you have priority. Also when you have a push-chair, it saves us from having to step down and back up onto the pavement. And it's true that they should also reduce traffic in the city."

5.3.7.4 Personal safety

Switzerland is considered a safe country, with low levels of street crime and – it was thought – relatively low levels of harassment in public space. Accordingly, issues around personal safety came up very rarely in the discussions with our participants. However, such themes form an important topic in many countries, with critical implications regarding gender. A recent United Nations publication reports that 92% of Moroccan women have experienced some form of harassment in public space in their lifetime, and that over 50% of men admit having exposed a woman to such treatment at least once (UN-Women, 2017). In Lausanne, a dozen cases are reported to the police each year, but according to a survey up to three-quarters of all young women aged 16-25 are affected by harassment every year. Accordingly, the municipality is taking street harassment very seriously and has launched a programme to combat it at several levels (Lausanne, 2017). A similar programme is being considered in Geneva.

Crime levels are slightly higher in Geneva and Lausanne than in the rest of Switzerland, but still low by international standards: there were around 10 violent incidents per 1000 inhabitants in each city in 2016, the same value as in Zurich. Generally, crime rates are following a slow downward trend in Switzerland (OFS, 2017a).

Among our panel, one of the only participants who mentioned personal safety was Fabiola 9937, a lady in her early sixties who regularly walks up and down the series of parks between the United Nations area and Geneva train station. "I don't walk through the parks in the evening", as she put it quite simply. Our other study participants said they generally felt safe in public space, or at least that it was something that they had decided not to worry about. Although we had many open questions that were expected to cover any significant problems that people might

have experienced while walking in public space, we realised somewhat belatedly that we had no specific questions on the fear of crime and the problem of harassment in public space. So we cannot conclude that harassment is not a problem for frequent walkers in our sample, we only conclude that it is a topic that did not come up spontaneously.

5.3.7.5 Conflicts with other travel users

We were under the impression that life as a frequent walker might entail occasional skirmishes with other users, especially car drivers and cyclists. So, we asked specific questions about this in the qualitative interviews and were attentive to anything similar that might come up during the GPS follow-ups. But to cut a long story short, very few people mentioned conflicts and those that were mentioned seemed to be both rare and relatively mild in nature.

Daniela 9354 was aware of a power relationship with car drivers, but did not feel the need to escalate to a full-blown conflict: “Depending on where you are, it’s true that it’s difficult to earn respect. Even if pedestrians have priority, well you have to be careful anyway because you never know. You never know what may happen… Well, there’s no point lamenting about it. I am not a fighter (*une personne belliqueuse*), so if they don’t let me through, they don’t let me through. (…) Sometimes, it’s true that we would have had priority. But if people don’t want to let you through… As far as I’m concerned, it’s my safety first.”

5.3.7.6 Cigarette smoke

Almost all the participants were non-smokers. Many participants said that smoking was more of a problem for them than exhaust fumes, although it was easier to avoid. Both men and women were sensitive to the issue of tobacco smoke. An example is Owen 8208, who refused to say which was worst between tobacco smoke and exhaust fumes ("like choosing between cholera and the plague"). Whenever he realises he is walking behind a smoker, "either I accelerate to overtake, or I cross over to the other side of the street", he says.

Kevin 1165 really appreciated the ban on smoking in cafés and restaurants. "But it’s true that we are perhaps more sensitive now, and the pavements have become places where people gather to smoke – so it’s even worse. Because it is concentrated, and you have to walk past that place. If I can avoid it, I will perhaps try to walk around the group. Or if I’m just behind someone who is smoking, I will overtake him or try to find another way. When you’re a non-smoker, it’s really quite unpleasant.” There were many other comments along the same lines, such as Tamara 2601: “It’s true that I really dislike walking behind smokers, so I try to overtake them”, Tiffany 2144: "I find it annoying. I turn my head, or I walk faster” or Daniela 9354: (Smoking) annoys me enormously… and even more as a pedestrian

(…) When I am walking on the street, it suddenly gets me, like that (she clenches her throat). (…) It disturbs me even more than before."

A specific point was made by Prescott 3655, who pinpoints bus shelters (*abribus*) as places where exposure to tobacco smoke is particularly strong. He even refers to them as smoking rooms (*fumoirs*). The problem, for him, occurs when he is walking in central Lausanne along a street with several bus stops along a narrow pavement: "you walk past and you are invaded by this smell of cigarettes and it's really aggressive", he says.

5.3.7.7 Air pollution

When asked if they were ever disturbed by air pollution, answers varied immensely from one person to another. Sidney 9500, an occasional frequent walker living on the outskirts of Lausanne, says that exhaust fumes have become difficult to detect. "Air pollution? I don't really feel it unless it's the diesel smell, when a diesel car comes past."

A different opinion is voiced by Daniela 9354: “(I am disturbed) by the pollution. Yes, sometimes you can smell it, air pollution. (…) It disturbs me. (…) I am more annoyed by air pollution (than by a cigarette), because a cigarette, if you walk past someone it only lasts a moment. Air pollution is continuous. (…) It annoys me, it’s a problem for me. And that’s why I try as much as I can to use roads that are closed to traffic – closed to traffic, or in the forest.”

On the opposite end of the spectrum, when pressed about the menace that air pollution might present for urban walkers in Switzerland, Graham 4964 quipped: “This is not Beijing.” Deirdre 6603 made the following comment: "When I'm with my children, I will obviously go and walk along the lake, that sort of thing that is more pleasant, where there is less traffic and less pollution – at least, I think there is less." Her last phrase, "I think there is less (air pollution)" is similar to Graham's comment. They can be interpreted the expression of a belief that air pollution forms a more or less homogeneous blanket above the city, without strong variations from one street to another.

5.3.7.8 Traffic noise

Most participants were aware of the problems associated with traffic noise. However, only some viewed it as a major problem. It seems that more people worried about air pollution or tobacco smoke, although this proved impossible to quantify due to many subtle expressions used to qualify people’s attitudes towards these three problems. It should be mentioned that it was rare to find a person who did not worry at all about the three threats, but it was also rare to find anyone who considered all of them to be a considerable menace.

5.3.8 Encouragements to walking

As with the obstacles analysed above, the perceived encouragements to walking were very wide-ranging in nature. We are suggesting a sub-heading on policies, because several of our frequent walkers were well aware that the on-going transformation of urban areas was sometimes in favour of walking – especially in Lausanne. Here, we should perhaps remind readers that most of our sample was over 40 years old, they therefore had a temporal perspective which helped them realise what policy achievements there may have been over time. Importantly, these perceived changes favorable to walking were not only about "horizontal" aspects such as pavements and road crossings, but also about more "vertical" aspects such as the perceived beauty of monuments and buildings.

5.3.8.1 Policies in favour of walking

Here, we present results regarding what local authorities may do to help people to walk more. A difference between Geneva and Lausanne, and between these cities and more rural areas, is sometimes apparent. As is often the case in this type of qualitative research, there is some overlap with other themes, such as traffic lights and pavements.

For Kevin 1165: "Organising things so that pedestrians don't have to wait for too long at traffic lights, that is an excellent thing to do (…) Pavements are also important. Setting up 30 or 20 km/h zones is even better. It makes you feel at ease and it creates less conflicts with car drivers, although some of them do not really understand how 20 or 30 km/h zones work."

Tamara 2601 has a very clear view: "Pedestrian areas are ideal. Then, there are streets with really narrow pavements and that is not nice at all. You can't walk past people; you have to walk on the street." Despite the fact that he drives extensively every day, Edmund 5864 cannot agree more. "I think pedestrian areas are great, because they make walking more pleasant, while forcing people to walk when they want to buy something, or if they just want to walk around in town. So pedestrian areas are a good method." He has another idea for encouraging people to walk: "In my village, they have put up signs that estimate the time needed to walk from one point to another, it takes less time than you think. So that could be a good way to incite people to walk more."

Keisha 5389 is enthusiastic: "The pedometer story, that really opened things up for me. So distributing pedometers to people, that's a great idea." We would tend to agree with her, because several of our participants became frequent walkers in this way. This makes us think that letting people have a pedometer is a good idea, the only open question being how it should be organised.

5.3.8.2 Evaluation of urban space

There were many positive valuations of urban space relate to Lausanne or neighbouring Morges. There were also a few for Geneva. Altogether, there were far more positive than negative comments about the quality of urban space in our study area, although there was an interesting exception (see below). For Kevin 1165, Lausanne is a great place to walk and he is appreciative of the efforts that the municipality has made over the years. For Daisy 5136, Morges is best: “I really like Morges. I just love those little streets, it’s pleasant. There are no cars. So that’s the really good side to it all.”

Kathleen 8194 appreciates walking in Geneva, where she used to live a few years ago. She displays some nostalgia: “Normally, when I’m in Geneva, I really like to walk because I miss visiting the city. (…) It’s to see certain places again, to impregnate oneself with the atmosphere.” She is also interested in the town-countryside duality of Geneva: “I am always surprised, when you come out of the urban centre of Geneva, you are straight away in a very green countryside, a real green belt. It surprises me every time (…). It’s a special kind of landscape, because the centre is extremely dense, and the neighbouring villages are also very dense. And suddenly you’re in the countryside. There is no real transition, compared to other places.” Also in the Geneva area, the old town of Carouge and its trees really speak to Frank 6415, as became apparent during his GPS interview: "That (portion of road) is annoying because there are lots of cars. So I branch off sooner to go into the areas where there are fewer cars. (…) On the way over, I did it (differently) because there was a magnificent alignment of big trees; I wanted to have a look at those big trees. But after that, it meant I had to endure all the length of the road. Since I had seen the trees on the way over, I said to myself: hey, I'm going to go through a quieter area. I slipped round the back, walked downwards for a bit, and it's really pretty there in the old Carouge. It's a bit like being on holiday, or during the summer: people are sitting at the (café) terraces."

The exception is Owen 8208, who is probably the best-travelled member of our panel, in the sense that he is often various European cities, especially in northern Europe: "Stockholm has a lot more space. It is a paradox, but in French-speaking Switzerland, our cities are pathetic for that sort of thing. All the German-speaking cities are a lot better for walking, if you walk in Basel it is just not comparable. Not Berlin either. Berlin is just fantastic for walking; all the streets are really wide; there are lots of trees. And what I also like in Stockholm, Berlin or Basel (Zurich is not quite as good) is that the buildings are low, you are not overpowered (*écrasé*) by the buildings. It's often 4-5 storeys. And straight away, the fact of walking on a wide street with buildings that are about 4 storeys… you can see the sky! (…) But as soon as you start walking in Lausanne or Geneva, it's really a very vertical architecture, with narrow streets, you really don't get the same pleasure. Urban walking when I'm in Basel is a lot more pleasurable than what you get in Fribourg, Lausanne or Geneva."

Careful consideration of these comments (and of others not shown here that go in the same direction) makes us think that the quality of urban space has at least two different aspects for our sample. The first is the situation on the ground, with what is usually called urban design: people seem to appreciate the efforts made by the municipalities to improve the quality of public space. The other aspect is the surrounding buildings, on which municipalities have much less to say. The width of the streets and the "verticality" of the architecture are very difficult to act upon, for historical, legal and political reasons.

5.3.9 Walking in relation to other modes

We asked our participants whether they used any other modes (apart from walking) and probed the interactions and inter-relationships between these modes. We also asked them a series of questions to identify any conflicts that they might have had, as walkers, with users of other modes.

5.3.9.1 Comparing walking and cycling

Most of the study participants did little or no cycling. In fact, it rapidly became apparent during the recruitment and prior interview phases that if a person declared a high level of cycling, they almost certainly were not a frequent walker. The idea of comparing the two travel modes was integrated into the interview guide, so a fair number of interesting answers could be extracted. Here are some of them, ranging from the emotional to the highly practical. It should be emphasised that hardly any cycling gets done in central Lausanne due to its extremely hilly nature. So for this item we rely on information from the relatively flat Geneva area, and mainly from the GPS/Spatial phase.

According to 6940 Teresa, who only participated in the Spatial phase of our research, cycling is simply too dangerous in Geneva. Security concerns did come up several times in the course of our investigations, but were rarely considered to be major problems. Teresa was the only person who drew a clear line between the safety of walking, which she considered to be acceptable, and of cycling, which she considered unacceptable. She admits that she is influenced by the fact that she worked as part of an ambulance patrol when she was younger, and thus came across many accidents implying motorbikes or bicycles.

Also from Geneva, Wanda 6283 has an interesting take on the identity and pleasure attached to being a walker rather than a cyclist. "I have always been much more of a walker than a cyclist, even if I cycled to go faster. In fact, I like walking so much that, if I go cycling, afterwards I need to go for a walk, for the pleasure of walking. So, I say to myself: I might as well walk!" This indicates that the concentration required to ride a bike is somehow higher or more intense than when someone is walking. The comment about the pleasure of walking is all the more interesting, because most of

Wanda's walking is linked to transportation rather than leisure. For her and for several others among our participants, purposeful walking and pleasure go hand in hand.

Finally, we were surprised to register almost no remarks at all regarding conflicts between walkers and cyclists. We were expecting at least some stories about bicycles getting into the way of pedestrians on pavements, but there was almost none at all. This should be placed in the general context of a lack of conflict – and lack of any kind of interaction – with other road users.

5.3.9.2 Walking and cars

A handful of participants – in fact, a small minority – expressed a distrust or dislike for cars. In the case of Keisha 5389, her process of "weaning" from cars was still underway. She said: "I used to live in Vevey, it was traffic jams. That's why I don't like cars. They really are a pain. (…) We had 3 (cars) at first, then we had only 2 for a time, around now, because we sold one of them. And there's another that's going to go soon. We will only have one left. ((Why?)) Because there's no point in having so many."

However, this type of remark was rare. Most of our study participants expressed either no opinion or a positive opinion about cars. Almost all of them had access to a car, although many did not use it during the week. Among those who did not have a car, most did not express any kind of aversion. These results are in keeping with recent research that shows that all travel modes tend to have a positive image (Munafò et al., 2015), although urban buses may represent an exception (see below).

5.3.9.3 Walking and buses

Several participants were critical about public transportation. Closer analysis revealed that criticism was hardly ever directed at train travel, nor at the Metro system (in Lausanne) but specifically at urban buses. For Tamara 2601: "With the bus, you are never sure when you are going to arrive. There is a timetable, I know. But if you are walking, you are really in charge of your own time, I feel. If you want to walk faster, you can win a few minutes.

Daisy 5136 is not a fan of urban buses either, especially in Morges where they are less frequent than in Lausanne or Geneva. "There's a bus that goes there. Usually that's what I do, I take the bus on the way over and then I walk back. The bus on the way back is annoying because you have to be there at the right moment, when you come out (of your appointment). By and large, if I can avoid taking the bus on the way back, it's true that I'll avoid it. For instance, in Geneva I used to walk everywhere. In Lausanne, I also try to do things on foot as much as I can." When pressed about buses within the Morges area, Daisy becomes vehement: "I am not going to get on a bus, the buses are pathetic here. And I'm not going to pay a bus

ticket if I don’t need it. ((What do you find pathetic?)) The price, the timetables, that’s it really.” But the most vehement distractor of urban buses was Bernard, who spent his early years in the Lyon area in nearby France. He is adept at explaining the difference between urban and railway transportation. "These buses, that are not school buses in France, where you have everyone in the bus, squashed together like sardines to go to school… I hated it. (…) And then I went to live in the city centre and it was a relief because I didn’t need to take public transport anymore. (…) But a day in the train to go to Lugano, that's rather pleasant in fact. You can work, the conditions are good. (…) Being in transport and living in transport, that's what I've been doing. Before, I lived a bit in Paris a bit in Lyon and (in a third city). So I did it (by train) and that was no problem. But public transport, say urban ones, that is a pain in the neck. On foot I feel far more efficient, much faster, much more in the city: I look around, I look at the buildings, I like it better. It's faster, it's a waste of time to look at timetables."

Commentary

Mode preference and customer satisfaction are complex areas where it has been clear for a long time that people do not choose their mode solely for objective reasons. The typology of logics of action mentioned in the Introduction section of this thesis is remarkable in the sense that only one of the 7 groups decides on their mode based on a neutral weighing up of advantages and disadvantages (Munafò et al., 2012; Munafò et al., 2015).

Whereas some cities, such as Copenhagen, have succeeded in making the bicycle part of their culture (Gössling, 2013), it is clearly much more difficult to make people enthusiastic about a "bus city". However, it must be borne in mind that public transport passengers form a very heterogeneous group (Verbich & El-Geneidy, 2016).

Regarding the idea of a pedestrian city, an obvious example is Venice which due to topography does not have any cars nor bicycles in its city centre. Despite the provision of public transport by boat, much of the mobility goes on by foot. This is therefore a natural experiment, which has not been investigated very much despite a very interesting article on a limited number of Venetian residents, that found walking levels in the range of 12'000 steps per day (Ayabe et al., 2013).

Drawing on these articles and our findings, we have reason to believe that there is competition not only between private motorised vehicles on one side and an orderly array of public transport, walking and cycling on the other side, but also between these various sustainable modes. It follows that walking is not only under competition with private vehicle but also with public transport (especially of the urban variety) and, of course, cycling.

5.3.10 Social and individual aspects of walking

This is a rather complex heading, containing some of the main results of our thesis. In the socio-ecological framework which we presented in our Methodology section, the individual is considered as being "surrounded" by layers corresponding successively to the social, physical and policy environments. Here, we consider the two innermost layers: the person and their social relations.

5.3.10.1 Walking as an "internal" activity

This is a complex heading, which we could have rendered as “Walking as a solitary pursuit”. We chose the word “internal” because we can expose it to “external” factors such as the social, urban or natural environment, which is often done in social psychology. This heading is an attempt to group together various utterances dealing with what goes on in people’s minds when they are walking. There is considerable diversity, but most participants feel no contradiction in saying that walking can help them alternatively switch off, let their mind wander, or concentrate on a particular problem.

Daniela 9354 puts it very simply: “Walking? It empties my head”. Likewise, Kathleen 8194: "I like having a time when I am alone. Walking enables me to do it. (…) For me, when I am walking I can put myself into my own personal bubble (*dans ma bulle*). I prefer staying inside it.” For Diane 1144: walking is a moment that I have all to myself. I can switch off, from work for example. Since you’re out of doors, there is fresh air. I feel like it is supplying extra oxygen to my brain. I am better at concentrating afterwards, on whatever I was thinking about or planning to do when I get home in the evening. That is the main reason why I walk." As for Tiffany 2144, who is a frequent jogger as well as a walker: “Generally, when I am doing sport – it’s the same thing when I walk – you feel a certain detachment from everyday things, you feel good, you switch off. I can think about things, but at a distance. And then I often find solutions. In general, I feel good. (…) I think about a whole load of things not necessarily connected to each other. They are things that come and go, come and go. (…) With the distance, what I like is that I often find a solution. This should be done like this or like that, and then I think about something else. That’s all.”

But such introspection requires a sufficiently long walking time. Tiffany 2144: “Usually, when I walk down to the station from my house I am in a bit of a hurry so I don’t know what I’m thinking about. It’s more when I have a bit more time, so it’s when I leave (my workplace) to go to the station, where the route is longer and there I will have time to think.”

We can also mention Deirdre 6603 in this respect: "Walking really helps me to resolve problems. (…) There are many big decisions in my life that I came to while I was walking. A bit on the Rousseau side. I really find that you make better decisions

when you're walking than when you're sitting down. But I don't have any particular problems to solve right now, it's more about organisational things. I don't have to use (my daily walking commute) to resolve problems."

Up to now, we have reviewed the opinion of people mainly engaged in walking for transport. It was interesting to find almost the same words in the mouth of Edmund 5864 when discussing how he would walk his dog in the evening: "It helps you to make a break with the rest of the day, to make a transition: there was work before, now it's something else, it empties your mind a bit and then you are ready again for the evening."

5.3.10.2 Frequent walkers don't know each other

A stunning feature of frequent walkers – at least, those in our sample – is that they don't know each other. We asked all of them if they knew of any other frequent walkers among their friends or colleagues and almost all of them (>90%) said that they didn't. Occasionally, we identified a participant whose partner was also a frequent walker, but this was not at all common. In only two cases, we heard of brothers and sisters who were known to each other as frequent walkers. Without betraying confidentiality, we can say that at least 3 or 4 pairs of people who we interviewed knew each other as colleagues without being aware that the other walked far more than the average.

In the words of Edmund 5864: "I don't know if I have other people around me, like that, who are frequent walkers. I can't, I can't manage to identify them." This is similar to Henry 5538: "I don’t know of anybody else that has the same system as I do, or walk or anything like that. There are a lot of people who do cycling that I’m aware of, but I’m not aware of anybody who specifically incorporates relatively long walks into their commute."

Here, we can perhaps mention the last column of the Table of participants (there are two of them, for the Qualitative and Spatial phases, respectively). At the end of the study, we asked each study participant, by e-mail, whether they would be interested in meeting other frequent walkers. As can be seen in the tables, around half of the participants in the two phases said yes and around half either said no or did not answer. In the same e-mail, we had asked if they had a justification for their answer. Not very many people responded to this, and for those who had answered positively the comments were not particularly enlightening (*Why not?* was one of the favourites). We are mentioning this here because one of our more elderly participants, David 9512 who lives in the countryside near Geneva, wrote this: "I enjoy walking but I don't feel the need to talk about it."

Among the negative answers, there were many comments similar to that of Tessa 5908: "I walk alone or with friends". Or more explicitly in the words of Dorothy 5134:

"I enjoy the solitude of that time, or if I want to share it, it will be with my partner or with friends". These two ladies from the Lausanne-Vevey area are joined by a Genevan, Diana 2109, who expresses it more abruptly: "No, I like doing my sport, walking, etc. on my own so I can do it when I want to, and if I want to be with someone I've got my friends." Some of the men were also less than enthusiastic: "I generally prefer to walk on my own, so thank you for your proposal but I am going to turn it down" read the rather formal response from Fred 3966, a super-walker from the Lausanne area. Others were not negative about the idea, but seemed somewhat wary, such as Fabiola, a semi-retired person living in Geneva: "it would depend on the objective of these meetings", she wrote. It should be mentioned that some of the people who said no justified it by a lack of time, but all the same we can extract two items of information from this: the first is that around half of our sample might agree to meeting other frequent walkers, and that the private, almost confidential nature of walking extends to not wanting to meet their peers for some of our sample.

5.3.10.3 Social interactions

While one of the previous headings dealt with “internal” factors, this one deals with external factors. Natural and architectural aspects have been handled elsewhere, this part concentrates on the human factor. Several themes emerge here. The first is that social interactions are generally weak: frequent walkers don’t talk to each other very much on the street. Further social elements are covered in separate headings, underneath. Again, we turn to the highly aware Lausanne walker, Kevin 1165: “There are people that you notice, like that, apparently because we operate along the same timetable. There is a man that I see near the park, around my age I think. But he is walking up. So regularly, around the same places, we walk past each other. I imagine he is going back home after work. ((When pressed to say whether he ever says hello to this person.)) No, not necessarily, we are each in our own rhythm.”

Kathleen 8194 is one of the only participants who says that she interacts with other walkers, but as we will see her interactions remain at a very basic level. “During my morning walking commute, I often pass by a gentleman with a red jacket, more or less always underneath the same tree. Sometimes we say hello too, so it’s as if there was a community of walking commuters.” When pressed, she emphasised that she had never had a conversation with this person, and had never even said hello to anyone else on her regular walking routes.

When asked if they recognised the same people during their regular walking bouts, several participants said they did not notice other walkers, but people who lived or who tended to be present in the areas through which they were walking. Here too, communication is kept at a minimum. Benjamin 6819: “There’s a lady who lives opposite the new ((supermarket)) building, for example. I know she lives there. Once when I was walking, it was in the morning, she asked me: Hey, I see you walking all the time, where are you off to? And starting from then, we began saying hello to each

other. Before, I used to see a lady who also went out for a walk in the evening (…). But one day I saw her in crutches, so I guess she stopped walking."

Kirk 4468 is the participant with the most extensive social interactions in our sample. He explains that he often talks to people while he is walking around in Geneva or neighbouring Carouge. When asked if he goes up to people he doesn't know, he replies with a smile "I sure do." When asked to elaborate, he says: "It goes really well. Some of them are looking for information. Otherwise, you can see right away that they want to talk. ((What kind of people?)) People sitting on benches, for example, but it depends, it depends. ((What ages?)) Young people ask me about their route, some can't read what's on their phone, sometimes also retired people. ((Which age bracket is least represented?)) I don't know, mainly people in the middle. There aren't that many on the streets. They are in their cars, I don't know, at work, on holiday. ((What's the average age of these people who are not there?)) Around 40 to 50 I suppose, I haven't done any statistics. But I could, to find out who I'm talking to (laughs). At least on every other walk I do, I talk to someone I know. ((And how often do you talk to people you don't know?) Maybe once every 5 or 6 outings. ((Does that mean once a week?)) Yes, probably."

5.3.10.4 Outsiders express surprise

When pressed, most of our study participants admitted that they had heard comments about their walking behaviour, usually from colleagues. It is important to emphasise that the comments were hardly ever negative, but they were not necessarily positive either. The most common reaction was genuine surprise, as experienced by Kevin 1165: "Sometimes people say to me: Ah, you walk to work? Ah, you are walking back home, oh really? They are a bit surprised, as if it was something… It's true that it's a bit uncommon, but it's not unpleasant." This also refers to interactions inside buildings, as experienced by Tamara (2601). "People know that if they are taking the lift they don't need to wait for me, so… (laughs) they see me coming and they say: Ah, it's you, we know there's no need to…" (laughs again). Tiffany 2144, who has a 30-minute walk from Lausanne train station up to her workplace, has no qualms at all about being different. "I see colleagues in the train, and then I tell them: look, I am walking up to the office, so there, see you later. It's the same thing (at the office), there's a lift and I rarely use it. And sometimes if I'm with colleagues they say to me: hang on, come up with me in the lift. I say no, I prefer to use the stairs. And I walk up. That's all."

Keisha 5389 has had the toughest remarks, but with no effect on her enthusiastic disposition: "You go out and finish your allotted ((10'000)) paces, once the children are in bed. That's what makes some people laugh, the fact that you can go out at half past nine in the evening to walk for an hour, to finish off your allotted paces. (…) Then people around will be more in the mood for poking fun at me, saying: ah, but you've got to do your paces today!"

With his 2 hours of walking per day, William 1483 is more exposed than others. "Remarks? Yes, I've had lots, (such as) why did you do that? So, I explain what I explained to you (during the interview) but in a shorter version. Then, at first they say: You're crazy. But then, they say, Oh but you're right in fact. It is well accepted." When he walks past a certain building near Lausanne, the caretaker looks at him and shouts: "Hello, walker!" (this makes William laugh a lot).

5.3.10.5 Converting others

This is a subheading under the general topic of social interactions, separated because of its importance in ascertaining whether frequent walkers might form a pioneer population with the potential to operate social change at population level. As we will see, despite some promising, rather isolated experiments, indications of a major social change are few and far between. Most of the comments refer to passive rather than active processes, such as people “knowing anyway” or seeing walkers and somehow being inspired by them.

Kevin 1165 has thought about this a lot: “When we are several colleagues together, I am sometimes surprised by the automatic reaction to take the bus. Whereas my reaction is to walk. When I tell them this, they are a bit surprised. – Oh, but it’s a long way away. But then I say it isn’t. I realise that I know the city a bit better then they do, as if from a different angle. And then I tell them: no, if we go this way, that way, we will be there really quickly. ((And they say, Oh yes, you’re right.)) It’s really a question of getting used to it. I was like that maybe ten years ago, whereas now… Anyway, it’s true that people don’t walk so much. (…) I don’t consider myself a super-walker. I walk as I like or as I can. So it’s not something that is usually discussed. It is not a topic of conversation. (…) Nowadays, being physically active is viewed quite positively. (…) I don’t even talk about it, so people know. Keisha 5389 hopes that her example may have an effect on someone, sooner or later: “There are more and more people, little by little, who by seeing me again and again with my (pedometer) that I do carry around here ((she shows her belt)). That doesn’t mean that they will become frequent walkers, but they start to realise that they don’t walk enough.”

Graham 4964 thinks he may have already contributed to a gradual change of behaviour, regarding his wife. “Well, there’s something where I surprise myself: when I get home in the evening, with my wife we do our daily debriefing – that is also a change in routines – by going for a walk. Around 1-2 km or so, just around the block, relaxed and friendly, talking all the way. Instead of sitting down. She has really taken to it, she enjoys walking, she has less back pain. Well, everything gets better, once you get moving.” Peter 4506 has a similar arrangement with his wife: "Especially during the summer, we like walking around the local area, in the evening (…). I think we started walking a bit more when we had children, it was a way to get out of the house, to talk about the children."

Noëlle 5703 only walks for leisure (with her dog), which did not prevent her from trying to "convert" her friends – to no avail. "I have lots of friends. When we took our retirement together, they said: hey, we'll come and walk (your dog) with you. I asked them several times, but it was never the right moment. So after the third or fourth attempt… (she raises her shoulders). ((And how about walking without the dog?)) It's got nothing to do with the dog. I think that people are not really walkers, that's all. When they get older, people walk very little. I'm really surprised. Because when I see some of my friends, now they are retired and they are not doing anything anymore, it's terrible."

William 1483 has tried to convince people on several occasions. The reactions suggest that much of the population is still in the Pre-contemplation phase of the trans-theoretical model of behaviour change. "No-one has said to me, now I'm going to do what you're doing. Others have said to me: Maybe, listen, yesss, you've put a little idea into my head. Maybe it wouldn't be too bad to… But how do you do it? And I tell them, look here, get off the bus 2 stops before and walk the rest of the way."

5.4 Discussion of the qualitative phase

In this chapter, we do not want to repeat what we have already written, nor do we want to impinge too much on the general Discussion section at the end of this thesis. So we will simply recall the main points that have come up, especially those that were somewhat unexpected. Then, we will try to relate them to the research question and working hypotheses.

In relation to the overarching research question about the ability of frequent walkers to bring about a more sustainable mobility system based on walking, we are tempted to answer that our sample does not have the desire nor the motivation to convince others. They do not know each other and keep very quiet about their rather unusual habit. This was very much unexpected, as is manifest through the episode of the unformulated hypothesis, i.e. that snowballing could be used to recruit frequent walkers to this project. This refusal to engage with others about frequent walking is in keeping with the key motivation attributes that we found, which are very personal (well-being, pleasure, health) and not collective at all (the environment is hardly mentioned). Even the walking skills, which seemed very apparent to the researcher – an intuition that will be confirmed in the Spatial section of this thesis – are played down by the study participants. These skills allow frequent walkers to juggle between modes and to plan and improvise in space and in time. No doubt that these skills can be learned and therefore there is some hope for them to be transmitted to others, in due course, but as mentioned previously most of our sample feels no need to take any initiatives in this area.

Walkability is not a vitally important aspect of urban walking, according to our sample. We must, however, advise that this is an opinion and not necessarily the reality of everyday walking for our participants. Here again, we will need to turn to the Spatial (GPS) section to see whether frequent walkers really do walk with little attention given to the walkability characteristics of their walking routes. For now, we remain with the claim that it is often easier to walk along a main road that has a wide enough pavement than to weave through narrow side-streets.

Under the heading of Implications for society, our 2 remaining hypotheses relate to Sustainability and the Pioneer effect. As mentioned earlier, since our frequent walkers don't know each other, don't communicate about walking and relish their "internal" or discreet activity, they are unlikely to become the vanguard of early adopters that might help transform the general mobility system. However, regarding sustainability, it is interesting to note that there are probably 2 groups of study participants, with varying levels of integration of walking into their personal mobility systems. This also needs to be verified using Spatial data (see next section).

6 SPATIAL/GPS PHASE

This phase is strongly linked to the skills that frequent walkers need in order to orient themselves in time and in space. The issue of walkability will come up again, as we will see some of our proponents navigate through crowded or polluted areas. Sustainability will also be discussed, linked to the question whether walking trips are added on to a programme of mechanised travel, or whether they can replace trips that would require fossil energy. The so-called pioneer effect will also be discussed.

6.1 Introduction to the spatial/GPS phase

This the only phase that can objectively prove not only the amount of walking going on in the study sample, but also which routes were being chosen. GPS debriefing interviews were conducted in this phase and should not be confused with the preparatory interviews described previously. For practical reasons, some participants had only one of these two types of interview, whereas others had both.

First, we must explain the fundamental difference between the two types of interview. The preparatory interviews were classical one-to-one interviews based on a 4-page interview guide. They had a double objective of understanding the motivation and behaviour of the individual person, and of acquiring a more general idea of the behaviour of the group of frequent walkers. As explained elsewhere, this phase was discontinued as soon as it was felt that saturation had been achieved. The GPS interviews were not based on an interview guide but on the GPS tracking data, which were visualised during the interview (both the interviewer and the interviewee could see the screen). Most of the questions asked were related to individual decisions that could be analysed based on what was observable on the screen. Here are some examples:

> *Why did you go along the main road in this case, rather than cutting through the park?*
>
> *Why did you use a different route on the way back?*
>
> *etc.*

In the cases where there had been no preparatory interview, we attempted to introduce some general questions about the participants' values, attitudes and motivations towards walking, when and in what circumstances frequent walking had been taken up, etc. Due to time constraints, the questions present in the preliminary interview could not all be handled, it was therefore necessary to act in opportunist fashion: asking extra questions as they came up naturally during the GPS debriefing.

For example, if a person changes their normal route, we would ask why, and if it is because of factor X then we would probe whether that was a usually defining factor or whether they viewed this instance as exceptional. Apart from this variable, qualitative element, the GPS interviews were highly systematic: they were organised in a consecutive, time-bound way, with the interview following the days and the times when various travel modes were used.

6.2 GPS tracking methods

The GPS trackers used were not the originally intended MobilityMeters which, although robust and already tested in previous mobility projects (Flamm, 2007), required specific wiring with which to be charged every night and were rather large and inconvenient. We opted for the smaller and more modern-looking GPS GT-730 Data Logger (Canmore Electronics Co, Ltd). In initial tests, they produced GPS data of better quality than the MobilityMeter; they were also smaller and easier to use, fitting easily into a person's pocket, as well as looking less antiquated. Indeed, the GPS GT-730 Data Logger resembles a slightly enlarged USB key, with a USB socket. It was therefore possible not only to charge it using a standard USB/electric adaptor (which in the past ten years has become a standard device in most people's homes or pockets) but also in the USB port of any computer or laptop. The few participants who did not have an available USB/electric mains socket were lent one by the project manager. Towards the end of the GPS phase, we discovered a triple-USB socket at IKEA, which was easy to use, cheap, and even served as a visual prompter for people who might forget the tracker when leaving their office or home.

Thanks to this new kind of USB-compatible GPS tracker, it was possible to brief the participants to accomplish a double-action (easier to remember than two separate actions): to switch the tracker off when plugging it into the socket, and to switch it on when removing it. This process (as well as the triple-USB socket mentioned above) were integrated into the project little by little, in a learning-by-doing way. It is hoped that this will prove useful for future research.

It can be seen that equipping participants with GPS trackers and getting them to use them properly was not straightforward. For this reason, it was not practical to also ask them to carry a pedometer. Participants who already had a pedometer function on their smartphone were asked to contribute the number of paces that they had accomplished during the GPS tracking phase. But because each application (app), each telephone and each person has his/her own characteristics we did not consider that these data could be comparable between subjects. The number of steps, if available, was used as an additional set of information for each participant, and was integrated into the discussions held during the GPS follow-up interviews.

It should be mentioned that when, as a test, 2 pedometer functions were installed on the same telephone (iPhone 4), we found that the apps produced wildly different

estimates although they were interpreting data from the same accelerometer integrated into the telephone. The application Steps was found to be extremely generous, while Moves.app was conservative. The Moves.app was considered useful and was suggested to the participants, however hardly any of them accepted to use it, for several reasons: lack of interest in the number of paces that they were carrying out; presence of another app they did not wish to uninstall; the high demand on batteries imposed by this application. The latter of these reasons was particularly important: on balance, we preferred participants to concentrate on charging the GPS tracker correctly and turning it on/off at the appropriate times, rather than enduring the double burden of having to charge two devices neither of which could hold out more than 12-14 hours.

Indeed, whereas the GPS trackers were advertised as being able to function “up to 18 hours”. Despite an initial test where one tracker held out for 15 hours, we soon realised that their usual survival time was more in the range of 12-14 hours. This was a distinct problem. Another challenge is that when participants were inside a building, the tracker would “make up” all kinds of points that would fly out of the building, resulting in a sea of dots around the building as well as outrageous arrows flying out at random onto surrounding mountains. The precise reason for these tracking artefacts is not known, but it entailed an impressive loss of time during data preparation – and sometimes also some exasperation during the follow-up interviews when there had not been enough time beforehand to clean up the data, or when some doubtful points had to be left open for discussion, just in case they were true (in one instance, a weird-looking projection across the lake turned out to be a trip on a boat and not an artefact as suspected).

The GPS trackers proved highly resilient. In one case, a participant went swimming while carrying a tracker in his pocket. Although the tracker ceased to function, the GPS data already present in the memory was intact and was successfully retrieved. The main problem associated with the tracker was the limited autonomy of the integrated battery. Although the charging time was relatively short (less than two hours to full charge, just a 20-minute charge gave an autonomy of several hours) none of the tested trackers lasted much longer than 12 hours. This was unfortunate, because it led to one of our most promising and interesting subjects leaving the project prematurely. This person had extremely long working hours, during which she was extremely active and therefore unable to recharge the tracker. But apart from this single, isolated incident, it proved possible to use the trackers in a satisfactory way.

Thanks to their USB socket, the trackers could be plugged into a large-screen PC (HP Pavilion) and the GPS could be downloaded. Basic transformation of the data, via an Excel file, enabled the information to be visualised on the screen, within a MapInfo window supporting the TripDiaryEditor plug-in developed by Michael Flamm, who served as a consultant for this part of the project.

Each study participant carried the tracker in his or her pocket for an average of 8-10 days: a full week + a variable number of days, due to practical considerations such as finding a time for picking up the tracker, time to prepare the data, and then a time for the interview itself. The time to prepare the data turned out to be a lot longer than expected. While preparing for the first GPS follow-up interviews, we realised that many useless points were generated by the system when the participant was indoors. Some were projected many kilometres away, or people were "projected" into the lake or onto the top of a mountain in the middle of the night; the time spent at these bizarre locations usually registered as 0.00 seconds, which we used as a criterion for manually eliminating these points. But some of these erratic points were in feasible locations and needed to be checked with the interviewees, so they proved to be a time-consuming and potentially bias-inducing problem.

It took us many hours to manually remove these points, with the risk of losing real information in the process. So we asked the later participants to switch off the tracker when they were likely to be indoors for a long time. This had the double objective of limiting the number of useless points and of increasing battery life. Because there was always a risk of the participant forgetting his tracker, we suggested linking two actions to each other: plug in the tracker, and switch it off. We even acquired some Ikea multi-plugs which were highly visible and therefore made it easier for people to remember to pick up their tracker on their way out.

In some cases, the number of trip segments was too high for the system to handle, so the Excel files (.csv) were split manually, in places which were suggested by the Trip Diary Editor. In these cases, there were two Excel files, giving rise to two RAW (.raw) files, which were integrated successively into the participant's travel diary. For example, in the case of participant 5389, an excel file with 105'022 lines (corresponding to 105'021 data points + the title line) was split into file 5389a.csv 77391 with data lines and 5389b.csv with 27630 data lines. Although these modifications were carried out using Excel, it then proved necessary to copy-paste each of the sub-files into the Notepad so that the Trip Diary Editor could use them (the .csv files were not usable in this case, it is not known why).

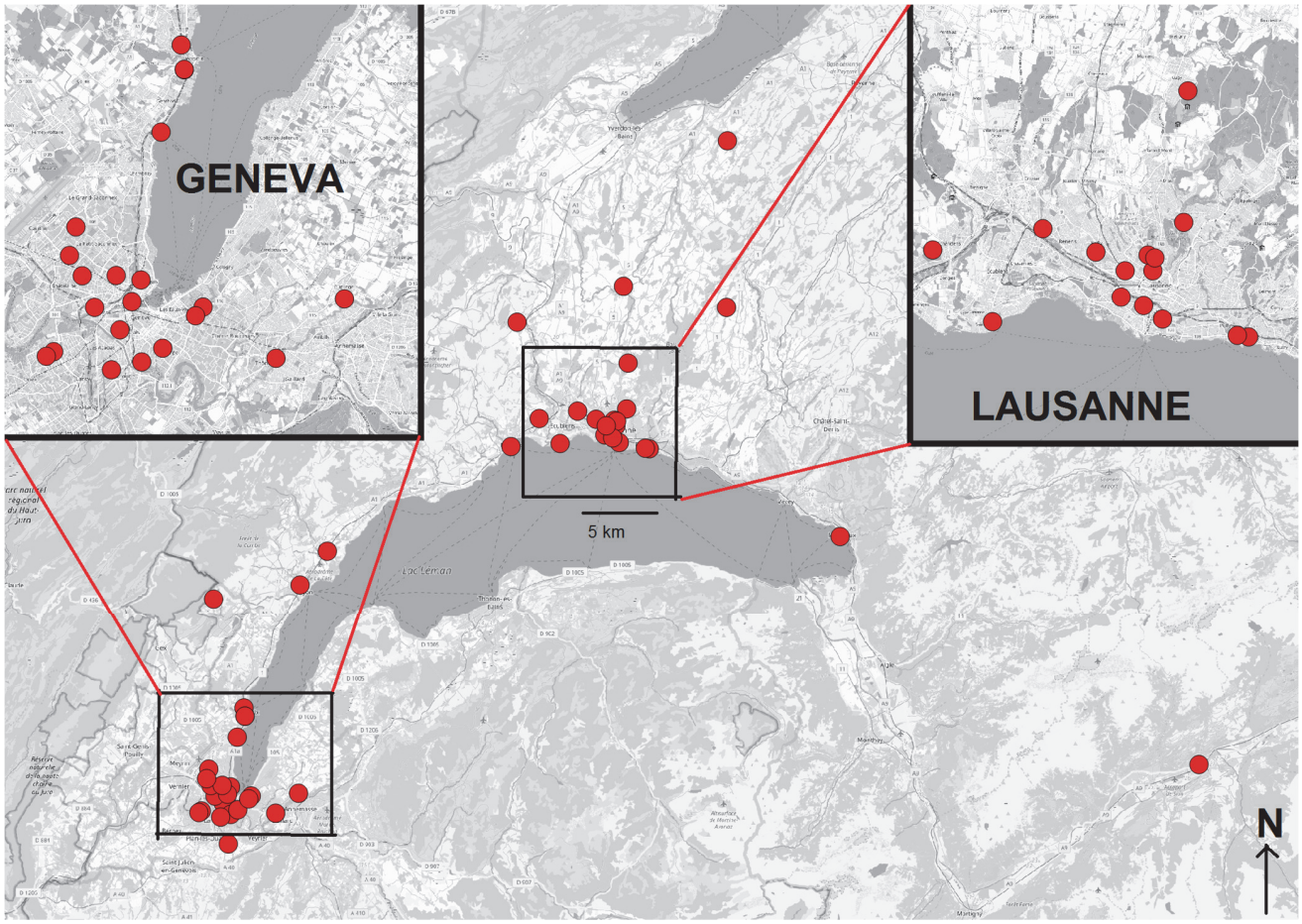

Figure 6-1. Map of the study area with insets for Geneva and Lausanne; dots represent study participants.

6.3 Results from the spatial/GPS phase

GPS tracking results were obtained from 48 participants and are presented below. After careful review of these data, it was decided to concentrate detailed analysis on a subset of 20 participants, who were fully qualified as frequent walkers and maintained a high degree of diversity. The participants are identified using a pseudonym followed by a number.

Of the 50 participants initially recruited to the GPS part of the project, one decided to quit for personal reasons; another was married to another participant and since they did most of their walking together they decided to "share" one GPS tracker (in the analysis they are considered as a single participant – the person who actually carried the tracker). The final number of participants in the GPS tracking phase was therefore 48. The participants all lived in the cantons of Geneva and Vaud, except one who lived in neighbouring France and another who lived in Canton Valais. Both of these people worked in Canton Vaud, therefore the recruitment criteria of either working or living in cantons Vaud or Geneva were respected. In the GPS phase, the sample was 54% female and the average age was 48 years (SD: 14 years).

The average walking was almost exactly 5 kilometres per day (5.02 km). However, this average sits in the middle of wide disparities. A score was created in order to judge whether participants were bona fide frequent walkers or not. This score was a combination of walking time and of walking distance, so that both fast walkers and slow walkers could be treated even-handedly. The maximum score was 10 for a full-blown frequent walker, and the average was 7.5 in our sample. Detailed analysis about the types of walkers associated with these scores will be treated in the section on typologies. Using this metric, 40% of our sample might be qualified as full-blown frequent walkers, with the remaining 60% scoring anywhere between 2 and 8 points.

Average walking time was 1.13 hours, i.e. around 1 hour and 20 minutes. Average tracking time was 12.0 days, of which 10.9 days contained usable data. There was therefore an average of one day's data lost per participant, corresponding to times when the GPS recorder was not functioning and/or was not being carried by the participant.

Mean speed was 4.6 km/h. There was an average of 89 walking segments and 64 walking trips per participant, amounting to around 55 km of walking over the 10.9 days of tracking. Total walking time over this period was on average 11 hours, of which only 2.3% of the time was engaged in pausing.

We decided to listen to all the Qualitative and GPS audio recordings. Altogether there were 89 recordings (some of the 74 participants had a prior and GPS interview), amounting to over 200 hours of information. Given the high quantity and quality of the information, it was decided not to write out each interview *in extenso*, but listen to the recordings while taking written notes. Whenever a relevant theme was identified, a written box was constructed with verbatim comments by the participant. Subjective headings were given to these boxes, then they were grouped into core themes. Finally, when similar citations covered the same topic, the more relevant ones were selected.
The results are presented on two levels. First, there is a selection of study participants who had particularly interesting or typical profiles at the qualitative and/or spatial level. Individual themes are then explored and supported by quotations from the study participants.

ID	Pseudo	Age	Sex	Place	Recruited	Status	Household	Meet others
1165*	Kevin	44	M	Lausanne	ça marche	Working	Couple + children	Yes
1461	Ginette	72	F	Geneva suburb	Newspaper	Retired	Living alone	Yes
1483*	William	44	M	Lausanne	Direct	Working	Couple	Yes
2109	Diana	54	F	Geneva countryside	Bus santé	Not in employment	Couple	No
2144*	Tiffany	49	F	Lausanne	ça marche	Working	Couple	Yes
2188	Edwin	59	M	Lausanne	Direct	Unemployed	Couple + children	Yes
2601	Tamara	38	F	Lausanne	ça marche	Working	Couple + children	No
2647	Matthew	43	M	Lausanne	Indirect	Working	Living alone	n.a.
2820	Kelly	58	F	Geneva	Direct	Working	Living alone	Yes
2953	Karl	73	M	Geneva	Bus santé	Self-employed	Living alone	n.a.
3521	Olivia	51	F	Geneva	Newspaper	Unemployed	Living alone	Yes
3966	Fred	60	M	Lausanne	Newspaper	Working	Couple + children	No
4028	Lisa	54	F	Lausanne	ça marche	Working	Couple + children + dog	Yes
4033	Walter	67	M	Lausanne	Direct	Retired	Couple	n.a.
4098	Bernard	33	M	Lausanne	Direct	Student	Living alone	Yes
4172	Alberto	47	M	Geneva	Direct	Working	Couple + children	Yes
4334	Wendy	29	F	Geneva suburb	Bus santé	Working	Living alone	Yes
4468	Kirk	73	M	Geneva	Direct	Retired	Living alone	Yes
4506	Peter	54	M	Versoix	Newspaper	Working	Couple + children	Yes
4608	Deborah	62	F	Vaud countryside	ça marche	Working	Living alone	Yes
4640	Xenia	46	F	Lausanne	ça marche	Working	Couple + children	n.a.
4964	Graham	51	M	Lausanne	ça marche	Working	Couple + children	Yes
5136	Daisy	33	F	Morges	Direct	Unemployed	Catherine	n.a.
5290	Georgina	44	F	Montreux	ça marche	Working	Couple	n.a.
5389*	Keisha	52	F	Lausanne	ça marche	Working	With children	No
5538	Henry	55	M	Vevey	Direct	Working	Couple + children	Yes
5703	Noëlle	62	F	Geneva suburb	Newspaper	Retired	Living alone	Yes
5864*	Edmund	46	M	Lausanne	ça marche	Working	Couple + children	Yes
6210	Zoé	23	F	Geneva suburb	Newspaper	Student	With parents	Yes
6261	Bérangère	53	F	Lausanne	ça marche	Working	With children	No
6283	Wanda	34	F	Geneva	Direct	Working	Living alone	Yes
6415	Frank	55	M	Geneva	Bus santé	Working	Couple	n.a.
6603	Deirdre	38	F	Geneva	Newspaper	Working	Couple + children	No
6819	Benjamin	20	M	Geneva suburb	Newspaper	Student	With parents	n.a.
6940	Teresa	46	F	Geneva	Direct	Working	Living alone	Yes
6995	Honoré	60	M	Nyon	Newspaper	Working	Couple + children	No
7022	Claudette	59	F	Geneva	Direct	Working	Living alone	n.a.
7226*	Paul	32	M	Geneva	Direct	Student	Living with parents	Yes
7432	Trevor	29	M	Lausanne	Direct	Student	Living alone	No
7470	Ophelia	51	F	Geneva	Bus santé	Working	Couple + children	Yes
8194*	Kathleen		F	Lausanne	Direct	Working	Couple	Yes
8618	Oksana	42	F	Lausanne	Direct	Working	Living alone	Yes
8708	Tania	47	F	Versoix	Newpaper	Working	Couple + children	No
9131	Renato	34	M	Sion	Newspaper	Working	Couple	Yes
9354	Daniela	49	F	Nyon	ça marche	Working	Couple + children	Yes
9427	Tony	67	M	Geneva suburb	Bus santé	Retired	Couple	n.a.
9512	David	69	M	Geneva countryside	Snowball	Semi-retired	Couple + children	No
9937	Fabiola	63	F	Geneva	Newspaper	Semi-retired	Couple	Maybe

Table 6-1. Participants in the Spatial/GPS phase (N_2 = 48)

*: also participated in the Qualitative phase, n.a.: no answer or not applicable

6.3.1 Towards creating groups

Here, we are suggesting approaches towards creating a typology of frequent walkers. They should be viewed as propositions and not as a definitive typology. After the first interviews, it became clear that distances walked varied considerably from one participant to another, but this was not the most interesting contrast, because it was a difference in degree rather than in nature. The single most important difference that appeared to us was whether the frequent walking behaviour – whatever its regularity and extent – was integrated into the person's personal travel routine. For some participants, walking was clearly part of their transportation system: they would walk to work or to the train station, to the shops, to a friend's house, etc. For the other group, travel was mainly carried out using a private car, and walking was purely recreational. Many of these people had a dog.

As often seems to be the case, it is by identifying cases on the intersection between these two groups that it is easiest to understand this typology. One of our participants, a semi-retired man owning a dog, would systematically drive into town on his own (without the dog); then he would return home, park his car, and take his dog on a walk in green areas around his house. During the GPS follow-up interview, there was an interesting occurrence: our participant was seen walking into town, a distance of several kilometres. It seemed all the more peculiar that he had just used his car for an errand, and on returning home had promptly set out on foot, towards the city centre.

The answer, logical but unpredictable (for the researcher) was very simple: the errand by car had been to a place where he could leave his dog in safe care for a few days. On returning home, he finally had the opportunity to swap his walking-for-leisure for walking-for-transport, which is why he promptly walked towards town. Interestingly, he did not take the main road which he usually took by car, but some and side-streets, some of which he knew about thanks to his walking around the home, with the dog.

This is, in our view, a good example of the imbrication of different types of walking in the routines of the same person. It shows that walking for transport and for leisure – or, indeed, for exercise – should indeed not be separated *ex ante*. Cases like this suggest that even *ex post* separation is scientifically fraught with danger: his walking into town and his driving into town had the same motive (going to his former workplace where he still maintained some residual activities), and used different modes for practical reasons. This man had a dog "prescribed" to him by his doctor a few years beforehand, due to an emerging heart condition. But it was only when the dog was temporarily removed that his walking behaviour was able to align with his transportation behaviour.

Another interesting case was a person living outside of Switzerland, who was able to participate in a face-to-face interview but who was not available for the GPS tracking phase. She used to drive to work every day without even considering any other options. Then one day, she broke her arm. After taking the bus for a few weeks, she became a bit restless and realised she did not enjoy waiting for, nor riding the bus. So she set off down the road. After enduring some remarks (she said other commuters didn't understand why she wanted to walk and at first would always stop to try to offer her a ride), she became used to her walking commute. Ultimately, her arm healed and she would have been able to take up driving to work again, but decided against it because she now thoroughly enjoyed her daily walking commute.

Based on the GPS data, an initial approach was to view the walking trips on a background map. This proved difficult to do, because the ranges were so different that it was not possible to compare maps with a similar resolution. For example, between a person doing all her walking in a 2-3 km radius around their home and a person walking in several towns several km from each other, a detailed map would suffice for the former participant but not for the latter where several towns would have been excluded. And a more general map would not give justice to the "local" walker's complex walking behaviours over a small area.

For these reasons, it was decided to choose for each participant a map (or max. 2-3 maps) which made the most information visible to the reader. Then the maps were placed on the floor and the PhD candidate attempted to place them in groups based on visual characteristics. Once this had been done, the maps were placed again on the floor, at random, and 3 colleagues were asked to carry out the same exercise. One of these colleagues was a political scientist well-versed in transportation issues, the other two were architects. There was gender balance (2 men and 2 women, including the PhD candidate). The results were that the main differences were between loops and linear patterns, and between continuous and interrupted routes. The number of these routes or groups of routes was another case in point.

Another analysis was based on the quantitative results obtained from the GPS data. The analysis of these data showed that not all the participants were bona fide frequent walkers – or, if they were, then much of their walking had taken place indoors and was therefore not amenable to GPS tracking. With the caveat of this indoor walking (including stairways) not being taken into account, we were able to create a suggested typology based on mean distances covered per day.

A first group could be qualified as "extreme walkers" because their daily averages were in the range of 8-12 km, usually amounting to over 2 hours of walking per day. A second group might qualify as "core frequent walkers" with around 5-6 km and 1-1.2 hours of walking on an average day. Described as "infrequent walkers", those under 4 km/day and/or under 30 minutes per day, the third group is also of interest because they went through the same selection process as the first two groups. It is

therefore a challenge to find out how and why they came to believe that they were frequent walkers when there is considerable data to suggest that they were not. Hypotheses about the presence of such “infrequent walkers” include the following: intense walking inside or around buildings, including up and down staircases; exceptional circumstances leading to reduced walking during the GPS tracking phase; forgetting the GPS tracker or having it switched off or not functioning during most of the walking phases; and outright denial (high or outrageous claims about walking performance, disconnected from reality). Of course, a combination of these four themes is possible.

As far as possible, the walking phases where the tracker had been either not functioning or not present were removed manually from the GPS follow-up. Also, exceptional circumstances did not lead to extra walking bouts being inserted manually into the data (which would have reduced the overall quality of the GPS tracking data, the whole idea of which was to be a separate source, complementary to self-declaration), however information on such instances was actively sought for during the follow-up interviews. In most cases, the “exceptional” situations were not that unusual, in the sense that they included instances such as being ill and not going out for 1-2 days; or the person was on holiday during part of the GPS tracking period. Both these situations were considered to be typical of daily urban life and therefore the data were kept in the database.

6.4 Profiles of study participants

Based on the analysis of the GPS tracking information, and of information from the prior interviews when available, we drew up a preliminary typology. This includes: local urban walkers, super-walkers, walking commuters, discontinuous walkers and leisure walkers. For each of these profiles, we have selected a couple of examples from our study participants. A last category, entitled composite profiles, contains frequent walkers who could not be integrated into one of the previous categories, or who displayed patterns of behaviour that could enter into several categories. It is important to emphasise that there were men and women, younger and older people, and representatives from Vaud and Geneva in all of these profiles. The objective here is not to "affiliate" each participant to a particular category, or to perform quantitative analysis on qualitative material, but to define a handful of categories that should be understood as "ideal-types". We hope that this experimental typology will prove useful for future research on walking and frequent walking.

6.4.1 Local urban walkers

These are people who tend to be in their mid 30s to early 50s in our sample. They mostly live in the centre of either Geneva or Lausanne and have opted for a lifestyle linked to proximity: very often, the live, work, shop and do almost everything else

within a small surface area. Although they walk and rarely use any other form of transportation, because the distances are short they do not necessarily clock up impressive walking times or distances. This theme covers participants and behaviours that are limited to a relatively small geographical area, covering only one or two Communes.

 **Kevin 1165.** This participant in his early forties lives and works in central Lausanne, has young children, and does not consider himself a super-walker. In the morning, he walks part of the way (it is mostly uphill), then hops on a bus to go to work. He generally walks all the way home (downhill) in the evenings. He is presented as a typical example of a **local urban walker**, who uses few modes other than walking. Because his centres of interest are relatively close to his home, he does not cover great distances: his walking average is only slightly over one hour per day.

 **Deirdre 6603** displays a similar **local urban walker** profile, but in Geneva. She lives and works on the same side of the city, rarely crossing the bridges to the other side. She has young children and works part time, uses public transport rarely and does not have a driver's licence (her partner does, but they don't own a car). She clocked up only 38 minutes of walking per day during the GPS tracking phase, because her activities are all within a 2 km radius, and because she was sick during 2 out of the 11 days of tracking.

 **Tamara 2601** is another **local urban walker** in Lausanne (but not in the same area as Kevin, one being north of the main train station and the other to the south). She also has young children, and lives and works within a relatively narrow radius. She moved from a smaller town into central Lausanne 8 years ago, to achieve a proximity lifestyle based on walking with very little car or bus use. Our GPS tracking shows that she walks slightly less than one hour per day in public space, due to her centres of interest lying so close to each other.

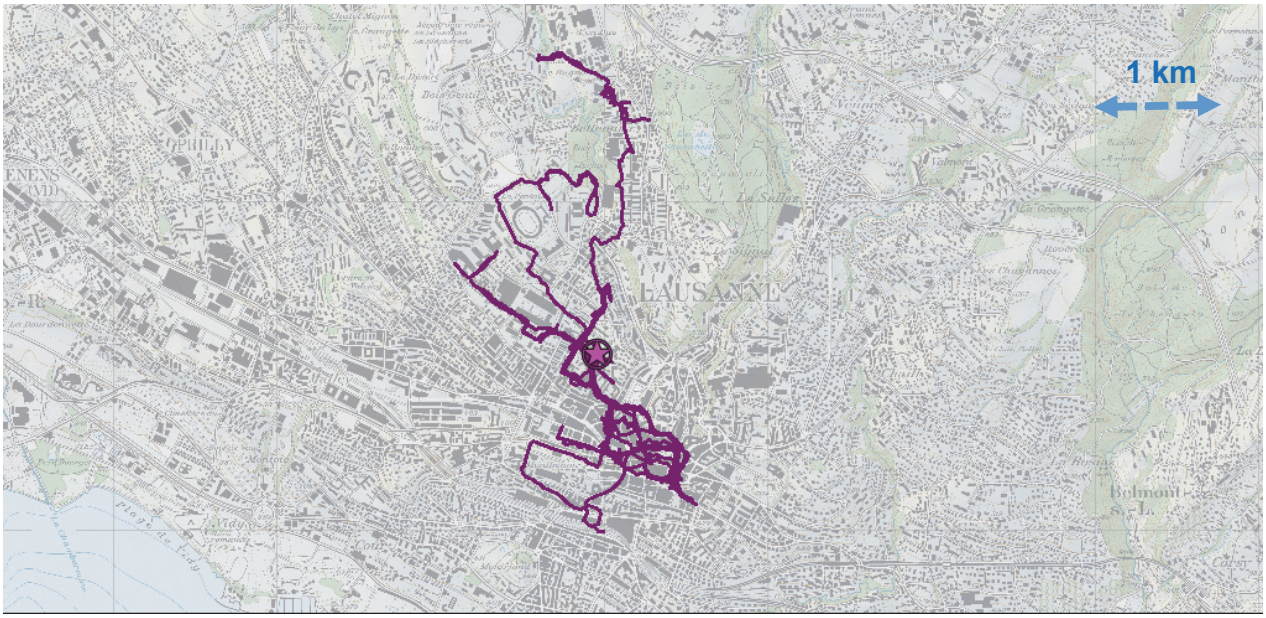

Figure 6-2.Tamara's continuous, localised walking (11 days of GPS tracking data), mostly in central Lausanne

Tamara's organisation is minutely organised across a limited area. Remarkably, there are no “jumps” or “submarines” going to other parts of the city, thus implying that Tamara does not use public transportation very much – nor does she drive a car. This type of organisation is local and sustainable. It is also quite varied. Extensive details cannot be given for confidentiality reasons, but we can say that such people tend to live and work in places close to each other and close to the city centre. Such people tend to be in an age bracket between 30 and 50 years old. They often – but not always – have children. If they do, they go to local schools, and most of their shopping and leisure activities are also in the vicinity. They often work part-time in the public sector or for civil society organisations. In a nutshell, this seems to be an archetype of urban living, free-ranging people. Their lifestyles are highly compatible with city life and with current injunctions towards health and well-being as well as sustainability.

6.4.2 Super-walkers

These are people who walk even more than the average frequent walker, often up to 2 hours per day outside of the home and workplace. Most of them live outside city centres, in suburban settings. Their walking might also be referred to as "generalised walking" because they routinely walk over distances that would not even occur to other people as being walkable. This theme therefore covers participants and behaviours who cover a large area, with little input from other transportation modes. It follows that these are people who cover very great distances every day, typically around double what other frequent walkers do.

Keisha 5389 was 49 years old when we met, and her approaching 50th birthday played an important role in her discourse. Her conversion to frequent walking was recent and linked to a pedometer (first manual, then an app). She strives to do her 10'000 steps per day, even stepping out of doors after her children are in bed in order to fulfil this goal. She is selling her cars one after the other (she had three) and has changed jobs in order to be more physically active. She lives in a leafy suburb east of Lausanne and frequently walks into town (around 4 km). She averages 1.5 hours of walking per day and can be described as a **super-walker.**

William 1483 is another impressive walker. He manages 2 hours of walking every day, while holding down a full-time job. He walks daily between Renens, Lausanne and the lake-side, usually along main roads, indifferent to traffic, at a very fast pace (6-7 km/h) with headphones on his ears. He is enthusiastic about walking, which he embraced in order to lose weight but that is now one of his main pleasures in life. On week-ends he goes hiking, of course. He is evidently a **super-walker**.

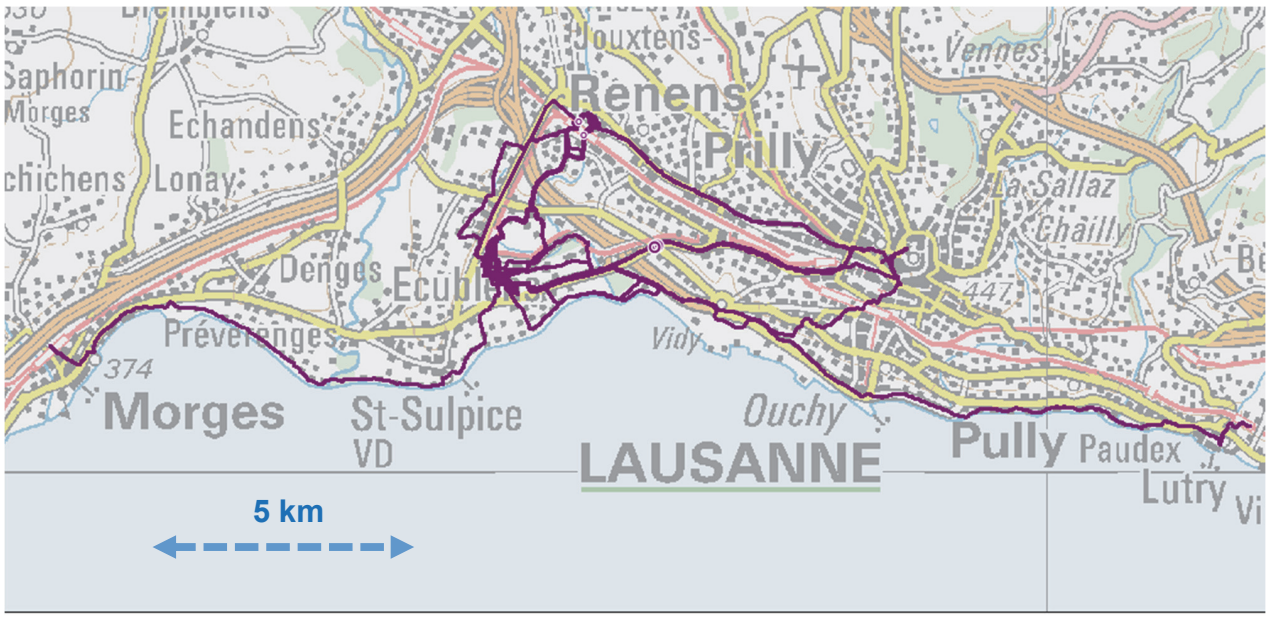

Figure 6-3. William's continuous walking around Lausanne – the sign of a super-walker (9 days of tracking)

In the person below, we have a similar situation, in Geneva. The distances covered are also considerable. In both cases, there is some walking in desirable areas (along the lake in Lausanne; in parks and along the lake in Geneva). There is also some walking in less desirable areas.

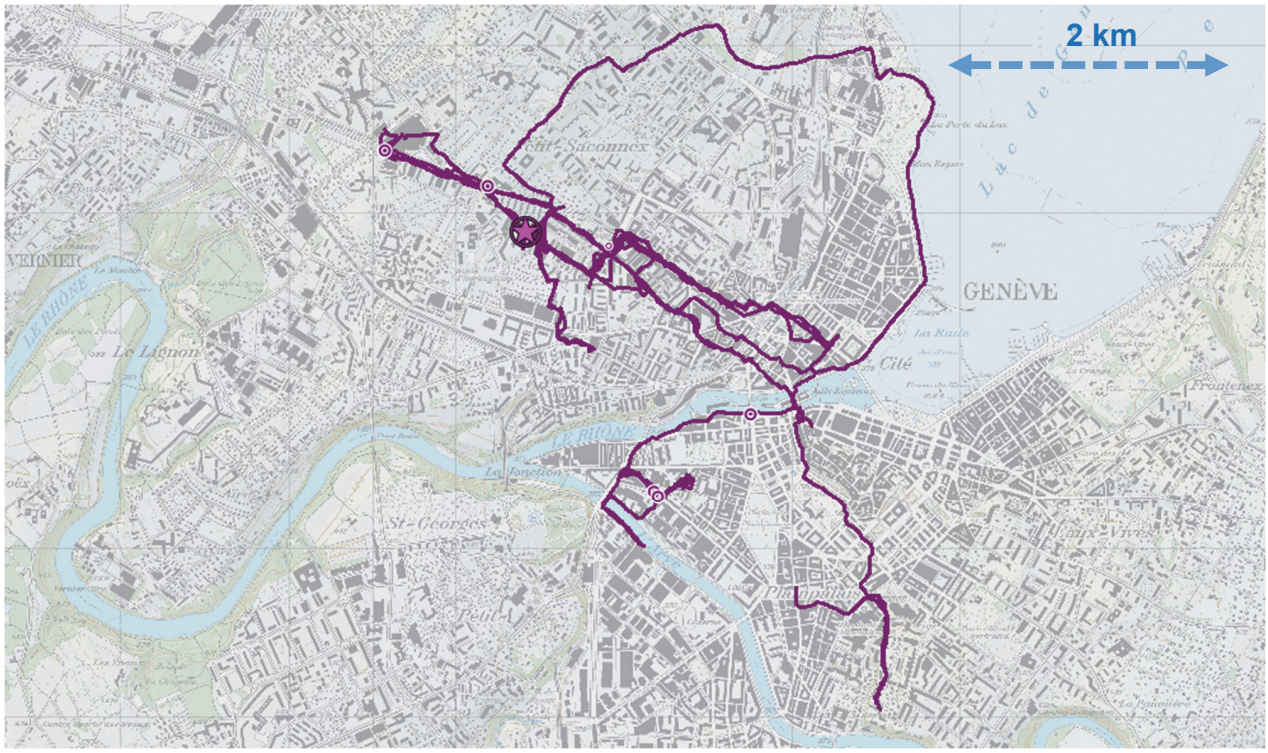

Figure 6-4. Continuous, generalised walking patterns in Geneva, over 8.5 days of GPS tracking

6.4.3 Walking commuters

This group is interesting because it contains people who are both multimodal (usually combining walking and public transport) and sustainable in their outlook and behaviour. The difference between these walkers and the two groups described above is that their walking is more predictable: it is usually attached to a recognisable routine. A few examples are given, as well as maps, to emphasis the repetitive nature of the walking patterns in this group. Walking commuters often display "bi-localised walking", i.e. walking at both ends of the commute, within the framework of a set routine.

Diane 1144 is a young woman who was not able to carry through to the GPS phase due to her pregnancy. She lives on the outskirts of Morges and typically commutes from there to central Lausanne, where she works. She would typically take the bus from her home to Morges station, then the train into Lausanne. There, whereas others take public transport, she would walk up the hill to her workplace and back (a round trip of almost an hour). She is an example of a **walking commuter** who associates trains and walking, while avoiding public transport in the city: she takes the bus on one side of her commute, and walks on the other.

Tiffany 2144 is also a young woman living near Morges. She is an accomplished athlete and runs regularly for training and in competitions, as well as walking for more than an hour and a quarter per day. She also enjoys hiking in the mountains. She walks on both sides of her commute: to a train station near Morges and from Lausanne central station up the hill to her workplace. She avoids urban public transport and gets a lot of pleasure out of walking and/or running in open space. Independent from all her extra activities, she is essentially a **walking commuter**.

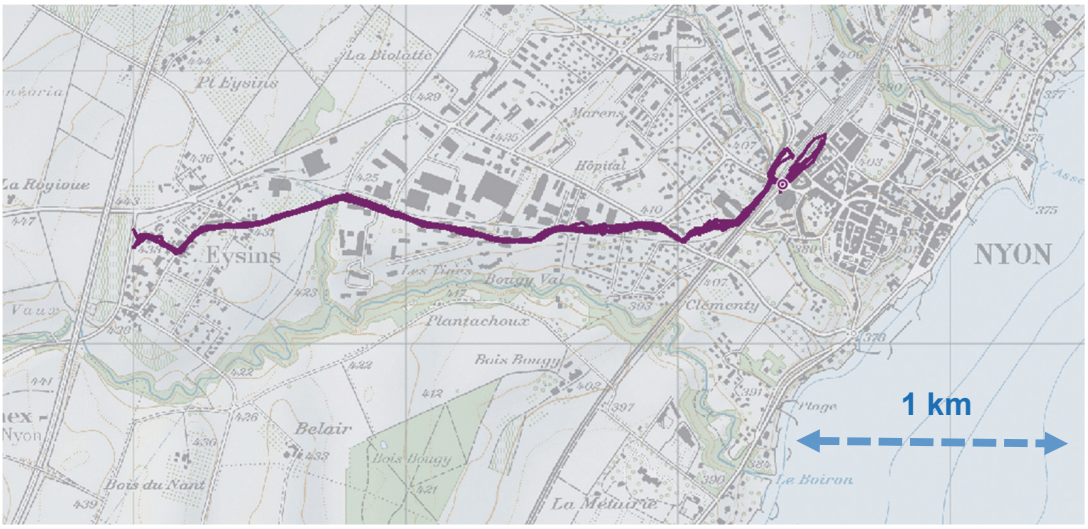

Figure 6-5. A typical walking commute into the centre of Nyon (over 11 days)

The figure above corresponds to another **walking commuter**, who has extremely regular habits. The map shows data over one full week, however the behaviour is so regular that the individual days can almost not be distinguished from each other. The walking trip goes from a car park in Eysins to the main train station in Nyon, from where the intermediate trip is done by train (then there is more walking to get to the person's office near Lausanne). This participant therefore drives his car, takes the train and walks considerably, 4 times a week (he works from home one day per week).

6.4.4 Discontinuous walkers

These people typically walk around their home, but also around their workplace or in other areas such as city centres. We use the term "discontinuous" because the various walking bouts seem disconnected from each other when visualised on the GPS-based maps. In fact, these walking areas are usually connected by public transportation.

Daisy 5136 was unemployed at the time of our meeting, living in central Morges with her children. She spent her time travelling between Morges and Lausanne by train, and in a complex set of activities within the two towns, where she walked and on occasion used public transport. Her activity patterns were concentrated in the central parts of the two towns, where GPS tracking is difficult because the buildings, with thick walls, are very close to each other. She is an example of a **bi-local walker**, with a very tight network of walking routes in two towns joined together by train rides. It is interesting to note that such an arrangement does not require “commuting”.

Daniela 9354 lives in Gland and works in Nyon (two neighbouring towns between Lausanne and Geneva). She takes the train from one to the other and walks to and from her destinations within both of these small towns, for work, shopping or other pursuits. But her walking in both towns is limited she averages less than an hour a day, due to her centres of interest being very close to the train station in both towns. She is simultaneously **bi-local** (like Daisy) and **local-urban** (like Kevin and Tamara).

Wanda 6283 lives in Geneva, near the United Nations area. She works part time and partly at home. She typically walks into town through the string of parks that descend towards the main station (Cornavin). She lives alone and juggles between walking and urban buses, which she is happy to use. Her organisation plans demonstrate a thorough knowledge of the public transport and pedestrian networks. She averaged only 36 minutes of walking per day in the GPS tracking phase, because on any given day she either walks a lot or stays at home to write – which she did frequently during the study period. She is a **complex bimodal walker**.

The figure below is the most typical that we could find among our 48 participants, to show disconnected walking – that is in fact connected by public transport. Since some information is already visible on the map, we are deliberately giving less detail about this person for confidentiality reasons. This **complex bimodal walker** walked in 4 different areas during the GPS tracking phase. The first map shows the general situation around Geneva, the following maps are detailed views of the 3 most frequently visited of the 4 areas.

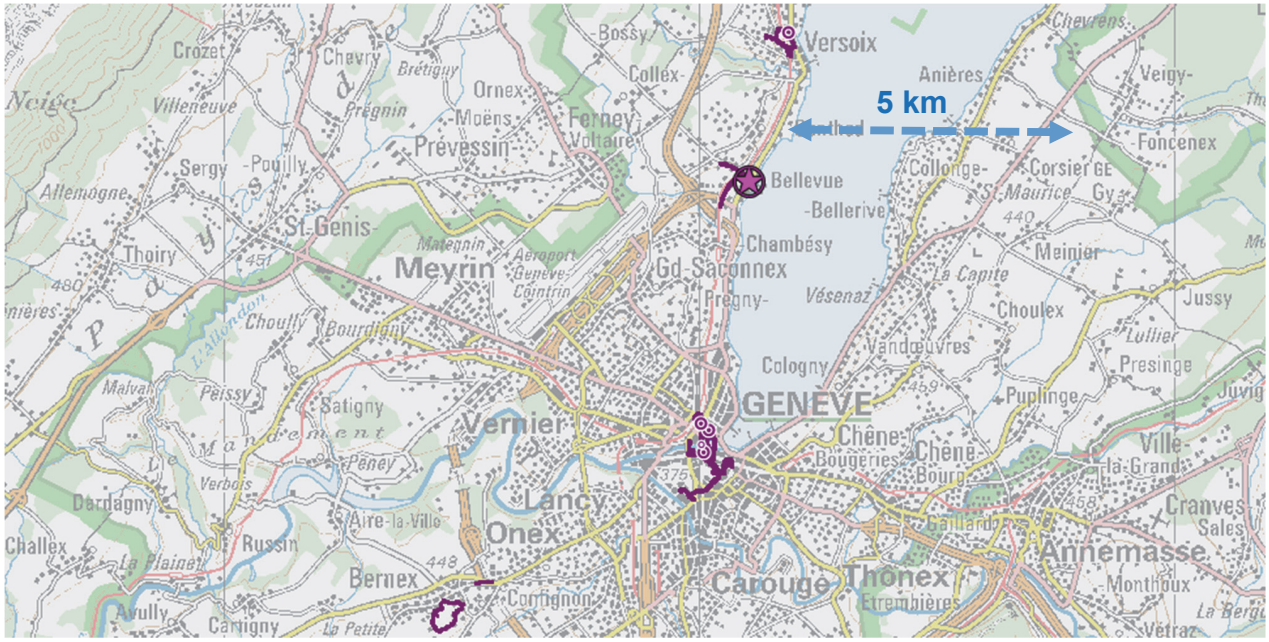

Figure 6-6. Isolated bouts of walking, connected by public transport, over an 8-day period

In the map above, it is useful to know that a regular train service connects Geneva, Bellevue and Versoix. It is this service that the person uses to move from one place to another. Once arrived in Geneva, the person almost always chooses to walk rather than taking the bus. The map below shows details of an outing in neighbouring Versoix, a small town along the lakeside. It can be seen that some of the walking has been done along the route Suisse (the road closest to the lake, next to number 384 on the map). This is a very busy road with high levels of noise and air pollution. It is interesting that the same person, on the same day, also went to the canal (on the far left of the picture), which is one of the quietest areas in the region.

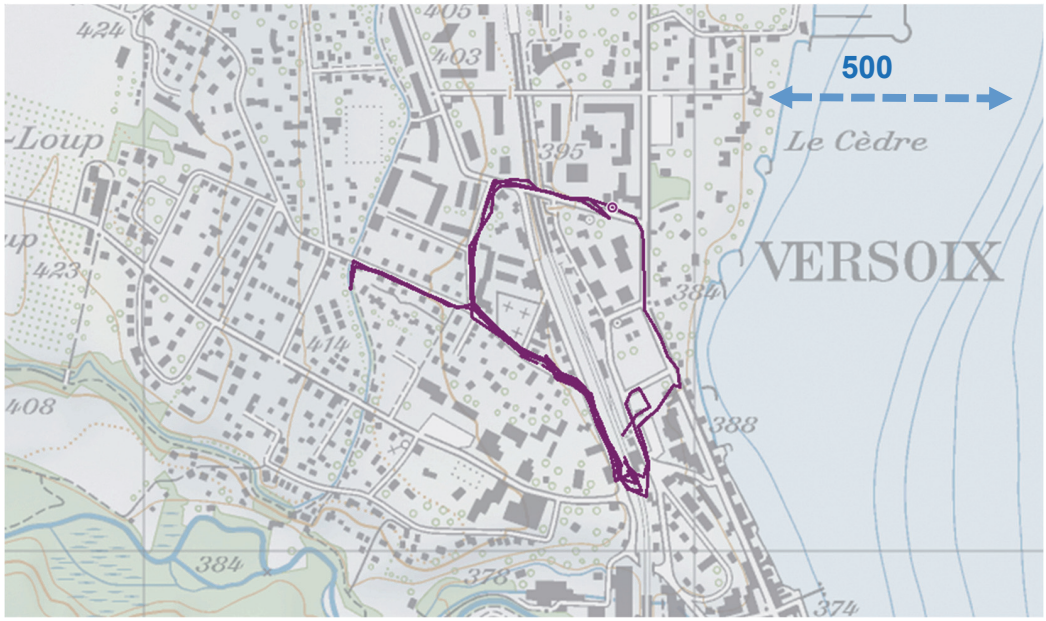

Figure 6-7. Detail of a day trip by train, with walking in a small town by the lake

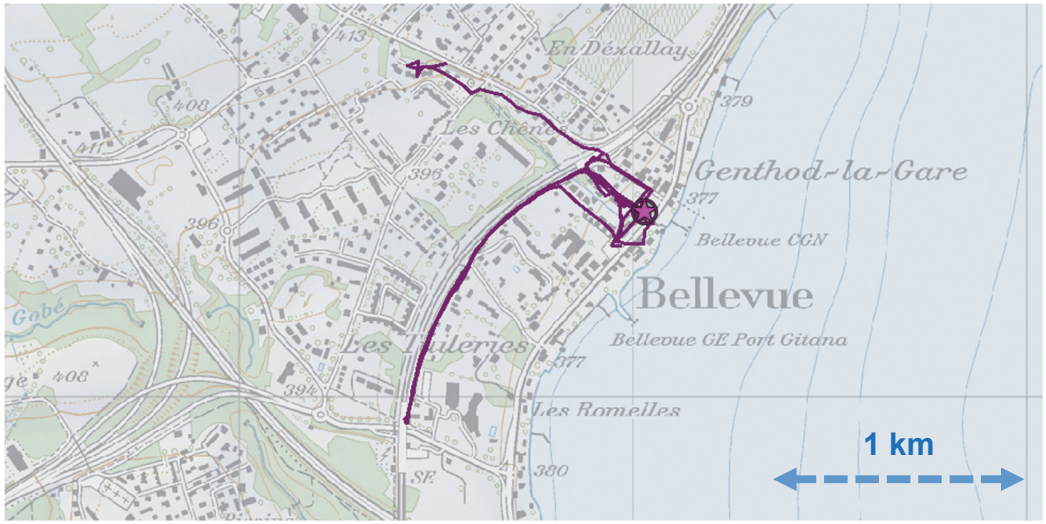

Figure 6-8. Detail of above figure, around the respondent's home (8 days of GPS tracking)

In the map above, what is interesting is that the person walks around her home (symbolised by the star) and seems to have several destinations within the village of Bellevue. Thanks to the GPS debriefing interview, we ascertained that the line at the bottom of the map corresponds to the person getting off the train one stop before the usual stop, and walking along a pleasant footpath parallel to the railway tracks. The line towards the top left of the map corresponds to a visit to a family member who lives nearby. Within the village, it is interesting to see that this person uses the 3 possible routes from their home to the railway station.

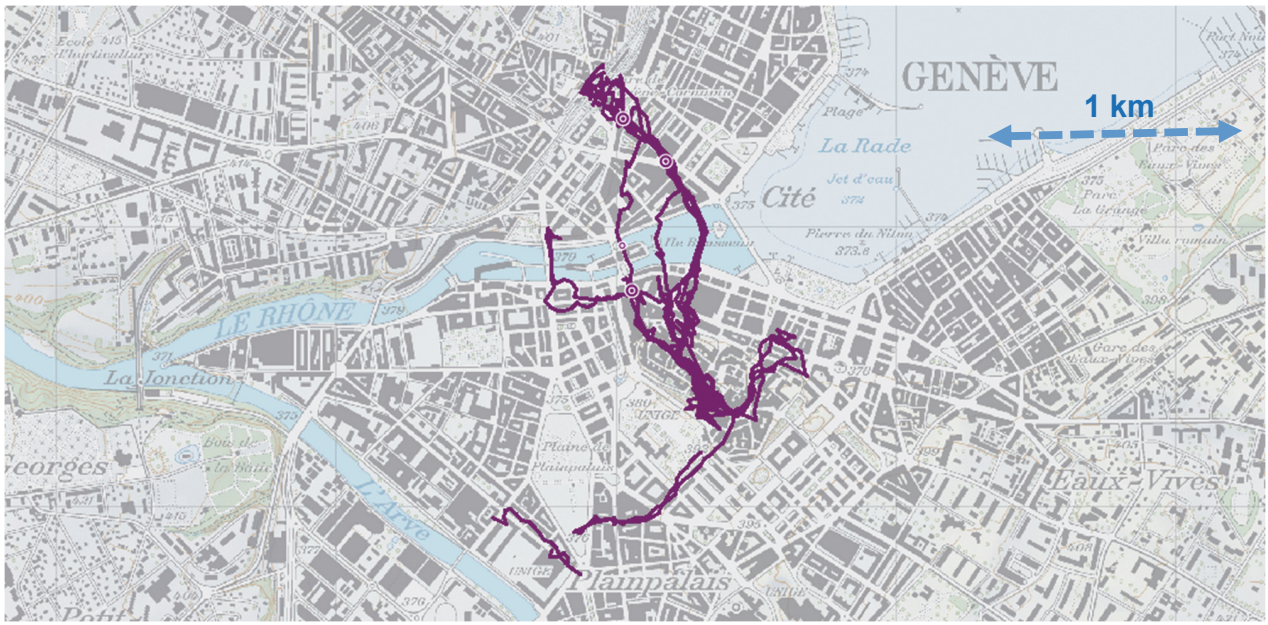

Figure 6-9. Detail of walking in Geneva city centre (8 days of GPS tracking data)

What is interesting about the above map is that the person regularly enters the city by train (the node at the top of the picture corresponds to Geneva's main station), and then has alternative ways of walking towards the old town and city centre that are situated the other side of the Rhône river. During the GPS follow-up, that lasted

less than 2 weeks, the person used no less than 4 out of the 5 bridges that could reasonably have been used. Only the furthest away and most heavily trafficked bridge (pont du Mont-Blanc, separating the Rhône river from the lake, close to number 375 on the map) was not used. The more frequently used bridge (to the right, with the thicker markers corresponding to multiple trips) is essentially a footbridge, like the one on its left.

The central walking bouts (just above the markers 380 and UNIGE) correspond to the old town, which is partially pedestrianised and has the double advantage of being quiet and with interesting views and buildings (cathedral, town hall, etc.). The dominating impression is that this frequent walker does isolated bouts of walking that are connected by train.

6.4.5 Leisure walkers

This heading includes people who walk for leisure but usually not for transportation purposes. This may be because they are retired, because they have a dog and do their daily commute by car, or for other reasons.

Edmund 5864 lives with his family in the rolling countryside to the north of Lausanne (Gros de Vaud). All his travel is by car and almost all his walking is related to leisure and, especially, to walking a dog. So he is a **leisure walker** whose walking is mostly disconnected from his personal transportation system. The disconnect is not complete, however, because he parks his car at a distance from his workplace in Lausanne and is happy to clock up around 3000 steps (return trip) that way. He counts his steps and believes that his walking is roughly 50/50 between transport and **dog-related** leisure.

Noëlle 5703 also has a dog. She is recently retired and lives alone in a house on the outskirts of Geneva. All her walking is related to her dog, that she takes into the countryside by car before operating closed circuits of walking in various areas. She is therefore a **leisure walker**, whose walking is entirely **dog-related** with the exception of the occasional trek abroad. The disconnect between personal transport and walking is complete. She never uses public transport, but with her friends they regularly take turns to drive each other into town (carpooling) when they have a cultural engagement together.

Much of the leisure walking in our sample was linked to dog walking. A rarer way of walking for leisure is playing golf. We had two people in the total sample who claimed this activity. We selected the more frequent player for a GPS follow-up. In the map below, the amount and regularity of the golf-associated walking can be observed.

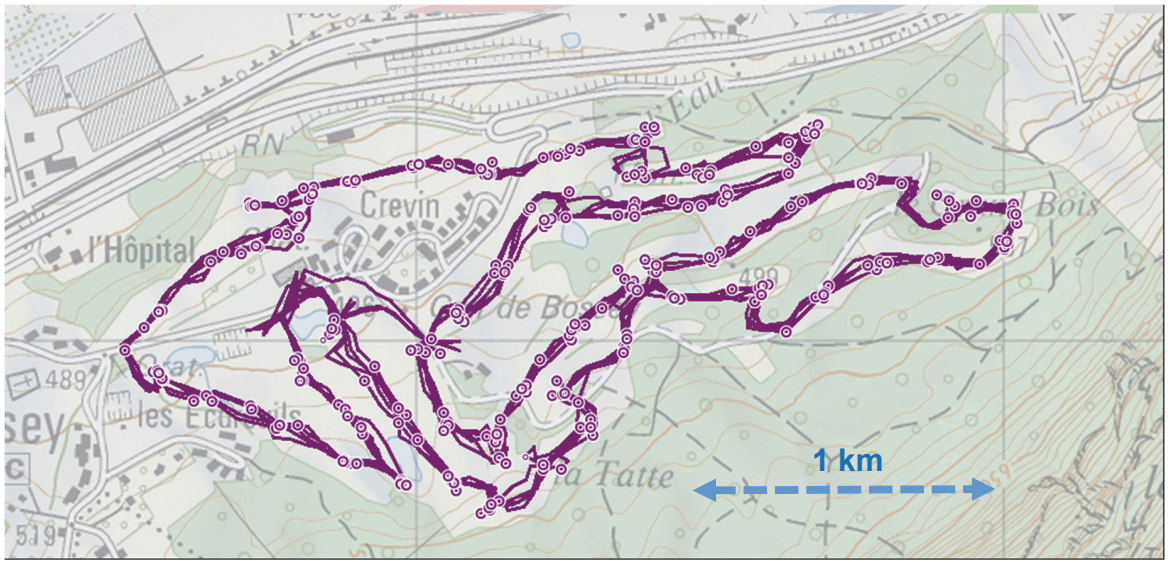

Figure 6-10. Repeated visits to a golf course in Bossey, near Geneva (9 days of tracking data)

In the scientific literature, golf has been recognised as a sport that should be encouraged in order to attain physical activity recommendations, especially for the elderly (Broman et al., 2004). In what is probably the first published literature review on golf and physical activity, golf was recognised as an interesting source of moderate intensity physical activity, that can be used in combination with other sources of exercise (Luscombe et al., 2017). Members of the same research team wrote that practitioners and policymakers should be "encouraged to support more people to play golf, due to associated improved physical health and mental well-being, and a potential contribution to increased life expectancy" (Murray et al., 2017).

6.4.6 Composite profiles

Similar to the discontinuous walkers, we present a few examples of participants who did not fall nicely into the "boxes" defined above. They have hallmarks of several groups as well as unique characteristics that make them rare, even within our sample.


Graham 4964 is a **complex walker**, because he not only associates walking with public transport, but also drives a car and rides a bicycle. He lives in a remote village with his family, all sharing a single car that he sometimes uses to drive to work. The rest of the time, he cycles to Yverdon train station and rides to Morges or Lausanne, his two main destinations for work. Within those two towns, he walks extensively. He has a parking space in Morges, but if he has to drive to Lausanne he deliberately parks near the lake and walks up to the city centre. He is constantly interacting with family members and colleagues, to see who can give a lift to whom and is literally juggling with transport modes so could be called a **multimodal super-walker**.

Benjamin 6819 is the youngest frequent walker in our sample. He lives in a small town on Lake Geneva and takes the train to one of the universities in Lausanne where he is a regularly enrolled student. He walks extensively in the morning to get to his local train station, quite a lot on campus during the day, and then again to get back home. In this sense, he is a **bi-local walking commuter**. A further interesting feature is that he usually goes out again in the evening, after supper, just for the pleasure of walking. He invariably wears headphones with which he listens to pre-prepared soundtracks. He walks for one and a half hours per day and is therefore also a **super-walker**.

Kirk 4468 lives in Geneva, about 2 km from the city centre. He walks for leisure, since he is retired. He has no car, no bicycle and no public transport pass. He does everything on foot, clocking up 1 hour and 15 minutes per day. What makes him unique is his propensity to engage with others. He is known in his neighbourhood for taking older citizens to walk with him, and was able to connect us with one of them (one of the only instances of a frequent walker being referred by a study participant). He is somewhere in-between a **local urban walker** and a **super-walker**, with elements of a **leisure walker** (not dog-related).

6.5 Discussion of the spatial phase

This project phase has enabled us to confirm several insights which we had in the Qualitative section. The first is that frequent walking is an extremely solitary pursuit in our sample. Hardly any of the walking bouts that we investigated were carried out with other people. The fact that other human beings were rarely spoken to nor communicated with in any way was confirmed. The main motivation for walking was to get from A to B quickly and in an "uncomplicated" manner. This similarity between project participants is all the more remarkable that the profiles that we have established in this phase are very different from each other. This discretion has major implications for the research question and the hypothesis on the Pioneer effect (H_5), that will be investigated in the Discussion section of this thesis.

The hypothesis according to which our sample has advanced navigation skills (H_2) is confirmed here. One of the maps presented previously provides a confirmation and we are supplying an extract of it underneath, for ease of reference. In the figure below, the investigated person knows exactly where to go and manages to piece together the crossing of two pedestrian footbridges in central Geneva (pont des Bergues and pont de la Machine) with the complex navigation of small sidestreets in

the old town. To do this, a strong grasp of local topography is necessary. It is however interesting to note that the depicted person does not walk through parks, although several are available in the local area (parc des Bastions, close to the Old Town, and the Jardin Anglais, by the lake).

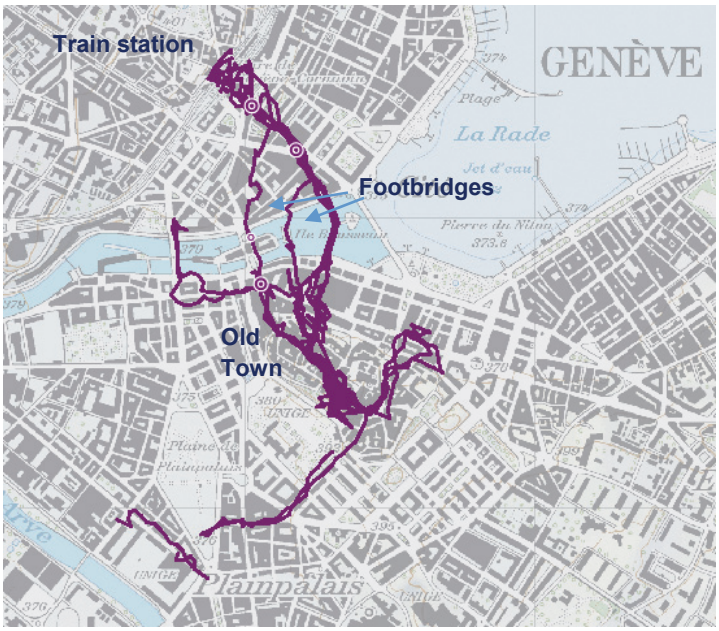

Table 6-2. Detail of frequent walking in central Geneva (over 8 days)

The hypothesis regarding the importance of walkability for our sample (H_3) remains more than ever open to discussion. The choice of different routes, mentioned in the Qualitative section and observed and verified in the Quantitative section, may be taken as meaning that our frequent walkers appreciate being given the choice. Rather than systematically choosing the more direct route or the prettier route, they very often switched from one to the other, demonstrating not only their skills and knowledge, but also a conception of walkability as a catalogue of possibilities rather than a distinct preference of one route over another.

Regarding sustainability (H_4), the existence of very different patterns associated with leisure walking in the countryside and practical walking for transport in urban settings is confirmed and illustrated by using GPS technology. The potential pioneer effect remains elusive, because detailed analysis of GPS data showed that most of our participants rarely stopped while walking – and certainly not to talk to anyone.

Finally, we also wanted to know how good our frequent walkers were at estimating their daily walking times. In order to obtain their opinion in a standardised manner, we asked them to fill in the Physical Activity Questionnaire (PAFQ), which is in two parts, with professional and non-professional activity sections (Bernstein et al., 1998; Guessous et al., 2014a). We found that the answers to the PAFQ were on average one hour per day higher than the data acquired by the GPS tracking. This is an interesting result, because a recent UK study found no such difference between

physical activity data acquired by using an accelerometer or filling out a questionnaire: around one-third of the study participants estimated their physical activity correctly, while one-third over-estimated it and one-third under-estimated it (Tully et al., 2014).

There are some caveats around these results. First, some of the difference must be explained by walking in buildings and other facilities, which could not be captured by GPS tracking. Second, there may be some recall bias and/or social desirability bias associated with answers to the PAFQ. Third, the two measurements did not occur at the same time; theoretically, this should not give rise to a systematic difference, but it clearly makes the results less robust. In conclusion, the discrepancy noted between GPS tracking results and responses to the questionnaire would require a new study, preferably supported by pedometers or accelerometers, which would supply a third source of information. This approach is compatible with the idea of a randomised controlled trial which is put forward in the Conclusion (and supported by complementary Health information in the Appendix).

7 GENERAL DISCUSSION

This section brings together selected items from the previous sections, in order to answer the overarching research question and test the working hypotheses. Once we have done this, we to review selected research results in relation to the Action and Maintenance phases of the trans-theoretical model. Finally, we confront some of our research results to other selected frameworks in the field of collective behaviour change.

7.1 Answering the research question

Can frequent walkers help bring about a healthy and sustainable transportation system, based on walking?

First, the bad news. Because of their individualistic mind-sets and motivations, and because they are reluctant to talk about their frequent walking habit to others, at present frequent walkers do not form a promising pioneer group. As asked specifically to those who participated in the Qualitative interviews, almost none of them belong to an advocacy group engaged in promoting walking, and very few would be interested in such an activity. The GPS tracking phase confirmed that our selected frequent walkers rarely stop to talk or otherwise exchange with other people. Since the frequent walking activity is barely visible – contrary to many other trends – there seems to be no way whereby frequent walkers can at present inspire others to pick up this desirable activity.

The good news is that around half of our sample said they would be interested in meeting other frequent walkers. So, even if there is no trace of an informal community of frequent walkers in our study area, this does not mean that such a community will never develop. Another source of good news is that there are many activities, attitudes, skills and characteristics, linked to our sample of frequent walkers, that can be used for advocacy, with a view to making frequent walking more acceptable, more enjoyable, easier and more prevalent at population level. Since these elements are linked to our five hypotheses, we will now go through these hypotheses, attempting to answer them one by one. This will lead to concrete policy recommendations and research agenda suggestions, which will be discussed further in the Conclusion of this thesis.

Now we turn to the working hypotheses, that have now been informed by research results. It is safe to say that the first three hypotheses, on daily practices, are globally confirmed by our data. Motivation (H_1) and skills (H_2) are both essential to frequent

walking. Despite important differences between study participants, some key elements emerge, around the conversion process (for Motivation) and around time management and orientation in space (for Skills). The situation for walkability (H_3) is a little bit more complex: we would be tempted to say that walkability is important but not decisive in determining frequent walker status in our sample.

The two final hypotheses are about the implications of frequent walking and of frequent walkers for society. They are in fact closely interrelated. The sustainability of the mobility system (H_4) can only be achieved if a pioneer effect of some sort (H_5) can help leverage motivation, information and know-how from the tiny pool of frequent walkers towards the general population. Sustainability in our sample was indeed closely related to the integration of walking into the person's personal mobility system (thus confirming H_4). Regarding the hypothesis on the pioneer effect, frequent walkers do form a promising and innovative group. But they are unlikely to inspire others by what they are doing, because their activity is essentially invisible and they avoid communicating about it (H_5 can therefore only be partly confirmed). The somewhat ambiguous answer to H_5 leads us back to the overarching research question, which could then be reformulated in this way: under what conditions can what we have learned about frequent walkers be used to inform policy and kick-start targeted research on frequent walking? These aspects will be covered in the Conclusion.

7.2 Testing the hypothesis on motivation

H_1: MOTIVATION. Integrating an hour or so of walking into a modern day is difficult, which is why it is rare and requires strong motivation.

This hypothesis can clearly be confirmed. The complex travel plans suggested in the Quantitative section were confirmed in the Qualitative interviews and then visualised in the Spatial phase. Although no control group was present in this study, it seems safe to conclude that frequent walking is not all that easy to do. Whatever has been written in other studies about how simple and natural walking may be should now have to take account that walking at a low level may be easy, but in modern life walking over an hour per day is not that simple – it requires organisation, and skills (see next point). The only typology of frequent walkers that clearly emerged from our data was the degree of integration of walking into personal transport systems. Clearly, only integration carries with it a high potential for sustainability. Our data, especially from the Qualitative and Spatial sections, show that frequent walking has a powerful transformative potential at the personal level. The many stories told about how study participants “converted” to frequent walking before maintaining their behaviour over time show the transformative nature of this behaviour.

Our conclusion is therefore that motivation is hardly a problem for frequent walkers, nor frequent walking. It is a behaviour that has very many positive effects for the person involved, from pleasure and well-being to health and time and money saving, through to the gift of beautiful views over the lake. Because it is an inconspicuous behaviour, requiring next to no equipment, it is relatively easy to do. Although many study participants received comments about their behaviour (for example when they are the only ones to take the stairs rather than the lift, or to walk from the train station to the office rather than taking the bus), it is important to remember that these remarks were not negative ones. So individual motivation for frequent walking is strong, it just does not affect very many people at present and it is very important to try to find out why.

Indeed, the picture at the collective or societal level is very different from the individual level. Clearly, if huge swathes of the population were to "convert" to frequent walking in the short or even medium term, this would have an effect not only on the transportation system but on the entire fabric of urban life. It is easy to imagine that such a sustainable urban future would include less air pollution, less noise, less traffic danger and accidents, etc. In a nutshell, it would make cities and other urban areas much healthier and more agreeable to live in. Whether it is realistic to imagine that such a thing might happen is the subject of the second research question. For stimulating motivation, we suggest the following:

- ➔ *Measures need to be taken to make walking more pleasant*
- ➔ *Measures need to be taken to make walking easier to integrate into a person's modern day*
- ➔ *People may need help to integrate walking into their daily routines*

7.3 Testing the hypothesis on skills

H_2: SKILLS. Frequent walkers have advanced navigational skills enabling them to plan and improvise complex routines in time and space.

Our hypothesis on skills can clearly be confirmed. Our sample of frequent walkers certainly has skills that enable them to plan an improvise in space and time. Our analysis of GPS data shows that routines such as walking for commuting can be very repetitive, but otherwise much of the walking that we have analysed leaves space for a great amount of improvisation.
Here, it is important to investigate exactly what we mean by skills, applied to walking. In an early publication on motility, it was suggested that empirical research should be carried out to see how its three core elements – access, competence and appropriation – are moderated by technological innovation, spatial limitations and other structural constraints (Kaufmann et al., 2004). In a later paper, a quantitative typology of motility was established using a large database of people engaged in

long-distance work-related mobility. There, the three pillars of motility (access, competence and appropriation) were described as: social conditions of access (for using the transportation supply in the broad sense), knowledge and skills (required to use the supply) and mobility projects (actual use of the supply for materializing transportation plans) (Kaufmann et al., 2017).

The same quantitative approach cannot be applied to our frequent walkers, with whom we have developed an essentially qualitative approach. However, several points raised in the article can be used now to help understand the results of our study and put them in context. For example, the article states that motility is inherently situated, in the sense of being connected to a given space. We believe this makes our choice of a relatively small study area (Geneva-Vaud cantons) correct in retrospect; however, it gives us the responsibility of explaining the area further in order to understand possible connections between motility and certain features and behaviours of frequent walkers discovered during the course of our work.

Generally speaking, the Geneva-Vaud area has a very high *hospitality potential*, i.e. it benefits from infrastructure and services that make it easy to be mobile, especially along the Geneva-Lausanne-Montreux corridor where most of our frequent walkers live and/or work. The frequency and the reliability of the railway network is considerable, with at least 6 trains per hour connecting Geneva and Lausanne for example. The region is also characterised by the presence of two important centralities (Geneva and Lausanne) within 60 kilometres of each other, each with a cantonal (province-level) administration and parliament, a University (two in the case of Lausanne), an airport (only the one in Geneva is international), a cathedral, international organisations (UN and Red Cross in Geneva, Olympic Committee in Lausanne), etc.

These two important centres are complemented by a handful of towns dotted around the lake: Versoix, Nyon, Gland, Morges, Renens, Vevey and Montreux. The whole area has a strong and resilient employment market (the unemployment rate is higher than the national average but far lower than the average of the EU) and relatively high rates of immigration. Despite its physical, linguistic – and, arguably, cultural – proximity with France, this part of French-speaking Switzerland is extremely Swiss in its institutions, laws and political mores. It is also very urban, for example the majority of the population in the Geneva-Lausanne areas live in apartments and it is rare for a family to be able to afford to buy a house. In both cantons, current public policies are attempting to further densify the towns and cities, so there is no policy to help people buy a house.

Lifestyles and social relationships can also be considered urban, in the sense that it is common and well accepted to marry or have a relationship with someone from another culture; it is also common to change jobs and go and work in another city (for some young professionals, it is easier to find a job than an apartment). Social norms

and values cluster around religious and cultural tolerance, a strong work ethic, and personal freedom. Despite the highly urban nature of the area and its population, green spaces play an important part in daily life: both Lausanne and Geneva have extensive parks, agriculture is still strongly present in the surrounding area, and there are many forests. The presence of the lake and of two mountain ranges – Jura and Alps – makes this urban area even more hospitable, and may have an effect on its "mobility culture" (Jensen, 2009) because most people would be expected to go onto the lake or into the mountains at least a few times per year.

Among the variables used to measure motility in long-distance frequent travellers (Kaufmann et al., 2017), we wish to investigate some that seem pertinent to the situation of our frequent walkers. Among the social conditions of access, *contextual access* is described as the number of minutes separating a person's home from a main train station, a local train station (RER), a motorway or an airport. In the case of our frequent walkers, all we can say is that contextual access if very high for all of them, and there are no particular differences between them. *Personal access* is described as having a laptop computer, Internet access or a car. Most of our frequent walkers had good personal access, which for them we would describe as having a smartphone (some used it to play music to themselves as they were walking, others had decided not to have one but fully by choice) and public transport passes (again, a subset of participants decided voluntarily not to have one, to save a little money and as a personal incentive for walking).

Skills for long-distance travellers were quantified in reference to number of languages spoken, ability to read a map, etc. Again, the approach was slightly different for our frequent walkers. Many questions in our qualitative set-up investigated skills related to walking, such as the ability to orient oneself in space and the ability to consider distance from a target building as an opportunity to walk. In short, our frequent walkers had very high skills: even those who professed at being hopeless at orientating themselves in space could be seen to have considerable skills thanks to the GPS follow-up.

The third dimension of motility for long-distance travellers was preparedness to be mobile. In our context, we will refer to "preparedness to walk" and modify its components accordingly. Willingness to move to another region or abroad, to commute over long distances, to commute on a weekly basis and to indulge in frequent business travel can be "pedestrianised" into: willingness to take entirely new routes, to walk over greater distances than before, to walk on weekdays and on week-ends, and to walk for professional errands (distinct from commuting) are useful potential categories for our sample of frequent walkers. Again, we can only say that most of our sample are open to these elements. In summary, the participants in this study have a high contextual and personal access to mobility services. They benefit from an array of skills related to walking, and since skills can be learned we suggest setting up some initiatives so that people can share them:

- ➔ *Propose workshops on skills related to walking.*
- ➔ *Modify existing walking tours (e.g. those organised by the Lausanne Tourist Office) to include practical elements about how to navigate slow traffic lights, seek out quiet streets, etc.*
- ➔ *Combine information on walking with information on the use of other transport modes (e.g. where to get off the bus or park your car to find a pleasant walking route into the city)*

7.4 Testing the hypothesis on walkability

H_3: WALKABILITY. Frequent walkers use areas which do not always correspond to traditional walkability criteria.

As mentioned in our extensive review of the walkability concept (see Literature review), walkability is a concept that does not have a single definition. It is important to note that it is a word that we did not use during our qualitative interviewing, nor our GPS tracking interviews. We did, however, see very clearly what sort of routes people used and, thanks to our knowledge of the study area, we were well aware of the levels of traffic in the various areas traversed by the members of our sample. We therefore discussed such matters with them in the two types of interviews, with questions such as: why did you choose such a route, when the other one is prettier/calmer/quieter? Responses were usually mundane, as discussed in the Results sections: people would often take a direct route if it enabled them to save time or if less concentration was involved. Apparent indifference to air pollution was a hallmark of frequent walkers in this study. When pushed, many of them would admit that they would prefer to amble through a green area rather than plod down the side of a busy road, but air pollution was hardly ever mentioned spontaneously. On the contrary, several participants complained about cigarette noise or about traffic noise, rather than about air pollution or air quality in general.

We already knew from our background in environmental health to what extent walking in a polluted or non-polluted air can have a different health effect. A publication in the *Lancet* that appeared as we were nearing the completion of our thesis brought the topic into the limelight one more time. The main problem is that toxic gases such as NO, NO_2, carbon monoxide (CO) or ozone (O_3) not only enter the lungs where they create havoc, but are able to diffuse through the membranes separating the inside of the lung from the pulmonary capillaries, thus entering the bloodstream. This is why air pollution is one of main risk factors for cardiovascular diseases. As for solid particles (PM2.5, PM10, etc.), they are likely to enter the lungs and become stuck in the delicate alveoli, thus blocking them up (these mechanisms are essentially the same as those that occur with tobacco smoke). The bottom line is

that a relatively short encounter with polluted air means that the person will have toxic substances in their blood for several hours afterwards. This fact is not at all know or appreciated by our sample of frequent walkers: we asked all of them open questions, and then more and more leading questions about this and drew a blank every time. The cherry on the cake, so to speak, was when one of them said: "this is not Beijing".

The article in the *Lancet* is remarkable because it compares people walking at approximately 1 km from each other as the crow flies (1.3 km on foot according to Google Maps), in central London. One is in busy Oxford Street, which has heavy traffic dominated by taxis and buses, the other is Hyde Park. The researchers (Sinharay et al., 2017)and the editors of the accompanying *Lancet* editorial (Thurston & Newman, 2017) insist on the fact that in all 119 participants, irrespective of disease status, walking in the park led to an increase in lung function and a decrease in arterial stiffness, whereas these beneficial responses were significantly diminished after walking along the polluted street. Finally, it should be remembered that, whatever the exposure of walkers to air pollution, it is likely to be less severe than the exposure of other road users. Indeed, a recent review of European studies showed that car users are the most exposed, followed by bus users and cyclists, with walkers the least exposed for almost all the pollutants analysed (black carbon, ultrafine particles, carbon monoxide, but not NO_x) (de Nazelle et al., 2017). Walkability as a general concept (not necessarily as a word) was rarely alluded at by our sample of frequent walkers. However, those who did express themselves were clear about what they wanted, as a priority:

- ➔ *It is necessary to reduce traffic on main roads in city centres; allowing isolated pockets to be pedestrianised or otherwise protected is not enough – these are not, by far, the only places where walkers go*
- ➔ *Pedestrian motorways need to be created: these should be fast, direct and wide, going from A to B. Just like motorways for cars or rapid railway tracks, but for walking.*

7.5 Testing the hypothesis on sustainability

H_4: SUSTAINABILITY. Frequent walkers vary according to the degree of integration between walking and their personal mobility system, which has implications for sustainability.

This hypothesis must also be accepted. Sustainability is indeed the area where the most differences are found, not between frequent walkers and the rest of the population, but between frequent walkers themselves. Although almost all the members of our sample were multimodal, in the sense of regularly using several

transport modes, it makes a huge difference to the environment if they combine walking mainly with public transport or mainly with driving a car.

We found it difficult to identify leisure walkers with a limited impact on the environment. No doubt Kirk, a retired gentleman living in a relatively dense area close to Geneva city centre, is the best example of such a combination that really was rare in our sample. On the contrary, the dog walkers and occasional golf players tended to travel by car almost every day. While another set of frequent walkers took public transport, and others still hardly used public transport because they accessed everything on foot (either by living and working in the same, central part of a city, or by walking huge distances every day). We are grateful to the experts that we consulted before the beginning of our project, who advised us not to operate an ex ante separation between walking for transport and walking for leisure: we indeed noticed that the former is linked to sustainability (which was no doubt to be expected), but for the latter the situation is more complicated.

Walking for leisure, in our sample, was linked to relatively unsustainable mobility practices. We do not mean this as a value judgment, but simply as a fact that no doubt requires further investigation. In fact, our hypothesis on sustainability could be reframed as a question: How do we promote frequent walking within a framework that respects and promotes sustainability? This is in our view a key question, critical to bringing about a healthy and sustainable mobility system in urban areas. However, when looking for future-oriented mobility programmes at European level, we see initiatives that seem very far removed from the promotion of walking. Although it is a smart behaviour with much potential, it is difficult to imagine how frequent walking would fit in among the other so-called "intelligent" mobility solutions now attracting funding and that seem to be considered by many as the only way to make the transport system more sustainable. According to the European Commission, it is necessary to invest in "intelligent transport systems" in order to succeed in "innovating for the transport of the future". On the web site of the Mobility and transport section of the Commission, we read this (EU, 2017):

> "Intelligent Transport Systems (ITS) are vital to increase safety and tackle Europe's growing emission and congestion problems. They can make transport safer, more efficient and more sustainable by applying various information and communication technologies to all modes of passenger and freight transport. Moreover, the integration of existing technologies can create new services. ITS are key to support jobs and growth in the transport sector. But in order to be effective, the roll-out of ITS needs to be coherent and properly coordinated across the EU."

Evidently, the Commission did not have walking in mind, as is confirmed in one of the accompanying documents that explains the strategy (EU, 2016a):

> Profound change lies ahead for the transport sector; both in Europe and in other parts of the world. A wave of technological innovation and disruptive business models has led to a growing demand for new mobility services. At the same time, the sector is responding to the pressing need to make transport safer, more efficient and sustainable. The resulting transformation creates huge social and economic opportunities that Europe must seize now, to reap the benefits for its citizens and businesses. Digital technologies are one, if not the strongest, driver and enabler of this process.

Up to the last line of that quotation ("Digital technologies…") walking could have fitted in very nicely. Our idea is not to level easy criticism at the Commission, which has many other projects and programmes including the EU Policy on the urban environment and the EU Urban agenda. This agenda is based on the Pact of Amsterdam, which contains a short paragraph entitled *Urban mobility* that mentions walking (EU, 2016b):

> The objectives are to have a sustainable and efficient urban mobility. The focus will be on: public transport, soft mobility (walking, cycling, public space) and accessibility (for disabled, elderly, young children, etc.) and an efficient transport with good internal (local) and external (regional) connectivity.

Our viewpoint is that, although there are interesting urban policies that are emerging from the European Commission and its partners, they seem to co-exist with a belief in technical fixes. Interestingly, the Commission seems fully aware of the paradox because the new "cooperative, connected and automated vehicles" are to be integrated into a "sustainable mobility planning or concept of Mobility as a Service, including public transport and active travel modes such as walking and cycling (EU, 2016a)." Not to cut too fine a point, but we notice that once again walking and cycling are lumped together, not developed at all, and mentioned last as if they were an afterthought.

What we are trying to get at is that frequent walking *is* an intelligent way to "increase safety and tackle Europe's growing emission and congestion problems". We are arguing that it should be the centre of the transportation system and the other modes should be considered as ancillary to walking, and not the other way round. Traditional cities were built around walking. In the case of rapid development such as what has happened in China over the last 40 years, it can be seen how walking (and cycling) have been gradually displaced by other modes (Gao et al., 2015). This is a trend that can be reversed, not to exclude other transportation modes but to make them ancillary to walking. Concretely, a car would serve only to take a person from one (walkable) area to another and not for a whole trip (exceptions would obviously be made for freight and for people with medical conditions that make walking difficult).

According to the results of our research, it is not surprising that frequent walkers do not self-identify as a group, nor do they behave in any way as if they belonged to such a group. The ambivalence detected in the choice between car and public transportation is complex, but at least the car can be related to individuality and public transport to a more collective, environmentally-friendly attitude. The problem with walking (and, no doubt, with cycling) is that it is a very solitary and individual pursuit. It is therefore even more difficult to grasp the motivations that might lead to such a collectively desirable activity, resting on individual, perhaps even individualistic outlooks and motivations. We therefore suggest the investigation of "structural stories" (Freudendal-Pedersen, 2009) which allow individuals to reconcile their mobility behaviours and values.

In previously published research (Freudendal-Pedersen et al., 2016), one of the aims of structural stories was to see how people whose behaviour was not favourable to the environment (i.e. they drove a car on a regular basis) could shoehorn their behaviour into a *Weltanschauung* that included attention to the environment. The paradoxes, contradictions or tensions involved are obviously likely to be strong. In our case, it is rather different: we would want to know how people succeed in reconciling personal and collective considerations that are going essentially in the same direction: towards a healthier and more sustainable mobility system. The structural stories seeking to link together two parallel strands that are not paying any attention to each other should be just as interesting as those that are trying to explain perpendicular forces. To sum up this idea, we suggest using focus groups and other qualitative methods to investigate structural stories related to frequent walking.

- ➔ *People who drive their car all day before going for a walk in the countryside are doing themselves a lot of good but are not achieving sustainability.*
- ➔ *Measures should be put into place that build on what these people have already achieved and which should be valued. Giving them places to park that are further away from the centre of the city and pleasant, protected walking routes into town would help. As well as these "carrot" measures, some "stick" measures such as refusing free (or almost free) parking to employees might help.*

7.6 Testing the pioneer effect hypothesis

H_5: PIONEER EFFECT. Frequent walkers have experience, attitudes and behaviours that can inspire others to become frequent walkers.

What we mean by pioneer effect is the capacity of a group to kick-start the growth of a particular behaviour within a population. In biology, a pioneer population, often referred to as a "pioneer community", is the first group to colonise a given area,

before others begin to arrive. Usually, it must have a "minimum viable population size" to ensure its persistence. Obviously, the situation is different for frequent walking, which is a behaviour not necessarily transmitted among families or peers. We find it useful nevertheless to consider what researchers consider to be a minimum size for an animal population to thrive in the wild. Despite inevitable differences between species, studies and settings, an review covering 102 animal species concluded that around 500-700 adults are required in order to "engender" a minimum viable population of roughly 5000-7000 adults (Reed et al., 2003). Regarding human populations, the late John Moore, an anthropologist at the University of Florida, calculated that no more than 100-200 individuals would be necessary to sustain a long-term population in the context of space travel (Carrington, 2012).

We are interested in this ecological approach because, in the current global context, the main limiting factor for the survival of many animal populations is habitat size. It is not too much of a stretch to consider that the urban "habitat" is also one that is of importance to potential frequent walkers. If we were to consider as our "habitats" the Geneva and Lausanne conurbations, we have approximately 900 potential frequent walkers in the MRMT2010 database. This corresponds to around 110'000 individuals because, as we have seen in the Quantitative section, great walkers represent 12.8% of the population. Supposing that only 10% of these great walkers are frequent walkers, we would still be left with around 5000 frequent walkers in each of the two conurbations. It follows that, even if frequent walking is rare, there probably are enough frequent walkers present in the Geneva and Lausanne areas to kick-start the growth of frequent walking at population level.

The question therefore becomes: do the frequent walkers in the study area have the individual and collective characteristics to persist and – eventually – to convince others to join them? Basically, are these people innovators or early adopters, heralding a significant development of frequent walkers and frequent walking in the study area, or are we talking about a transient phenomenon likely to peter out of its own accord? As this question is at the core of our thesis, we must investigate it further, keeping trans-disciplinarity as our *Leitmotiv*.
We mentioned the concept of early adopters in the Introduction to this work, as well as the innovators who may precede early adopters. This framework has many variations but is generally known as the theory of the diffusion of innovation (Hong et al., 2017; Rogers, 2003). We use the terms innovators, early adopters, pioneers or mobility pioneers (Kesselring, 2005; Kesselring, 2006), not interchangeably but as expressions with similar meanings that might be used to describe frequent walkers. The use of these variable terms made it a little easier to locate interesting publications on the subject. Since there is no information on frequent walking as an "innovation", we looked at the literature in other fields.

The uptake of electric vehicles (EVs) is one area where recent research interest has generated useful information, so we turned to a study in Germany that tried to characterise early adopters of this technology (Plötz et al., 2014). In their review of the innovation adoption literature, these researchers found the perceived characteristics of the innovation and the characteristics of the adopters themselves to be the most important predictors of innovation adoption.

It is therefore necessary for us to understand for whom frequent walking makes sense from an economic and environmental perspective. "However, users for whom EVs make economic sense are not necessarily those who are actually interested in EVs or evaluate them positively. Or at least not everyone who claims to be objectively prone to buying an EV is really interested in doing so", write Plötz et al. In this phrase, it is more than tempting to replace EV (electric vehicles) by FW (frequent walking):

People for whom *frequent walking* would make sense are not necessarily those who are actually interested in *frequent walking* or who will evaluate it positively. Or at least not everyone who claims to be objectively prone to *frequent walking* is really interested in doing so (with thanks to Plötz et al. 2014 – *modified by us*).

The researchers continue with an analysis of an extensive online panel of people interested in car driving, which they subdivided into groups reminiscent of the trans-theoretical model (although this framework is not mentioned in the Plötz et al. article). So, we adapted the published information by Plötz et al. – also integrating the trans-theoretical framework – to see if it can be applied to frequent walkers (see table underneath).

Position in scale	Category	Affinity for walking
Action / maintenance	Frequent walkers	High affinity for walking
Preparation	Interested, with intention to act	High affinity for walking
Contemplation	Interested, with no intention to act	Low affinity for walking
Pre-contemplation	Not interested	Low affinity for walking

Table 7-1. Frequent walkers in the trans-theoretical model

In order to attribute their participants to the 4 groups mentioned above, we suggest using a process whereby 3 dimensions are assessed using a Likert-type scale:

- Present frequent walking status.
- Intention of becoming a frequent walker in the next 6 months (this is 5 years in Plötz et al. – we use 6 months according to the trans-theoretical model).
- General interest in frequent walking.

We follow the same researchers when they evaluate the car drivers for whom electric vehicles might be the most useful: those who spend a considerable amount of their travel time at speeds < 18 km/h. Translated into frequent walker terms, a potential

follow-on population would be people who are already relatively slow in terms of their global mobility system. It is immediately apparent that people trying to navigate the traffic-clogged streets of central Geneva in slow-moving buses are prime targets to become the next wave of frequent walkers. Salary level is an important part of the desire (and capacity) to buy an electric car. This is not immediately relevant to out topic, so we would drop that aspect for now.

The researchers go on to say that "the majority of respondents who should buy an EV work full-time and live in small to medium-sized cities (…) The second largest group are part-time workers also living in towns with fewer than 50,000 inhabitants", etc. It would be very useful to be able to make such predictions for future frequent walkers.

Interestingly, the researchers write that "inhabitants of large municipalities cannot be expected to be early adopters of EVs from an economical perspective since they own only a small share of vehicles in general" (Plötz et al., 2014). For frequent walkers, the situation would be exactly the opposite: because most of the walking and most of the frequent walking goes on in cities, that is where the early adopters can be found – this corresponds to our experience in this thesis. The potential user of an electric vehicle is described as a male aged between 40 and 50, living in a small town – which, apart from age, is also the opposite of the frequent walker profile.

Finally, Plötz et al. found that electric car buyers were more likely to work full-time. Since we had not investigated this in the Quantitative section, we did a rapid analysis on SPSS and found that it was indeed the opposite for frequent walkers, 38% of whom work full-time, 25% part-time and 37% are not working; figures for the total population are respectively 43.5%, 22% and 34.5% (missing values are not taken into account).

- ➔ *The key is how to move from the individual to the collective level. Creating walking clubs may be one way forward.*
- ➔ *Around half of our study participants said they would agree to meet other frequent walkers. Informal meetings or more formal ones (focus groups) should be organised.*
- ➔ *We have reserved an Internet address called frequentwalkers.com which may prove useful as a focus point for sharing information on frequent walking.*

7.7 Reviewing results with the trans-theoretical model

As already explained, we have used the trans-theoretical model as a background to guide our trans-disciplinary study. Now, we review the pertinence of the model in the light of the results presented in the previous sections of this work.

First, there is reason to believe that much of the advocacy work in favour of walking (see previous paragraphs) is either aimed at the Pre-contemplation stage or not targeted at all. There is therefore ample room for us to argue that some of this advocacy work, although not useless, might be better employed to help people progress from one stage to another among the later stages of the framework.

In particular, we note that the passage from Contemplation through to Preparation and to Action may well be very different for walking than it is for smoking cessation. Thanks to prior work in tobacco cessation, we know that it is a very particular habit to take up (we consider tobacco cessation to be a healthy behaviour, not just the absence of an unhealthy behaviour). This is because the nicotine in cigarettes (which explain the brunt of the tobacco epidemic, cigars and pipes playing a very minor role in almost all countries) acts most efficiently by attaching to acetylcholine receptors on brain cells, which then produce, release and/or uptake at least three key neurotransmitters.

Noradrenalin is a stimulating neurotransmitter, which explains why some smokers feel the urge to smoke when they are concentrating on a challenging task. Dopamine is a key neurotransmitter involved in the sensation of pleasure and is released physiologically when a person consumes food or drink or engages in sexual activity. Finally, melatonin is the key neurotransmitter involved in mood, which explains why some people who quit smoking are affected by depressive feelings.

Walking, on the face of it, is completely different from smoking and from smoking cessation. However, we must remember that physical activity also leads to the release of acetylcholine and therefore also to the release of noradrenalin, dopamine and melatonin. It is possible that the public policy advocacy activities are “too high up” in the hierarchy of the trans-theoretical framework. After all, everyone knows that walking is a healthy activity and that everyone “should” be doing it.

A recent review of the use of the trans-theoretical framework in the context of transport behaviour interventions found that there were very few studies on the subject, that they were generally of inferior quality. If they aimed at any stage of change at all, it tended to be Contemplation or Preparation. Very few of the 13 identified interventions (mainly in the UK, North America and Australia) addressed the Action or Maintenance stages. The authors of this review (Friman et al., 2017)

mention that items such as creating or maintaining “helping relationships” or engaging in “counterconditioning” were totally absent. Surprisingly, interventions supporting consciousness-raising were implemented for participants who had already made a change and who were therefore in the Action or Maintenance stages. No interventions at all supported the development of coping skills during the maintenance stage, where such skills are known to be very important.

7.7.1 Action phase

This is not often done, but we would like to try to integrate our findings about the Action phase with the international literature on life events. This is because it has been shown many times that when people experience a significant life course event, such as changing jobs, moving house or becoming a parent, they are more likely to change important parts of their personal mobility plan. For example, not that long ago it was common for people getting married to move from the town into the countryside and buy a car, thus responding to an array of cultural norms. Nowadays, no doubt the situation is far more complex. However, life course events still provide the opportunity to influence and change travel behaviour, because these are times when people have the opportunity to reflect on their mobility habits and routines (Beige & Axhausen, 2017).

A recently published on-line mobility survey of 324 adults living in the Republic of Ireland recorded only 740 life events in their entire lives, i.e. between 2 and 3 per person on average, despite a relatively open definition of life events. Categories used were: started college, moved home/town, started first job, changed job, had a child, moved in with partner, became unemployed, became ill/acquired a disability, separated from partner, retired, and child(ren) leaving home. The authors (Rau & Manton, 2016) note that this may be indicative of systematic under-reporting in their sample.

In our sample, which had the advantage of the qualitative approach, we specifically asked about any other life events that might have coincided or surrounded the increase in daily walking – we received almost no positive answers. This is in keeping with the results indicated above: if life events as described above are rare and starting frequent walking is also rare, then it will be even rarer to capture both events in the same person. Unless there is a strong causal link between the two events, of course. We believe that we have evidence that the conversion to frequent walking, in our sample, was generally not linked to other significant life course events. Or if they were, then they were the sign of a gradual development over many years.

Since our results in the Qualitative and Spatial sections of this thesis provide little evidence for the coupling of the "conversion" to frequent walking with significant life

course events, an alternative explanation is that the conversion is a life course event in itself. To push the discussion a bit further, we would like to draw a parallel with smoking cessation, which is a relatively intimate decision, comparable to the adoption of frequent walking. Smoking cessation is in itself a significant life course event, not necessarily linked to another life course event. Of course, there can be a link between the two events in some cases, for example it is common for new parents to quit smoking, or for people to start smoking again after a separation (Bricard et al., 2017; Lindstrom & Giordano, 2016).

In the same way, we feel that turning to walking is a life choice and life course event in its own right. In some of our participants, we have seen that increasing walking is part of a chain of events. For example, one of them successively gave up his car, cycling and the regular use of public transport – increasing his walking formed a part of this more global process.

7.7.2 Maintenance phase

This phase is often neglected, because there is a natural tendency to think that once the effort to operate a change has been made, it would imply too much energy to go back to the initial position. This is of course false, as anyone who has tried quitting smoking, losing weight, etc. could testify. Relapses are very much part of the behaviour change process. Due to the research design of our project, it was not possible to include people who were "former" frequent walkers and who might have offered some clues about this process. This is, by the way, another reason why it would be advisable to set up a project with a cohort design which might follow several people during 1-2 years (see the Research agenda in the Conclusion).

Our walkers were relatively undeterred by the traffic-light inequities of their everyday urban lives, but it must be remembered that several of them (e.g. 8194 Kathleen or 1483 William) were quick to point out exactly where their "worst" traffic lights were – thus recognising that they represent a significant obstacle to daily walking.

7.8 Confronting our results to existing frameworks

This section takes results and data from the previous sections and confronts them with each other and with various insights from the international scientific literature. The approach remains firmly trans-disciplinary. The first topic up for discussion is whether it makes sense to further sustainable mobility systems and policies, rather than simply making transportation systems more technologically efficient (Freudendal-Pedersen et al., 2016). As has also been said, there is “too much transport in the study of travel and not enough society and thinking through the complex intersecting relations between society and transport” (Urry, 2007). We would

like to suggest an approach which combines these insights with the results obtained in this thesis. In a nutshell, we would like to plead for indeed making one particular transportation mode and system more efficient, however it should be walking. Because, once we have demonstrated that walking is the most socially inclusive, healthy and environmentally sustainable mode, it follows that scientific and technical advice and knowledge should be pressed into service in order to promote it, over and above all other modes.

The objective of achieving "seamless mobility" is an overarching imperative in urban and transportation planning (Freudendal-Pedersen et al., 2016; Jensen & Richardson, 2004). We therefore suggest concentrating on ensuring smooth flows and seamless mobility, for walking within urban areas. This may seem somewhat provocative, but we believe that the data obtained during this thesis implies that favouring seamless daily urban walking – especially, walking for transport – makes sense. The frustration expressed towards slow traffic lights and the skills deployed by our study participants to either time their arrival or avoid them entirely show that this is a major problem that must be addressed. If "seamlessness" is to be taken seriously for other modes, why not take it seriously regarding walking?

In this discussion, we must pre-empt any criticism that analysing the values, behaviour, motivation or skills of frequent walkers might be irrelevant or should not be used for policy. Indeed, in her review of the book (Pooley et al., 2013) attached to the British EPSRC-funded Understanding Walking and Cycling Project, Rachel Aldred recalls that in 2011, the project argued that policy-makers should not base policies on walking or cycling "on the views of existing committed cyclists and pedestrians". She went on to say that "While this proved uncontroversial for walking, some cycling advocates vehemently criticised this approach" (Aldred, 2014).

Our research consistently opposes this viewpoint: on the contrary, we argue that policies in favour of walking can learn a lot from committed pedestrians. At the most basic level, it is unwise to oppose the use of information that has never been collected. Then, if the opinion or example of frequent walkers is irrelevant, why would it be useful to rely on people who have chosen not to walk? Or would the establishment of pro-walking policies be entrusted to people who display intermediate knowledge and practice of walking? It can be seen that this argumentation does not make any sense, indeed, any serious analysis of public transport or of car driving would quite naturally seek the opinion of regular users of those transport modes.

We also find this argumentation interesting from a power point of view. The fact that cyclists but not walkers opposed this idea is a sign, in our view, that walkers simply do not have a lobby, or at least do not have a lobby in any way comparable to the cyclists' lobby. This belief is confirmed in another review of the same book, where Jack Skillen of the civil society organisation Living Streets notes that walking "comes

out very strongly from the research in terms of the enjoyment it brings to all sorts of people." However, "unlike driving or cycling, walking is barely noticed as an activity (…) so its status is less recognized" (Skillen, 2014).

7.8.1 Pro-environmental behaviour

As well as being a healthy behaviour, frequent walking can reasonably be described as a pro-environmental behaviour. This allows us to tap into published research in this area, and see whether frequent walking – as we have defined and researched it in this thesis – may fit into such a framework.

The question of what shapes pro-environmental behaviour is complex, according to a recent review of the question (Kollmuss & Agyeman, 2002) based on earlier work (Fietkau & Kessel, 1981). Rather than a direct relationship between environmental knowledge and pro-environmental behaviour, these researchers see environmental interest, knowledge, values and attitudes as making up a complex "pro-environmental consciousness" embedded in broader personal values and shaped by personality traits. These internal factors interact with social, economic, political and cultural factors to lead towards pro-environmental behaviour. Several barriers lie on the route between the various internal and external predisposing factors and any actual behaviour, the most significant of which is the force of ingrained habit (sometimes described as "old behaviour patterns").

SocialCognitive theory describes personal agency as the "capacity of individuals to intentionally choose, execute, and manage their own actions to (achieve) expected outcomes". When applied in the environmental psychology area, this theory argues that individuals with high environmental self-efficacy and who are in favourable contexts are more likely to set themselves and achieve challenging goals (Sawitri et al., 2015).

The individual determinants of pro-environmental attitudes and behaviour include an array of cultural factors (environmental values) and psychological factors (environmental beliefs). These individual determinants interact with situational or physical determinants in the person's environment (Corraliza & Berenguer, 2000). According to these researchers, the mismatch between pro-environmental attitudes and not so pro-environmental behaviours can be explained by (negative) beliefs about the conditions in which the pro-environmental action may be carried out. In a nutshell, environmental behaviour depends not only on what people believe is right but also on what they believe is achievable with a reasonable investment. When a strong mismatch is perceived between the individual's disposition and the prevalent conditions, even the most positive attitude will not lead to the behaviour taking place. Even the strongest motivation can be inhibited by situational factors. Similarly, low

motivation can lead to a pro-environmental behaviour taking place, if the physical conditions are perceived as being positive (Corraliza & Berenguer, 2000).

Because we are interested in the promise of weight loss to inspire future frequent walkers, we analysed an article on perceived causes of obesity in Australia, China, Indonesia, Singapore and Vietnam (Worsley et al., 2017). This article based on an online survey identified three groups of statistically reliable factors: unhealthy food behaviour, beyond personal control and environmental influences. “Lack of physical activity opportunities” was the only item which might be considered to include walking, and it is of interest that it was grouped under the “beyond personal control” heading. The remaining factors were essentially: sugar-sweetened beverages, oversized servings, fast food, lack of awareness of the dangers of obesity, poor availability of healthy foods, genetic causation of obesity, modern technology, the promotion of unhealthy foods, and the low cost of unhealthy foods.

In the same article, respondents were asked about their perception of the effectiveness of ways to maintain or reduce their body weight. Here, the answers were different, demonstrating that the way into overweight and the way out of it may not be the same, or at least that they are perceived differently. Indeed, establishing an exercise routine was by far the most popular item on the list: depending on the country, between 85% and 92% of respondents believed in its effectiveness (while less than half of all respondents believed in replacing soft drinks by diet soft drinks, and only one-half believed in dieting). This implies that the same people may be slow to understand that physical inactivity is causing their overweight, while readily accepting it as a solution. What is missing here, however, is the link between regular physical activity and walking. Indeed, the word fragment “walk” did not appear at all in this article.

7.8.2 Strategies for sustaining walking habits

Very few published articles discuss how walking habits might be sustained over the long term. A notable exception is a study carried out on 71 experienced walkers using Conceptual Content Cognitive Mapping (3CM). According to these researchers (Duvall & De Young, 2013), the most frequent strategies involved using health goals and supportive walking environments. Overall, their findings suggest that experienced walkers use a variety of strategies including focusing on positive health outcomes, using attractive natural settings, and developing realistic action plans. We can in full confidence state that our results confirm these insights. However, there are a few nuances such as an insistence on wellbeing rather than a narrow definition of health in our sample. As for the attractive natural settings, we would relate them to the walkability criteria that we have investigated, i.e. we did not find them to be clinching arguments in favour of frequent walking. Finally, the realistic action plans could be related to the skills that we observed among our sample.

There have been a few recent studies on the mainstreaming of cycling, for example in Toronto, Canada, where Beth Savan et al. reviewed several social psychology tools including the trans-theoretical model. In this respect, she quotes work from Victoria, Australia, that emphasises the importance of the maintenance phase for sustaining behaviour change (Rose & Marfurt, 2007) before concluding that programme design for social interventions to increase utilitarian cycling would need to take a "mixed method, multi-staged approach" (Savan et al., 2017). We believe this is fully in keeping with the approach that we have used in our thesis. Specifically, she writes:

> Although there is a growing literature about cycling promotion, there is a gap in the behaviour change approach to cycling promotion in the academic literature (Savan et al., 2017).

We can only say that if this gap exists regarding cycling, it is more than likely that there is a similar one as regards walking. But we would qualify this judgement: the medical literature contains many initiatives linking behaviour change and the promotion of walking, but usually linked to specific health conditions or groups, and not with the general public in mind. Whereas the literature about encouraging people to cycle usually concerns people who are in relatively good health.

7.8.3 Adoption of sustainable innovations

A team based at the University of Groningen (The Netherlands) has investigated whether the adoption of sustainable innovations might depend on their evaluation of instrumental/functional outcomes, environmental outcomes, or symbolic attributes such as the impact on self-identity or social status (Noppers et al., 2014). These researchers tested the perceived importance of these attribute types for the adoption of the electric car and the use of a local energy system. Their results showed that the adoption of these sustainable innovations was mostly driven by the (positive) evaluation of environmental attributes. We can only say that this is not the case for the frequent walkers that we investigated in this study: their adoption of frequent walking was apparently not linked to environmental attributes. However, we find the framework very useful, because the instrumental/functional and symbolic aspects were present among our participants. The same team went on to investigate the symbolic attributes of sustainable innovations, concluding that it is these attributes that should be put forward because they are the most likely to lead to further adoption of the sustainable innovation (Noppers et al., 2015).

Detailed analysis of these two articles (Noppers et al. 2014 and 2015) proved interesting in the light of our research findings, for several reasons. First, the use of a local energy system is similarly "invisible" to other people and therefore resembles

frequent walking in that respect. Second, the authors offer an authoritative literature review stretching back to Goffman and Giddens about how choices of products and/or behaviours are made to preserve or foster congruence with our images of ourselves. "While many products can signal the owner's status and identity", Noppers et al. (2014) argue that "the signal ensuing from the adoption of sustainable innovations may be particularly strong." They see the instrumental drawbacks as a factor which might actually improve and reinforce the symbolic aspects of the innovation. In the case of frequent walking, the very fact that walking takes longer and implies going through unpleasant areas may make it even more powerful in the eyes of the true believers. To paraphrase President Kennedy, maybe frequent walkers don't walk because it is easy but because it is hard. Indeed, frequent walking, especially in urban areas, ties in very well with the high "behavioural costs" mentioned by Noppers et al. (2014). Building on the published work of this team, we suggest the table below, where we have added a column for frequent walking. We hold the concept of "positive self-signals" as particularly promising to help understand the motivation of frequent walkers.

Evaluation of attributes	Definition	Examples for cars	Frequent walking
Instrumental or functional attributes	Perceived positive or negative outcomes of ownership or use of a sustainable innovation	Consumers choose a car with more instrumental advantages: purchase price, speed, number of seats	Walking is tiring and takes time (negative) but is positive for pleasure and well-being
Environmental attributes	Reflect the positive and negative outcomes of ownership or use of a sustainable innovation for the environment	People with stronger environmental values are more willing to use vehicles running on alternative fuels	Environmental values were very strong in our sample, who claimed no relationship with frequent walking
Symbolic attributes	Reflect the positive or negative outcomes of the ownership and use of the sustainable innovation for one's identity and social status	The adoption of sustainable innovations signals positive characteristics to others. Inconspicuous choices are also influenced by symbolic attributes, because people are motived by positive self-signals	Signals to the outside were rare in our sample. The concept of positive self-signals holds a lot of promise for understanding frequent walkers

Table 7-2. The 3 types of attributes, after Noppers (2014), modified.

8 CONCLUSION

This project is the first word on frequent walkers, and hopefully not the last. We would welcome confirmation studies on this little-known group in other countries and settings. We want others to learn from our findings, and also from what we perceive as limitations to our research approach. So here, we are proposing a short, forward-looking chapter as well as an acknowledgement of limitations. We conclude with two deliverables also strongly oriented towards the future: recommendations for public policy and a research agenda.

8.1 Thinking about the future

It would be interesting to imagine what a society with many more frequent walkers would look like, as a contribution to the contemporary scientific debate around sustainable mobility futures. Indeed, imagining the future helps make us aware of what is wrong in the present mobility system (Freudendal-Pedersen et al., 2016). Likewise, we would argue that by focussing on what needs to be changed now, it is possible to imagine the future.

From a public health point of view, it is clear that only a small increase in walking would be sufficient to reap substantial benefits, but it is not sure what increase in walking would be necessary to operate a real change in biomedical and psychosocial health at population level. Even more importantly, it is not known how those increases in walking need to be distributed in the population. From this point of view, a health impact assessment (Simos & Arrizabalaga, 2006) of, say, doubling current walking levels seems long overdue.

If frequent walking were to become mainstream, there would be many more people out of doors, walking up and down the streets. Based on our data, much of this extra walking would be occurring within or near city centres. It is tempting to imagine that, if conflicts between frequent walkers and other road users have been rare up to now (questions in our qualitative interviews addressed these matters specifically), they may increase with higher volumes of pedestrian traffic. Conflicts would be likely to occur with cyclists, motorcyclists and car drivers, but also potentially between walkers themselves. Our frequent walkers seem to be generally very tolerant, but it remains to be seen how fast walkers (most of our participants belong to this group) would react if they were "swamped" by hordes of slow walkers on relatively narrow pavements.

It is tempting to imagine that walkers, with frequent walkers at their helm, might congregate into associations or pressure groups in order to defend their interests –

and demand access to more urban space. Such groups already exist but are finding it hard to attract people such as frequent walkers – *Mobilité piétonne* and its limited number of members are a case in point in the Swiss context. Our research shows that, at present, frequent walkers do not view themselves as a constituted or even informal community. So, it is unlikely that they will themselves operate a revolution, in any sense of the term.

If our "utopia" is a country or urban area with high levels of frequent walkers who play an active role in changing society, we should investigate two other possibilities. One is that higher levels of walking might be achieved without the intervention of the present vanguard of frequent walkers, i.e. that information from frequent walkers might somehow be packaged and transmitted to other people, who would thus be able to progress through the various stages of the trans-theoretical model. We will call this the "walking culture" scenario. The other scenario is that the generalisation of frequent walking will not occur, or if it does, then the brunt of the increase will be related to leisure walking in rural areas – with no benefit to sustainability. We refer to this as the "non-walking culture" scenario.

We believe that the measures needed to favour a "walking culture" and to prevent the alternative scenario from happening – although worth considering separately from a scientific point of view – boil down to the same set of measures, which will be described in the upcoming chapter on policy recommendations. But other researchers have been thinking along these lines. In a recent book about connecting sustainable transport with health (Mulley et al., 2017), a conclusion aptly termed *The future of walking?* provides a "think piece" about a future where walking would play a far greater role than today. Here, UK researcher Miles Tight mentions apps for mobile phones as an area where we may yet see development in future years, as people seek new ways to navigate more complex cities on foot. But technology is not the main thrust of his article: key for the future is the way people feel about walking and the value that they place on walking. This opens up opportunities for social science research on daily walking. In our view, a crucial point will be whether future frequent walkers will feel empowered to communicate about their positive feelings and experiences linked to walking (Tight, 2017).

Long-term background trends such as declining fossil fuel resources and the ageing of the global population are other elements that Tight (2017) feels we should bear in mind. Among the research gaps listed in his conclusion is the lack of information about the precise routes that walkers take, and why they take them. For example, if an intervention were to encourage people to walk along a more pleasant route rather than trudging along a main road, we know very little about the arguments that would make people adapt their behaviour – and even less about those that might incite them to switch travel modes altogether. We are willing to contribute some of our research findings to try to find solutions to these questions. There is also a massive gap regarding walking trips that are *not* carried out. We know, thanks to the motility

framework, that social conditions of access as well as mobility knowledge and skills are not sufficient for a trip to take place. Miles Tight refers to this as "suppressed demand for walking" and we believe it should become a research priority.

Also mentioned in *The future of walking?* is the Visions 2030 project focusing on the UK and that has implications for other settings, including our study area. It used a test city the size of Nottingham – which has an urban area roughly comparable to Geneva. There were 3 scenarios or visions, the third of which being the most extreme, resulting from an extreme shortage of fuel. The mode shares (based on transport stages with a 50 metre cut-off) for this scenario are 40% each for walking and cycling, 15% for public transport and only 5% for the car. For us, it is interesting that it was felt necessary to justify such a scenario by extreme fuel shortages, and that the idea of rising levels of walking would have to be accompanied by comparable rises in levels of cycling.

Initiated as a UK government project, Visions 2030 was also published in peer-reviewed form (Tight et al., 2011) where we can see the future scenarios played out as Vision One (European best practice), Vision Two (car-free public transport-oriented) and Vision Three (localised energy-efficient). It is clear that the process of scenario building is based on "*desirable futures*" (italics in the original publication) and involves trend breaking rather than extrapolating current trends. Essentially, the authors state that, by 2030, social change will have needed to take place, without saying how such a change might be brought about (unless the fuel shortages are considered to be the only option).

What is interesting in this prospective exercise is the idea that the transportation system is "endogenous" and operates on an "exogenous" background context, with the implication that the background can influence transport, but not the other way round. Tight et al. (2011) criticise this approach and summon the New Mobilities paradigm to the rescue: mobility has an influence on society, as well as society having an influence on mobility (Sheller & Urry, 2006). It follows that the fuel shortages present in Scenario 3 do not, or do not only determine the scenario. Indeed, the transportation system may be partly responsible for the said shortages.

We draw again on work by Tight et al. (2011) to emphasise another point: much of the work on walking, including our own, is based on urban settings. Whatever is going on outside cities is bound to have an effect on urban settings, and vice-versa. If fuel shortages really do become a problem, then people living in the countryside may have to opt for a truly rural lifestyle, or move (back) to the city.

Tight et al. muse that people in peripheral areas who enjoy walking and cycling may migrate to the city, while city-dwellers who prefer their car will move in the opposite direction. We believe this has already happened to a significant extent, at least in Switzerland. This was noticeable among our sample of frequent walkers, where most

of the people who drove a car every day lived in the countryside (from golfer and sportswoman 2109 Diana and dog walkers 4608 Deborah and 5703 Noelle to 6603 Deirdre in central Geneva or 2601 Tamara in central Lausanne who chose their locations so they could live without a car). A future mobility system based on walking in cities will necessarily have an effect on more peripheral locations. Although the continued urbanisation of the planet is well documented and does not seem to be slowing down, the key to sustainable transportation futures may well lie in rural areas.

One of our rural dog owners admitted to us in private (not on audio recording) that he dreaded the day when he would become too old to be allowed to drive. This rather distant threat (he was still of working age) struck us as showing to what extent urban living is more flexible than rural living. As the ageing of global populations carries on its course, we may see more and more people seeking refuge in the city for reasons linked to transportation. Given the political weight of senior citizens, now and in the future, social norms might change, in due course, to make walking more desirable than today. However, in our view, the eventual influx of senior citizens from rural areas into the city is unlikely to herald a golden age of cycling, thus breaking the link between walking and cycling that has been the mainstay of "alternative" mobility for the past 20-30 years.

8.2 Limitations of this study

From the inception of this research project, we decided not to separate utilitarian and recreational walking. We believe that we were right to do this, in the Swiss context, because much of the walking was intermediate between these two motivations or combined them in various ways. Nevertheless, it is of interest to look at recent publications that have tried to draw a clear distinction between utilitarian and recreational walking, with the caveat that the main study that we identified in this area was carried out in the USA, where conditions are likely to be different from Switzerland. In this study (Kang et al., 2017), objectively measured utilitarian and recreational walking were described as “different behaviours”. Walking bouts were classified as one or the other based on whether walking had a destination or not, i.e. only loops were considered to be recreational. Although we are impressed by the quality of the work (data were collected for 651 Seattle residents wearing an accelerometer and a GPS unit, who also filled out a travel diary for one week), such a separation between functional and recreational walking does not correspond to our view of the topic.

Another limitation is the absence of a control group. For example, it could be argued that some people who are not frequent walkers may also have high motivation and skills related to walking. Control groups are not that common in social science,

especially not in qualitative research where it is difficult to justify extra budgetary spending to investigate people who are not the major focus of the research project. But control groups are considered vital in many areas attached to public health and health promotion, so we may have a (trans)disciplinary issue here. This is something we hope to address in future research projects (see Research agenda).

A further limitation is linked to our recruitment strategy, which sought to maximise diversity (this is not a limitation) but which did not succeed completely in doing so. In particular, the Qualitative phase mainly contained people who were employees of Canton Vaud, implying a relatively high – and homogeneous – standard of living, as well as an excellent level of social integration. Almost all the sample was of Swiss nationality, whereas on 31st December 2016 around 40% of the population of the canton of Geneva was not Swiss (and around 34% of the population of canton Vaud). So it should be emphasised that foreign residents were for practical purposes not addressed by this study, and the study design does not enable us to say whether this is because they are less likely to be frequent walkers or simply less likely to be accessed by the recruitment strategies that we used. The nationality, social and gender issues are intertwined because, in Switzerland, the brutto median salary is around 15% lower for foreigners than for Swiss nationals. This is almost the same difference as between Swiss male and Swiss female workers. A Swiss man earns around 35% more than a foreign woman, and these figures only take into account legally declared workers.[6]

Finally, there are limitations associated with our sequential, mixed-methods design. No doubt we could have achieved a deeper level of understanding in some areas if we had done only a quantitative, or qualitative, or spatial analysis. But we would have missed out on the breadth of information. Since this is the first study on this topic, we believe we were justified in choosing a wide-ranging, open-ended approach. Hopefully, future research projects on similar topics will be able to specialise a bit more on such or such an aspect of frequent walking.

8.3 Policy recommendations

This section is not a review of what others have suggested, it is a personal take on what has emerged from our present research project. It follows that it should not be considered as an exhaustive list of what should be done, but as measures that should be added to current initiatives and campaigns, for example around urban quality, which remain as necessary as ever.

[6] www.bfs.admin.ch/bfs/fr/home/statistiques/catalogues-banques-donnees/tableaux.assetdetail.327816.html

Linking and signposting

Several of our study participants became frequent walkers thanks to a pedometer (manual or electronic) or via Nordic walking. There also is a link between frequent walking in urban space and hiking, since many of our participants were seen to elope to the Valais or other neighbouring regions during the course of their GPS tracking. It was not clear whether walking in the mountains had led to urban walking or the other way around, or if both behaviours were the consequence of upstream factors. What is evident, however, is that frequent walkers (at least those that we studied) are mostly an extremely mobile group. So, whatever encourages walking in one area is likely to encourage walking elsewhere.

What we are getting at is the idea that links should be made between hiking and urban walking. This could be done by promoting the use of shoes and clothing that are appropriate for both hiking and urban walking. We would also suggest targeting hikers, in the mountains and other places where they can be found, with messages linked to urban walking. This process could be supported by using the same signs to indicate directions and distances in cities as those that have been used for many years in mountain and countryside settings in Switzerland. Signposting is a controversial subject for walking researchers and practitioners. It often comes up in international conferences such as Walk21, and despite many ideas and experiments on the subject there is little consensus.

At present, a person getting out of a bus or train in mountain areas in Switzerland will see an array of easily-recognisable yellow signs directing them to various destinations (average walking times are indicated, but not distances). The same person getting out of a train in Geneva or Lausanne will find no such information, or at least not in the same, easily recognisable form. We wish to argue, very strongly, that seeing the same signs in urban areas as in mountain areas is likely to help people make the link between the two behaviours. To start with, we suggest something extremely concrete: setting up signs indicating the direction and distance from Geneva and Lausanne stations to their respective hospital sites: HUG and CHUV. Both are accessible on foot, within around 25-30 minutes. As in mountain areas, the signs would have to be repeated at regular intervals and whenever there is a significant change of direction. In between signs, paint can be used (alternative white and red lines) – like in the mountains. We believe this should be done because at present there is a bewildering array of systems in different cities and towns, as has been shown by the Swiss civil society organisation *Mobilité piétonne*. This organisation reviewed ten different systems within Switzerland (none of them in the study area of this thesis) and concluded that one of the main things that is missing is a systematic overview or "big picture" (Regli, 2014).

Pedometers

Another suggestion that we have is based on the notion that pedometers are useful for helping people become frequent walkers, but have a number of problems or

pitfalls. First, many people are not willing to buy such an object, although they may be happy to receive one for free even if it is only for a short time (hence the success of the *ça marche avec mon podomètre* programme). An interesting observation during the course of our thesis is that the existence and improvement of smartphone-based pedometers and watch-like accelerometers has apparently not reduced people's interest in mechanical pedometers. However, although some private medical insurance companies in Switzerland have been known to give them out for free to their members, the cost remains an obstacle (this seems to be a question of principle because they usually cost in the range of 25-50 Swiss francs). This is probably because people do not want to acquire an object that they will only be using for a short time. So, our suggestion is to use the network of public libraries to lend pedometers to citizens. The advantage is that the network is already available and controlled by municipalities. An organised, controlled system for lending books is in place, with fines and penalties as well as possibilities for extension. We suggest setting up a pilot project to test this idea.

Public transportation

Looking back at the main skills displayed by our study participants, we realise that it is not easy to teach time management or "space management" to people. However, we should not stop at this level of analysis. In fact, the complex time and space management skills displayed by our frequent walkers mostly had an important ally: an efficient public transportation system. Most of the participants who used public transport either knew exactly when to turn up at the station to catch a train, or knew that services were frequent enough (and alternative activities such as shopping accessible enough) for them not to have to bother about looking at the timetable, nor even at the time.

The implications are that the Swiss public transport system, already hailed as one of the most efficient in the world, may be one of the reasons why levels of walking are relatively high (although safety may also play a role). This allows us to point towards areas where the situation could still be improved. First, access to train stations is not always easy: both Geneva and Lausanne have a major road running in between the station and the city centre. Despite the existence of underground passages, many people still prefer to cross over on the surface, where waiting times at traffic lights can sometimes be rather long (especially in Geneva). So, ideally, there should be a pedestrianised area in front of train stations, that allows easy access to and from the city centre. Ways of achieving this include: putting the traffic underground, removing or diverting traffic elsewhere, or allowing access to the station but no through traffic (a car arriving from the western side would have to turn round and head back west).

Cigarette smoke

Since cigarette smoke was pinpointed as a problem by several of our participants, we suggest making it illegal to smoke on train platforms. This is an idea that has already been considered by the national rail company (CFF) and pilot projects are underway

in a handful of stations in Switzerland, including Nyon that is in our study area. The situation regarding bus stops is a little bit more difficult to control, but it is certainly possible to declare that open bus stops (*abribus*) are non-smoking areas. We suggest testing this idea. This should be possible at municipal level, since the municipalities are generally responsible for the provision and maintenance of bus stops.

Teaching skills

The skills necessary to read a map or a timetable, navigate the city on foot and get to where one wants to go in a reasonable time frame can be learned. Here, maybe the private sector could intervene, with government backing for the initial phases. The basic idea would be to roll out courses on walking, or on the combined use of walking and public transportation. Such courses could be given partly indoors (to study maps and timetables and to learn how to plan walking trips and establish the associated routines) and outdoors (to learn how to apply this knowledge and improvise on top of all the planning). Similar courses are already given by the Association for transport and environment[7] for schoolchildren and, more recently, for senior citizens. The idea here is to target adult, professionally active individuals who have a choice of transport modes. The courses could be individual or collective – or a combination of both – and would have a cost covered by the person or by their employer or health insurance company (a remit of the private sector in Switzerland).

Walking highways

Evidence from this study shows that wide, straight and unencumbered pavements are much appreciated for walking, especially if they are not interrupted by crossings or traffic lights. This remains the case, even if the pavement runs along a main road. However, even the frequent walkers most insensitive to neighbouring traffic admitted that if they had the choice, they would rather walk along a quieter route. So the suggestion is to instate “walking highways”. Motorways are reserved for cars and other motorised vehicles (no walkers or cyclists are allowed) and have no crossings. Our “walking highways” would be much the same: crossings would be few and far between, and everything would be organised so that these walkways capture as much pedestrian traffic as possible. Here, we suggest pilot projects in Geneva and Lausanne, targeting the most promising route in terms of numbers of people involved: the routes from the main train stations to the University hospitals, in both cases going through the central part of the city.

Here, we should perhaps emphasise that the University hospitals are being pinpointed not because of their hospitalised patients or visiting relatives, but because they are major generators of pedestrian traffic, and of traffic generally. In Geneva and Lausanne, the hospitals are placed on the other side of the city centre compared to the train station, makes it logical to draw a line from the hospitals to the train stations,

[7] ate.ch

going through the city centres (including the old town and commercial streets in both cases). These are not viewed as the only walking highways that should be drawn, but potentially as the most important and therefore the first that should be laid out and signposted accordingly.

Advocacy and communication

We asked all our participants whether they would agree to meet other frequent walkers, and around one half said yes. We therefore intend to invite them to a public discussion and an optional walk. In this ways, we may be able to kick-start the informal community of frequent walkers that remained elusive throughout this research project.

In order to stimulate internal factors including personal motivation, we believe that the interesting idea of prescribing pleasure to people via walking (Segar & Richardson, 2014) deserves to be investigated and supported, while opposing the notion that walking for pleasure is necessarily slow (Hills et al., 2006). Communicating about the pleasure that can be derived from walking can indeed be stepped up, for example using role models. The pleasure itself can be increased by reducing and calming traffic and stepping up urban improvements such as continuous pavements and pedestrianised areas.

For more people to become interested in frequent walking and progress to frequent walker status, action is required at all levels of the trans-theoretical model. For those in pre-contemplation, i.e. who have not even considered walking a lot, it is necessary to sensitise them to the advantages linked to frequent walking. For this, we suggest the creation of an Internet site, which could deliver tailored information on walking to people in all stages of the trans-theoretical model, as has already been done successfully in the field of tobacco control (Bock et al., 2008).

There are indications from published research that people are willing and able to access an array of health information on the internet. In the USA, up to 80% of the population goes online to try to access information on health (Wright et al., 2012), with weight loss, nutrition and exercise featuring among the most popular topics (Fox, 2006). Figures in Europe are likely to be only slightly less high, with a recent study in Scotland recording that 68% of a convenience sample went online to search for health information (Moreland et al., 2015). These publications underline that not only do people access health-related information frequently, but they are likely to act on the information: it influences their behaviour in around 40-50% of cases, according to these studies. The problem, in our view, is that this will not lead them to information related to the environment or urban quality. So, a person seeking to lose weight, reduce their impact on the environment and/or may miss out on some of the most important aspects of walking. Our suggested web site would link up information from public health, sociology and urban studies, with a focus on (frequent) walking. It

would contain practical tips on how to organise oneself to walk more, what to look out for when navigating urban settings on foot, etc.

Incentives
When discussing how public policies could make urban settings healthier and more sustainable, the question of incentives often comes up. This is because they already exist in other policy sectors. Within our study area, we could mention the support given by several communes in canton Geneva for cycling or the use of public transportation. The former is supported by financial contributions towards buying an electric-assist bicycle; the latter by contributions to the cost of an annual pass for the local public transportation system (*unireso*, which includes Transports Publics Genevois and other providers). Other incentives in the Vaud-Geneva area include payments to encourage house owners to change their windows for high-quality double glazing, with a view to reducing fuel consumption and therefore greenhouse gas emissions. No financial incentives were found when we investigated policies on walking in the Vaud-Geneva study area. This is not to say that walking is not encouraged, but that there is no tangible incentive such as a financial contribution. If incentives in favour of walking were to be introduced, what could they look like? Drawing on our qualitative and spatial data, we suggest that the following ideas should be investigated further, preferably by being tested and evaluated in real-world settings:

a) Giving out or lending pedometers
b) Giving vouchers for buying improved footwear or walking clothes
c) Modifying and increasing contributions towards public transport, to favour and include walking

8.4 Research agenda

This final chapter has two levels. The first is a general research agenda which should be supported at global level, or at least at European level. The second is a more personal research agenda where we consider potential follow-on projects for this thesis.

Policy packaging
At a general level, we agree with a recent *Nature* editorial (Bruun & Givoni, 2015) that governmental agencies need to support interdisciplinary systems-level research, rather than technological fixes with commercial potential such as autonomous cars. We are interested in the "policy packaging" concept mentioned in this editorial, where a combination of instruments is implemented while steps are taken to minimize unintended effects and increase the chances of an intervention’s success (Givoni et al., 2013). Given examples are London’s congestion charge system, whose package

included discounts for local residents and an improved public transportation supply. The policy packaging approach is of particular interest to us because it is reminiscent of the (relatively successful) tobacco control campaigns that swept through much of the world during the early 2000s. Several measures were introduced – although often not in a coordinated manner. There were differences between countries and sometimes even between local authorities, but most policy packages contained: banning smoking in public spaces, increasing taxes on cigarette packets, making health warnings larger and more explicit (with a view to progressing towards plain packaging), outlawing direct and indirect advertising of tobacco products, counter-marketing, school education, and supporting tobacco cessation programmes (Carroll et al., 2016). For walking, we have yet to see a comprehensive plan including the elements mentioned above, which are all in the WHO Framework convention on tobacco control.[8]

International guidance documents

Future personal work around frequent walkers includes possible post-doctoral activities related to public policies. As we discussed at the International Conference of Urban Health in Coimbra in 2017, walking does not have much support at the highest international levels (Christie et al., 2017b). The word fragment “walk” does not even appear in the Sustainable Development Goals, nor in many key guidance documents from the United Nations and even, in some cases, from the World Health Organization. During that conference, we suggested that this lack of top-down support may be one of the things which is preventing cities across Europe from prioritising walking. In this respect, it may be useful to mention that these guidance documents (at least in the case of WHO) are not simply top-down, normative sets of rules. They emerge from literature reviews and expert consultations and often require the approval of Member States. Future work should investigate these aspects in detail, concentrating on these points:

a) What policy documents do urban practitioners use in the field to justify their action?
b) What supporting documents are used by civil society organisations and other groups that seek to promote walking
c) If new policy documents were to appear, what should they look like to have maximum effectiveness in the field?
d) What needs to be done to make international guidance documents focus on walking?

Health impact assessment

As mentioned in the Quantitative section of this thesis, recently analysed data from the Netherlands (Fishman et al., 2015) shows that over a third of the population of

[8] www.who.int/fctc

that country exceeds recommended physical activity levels using walking and cycling alone, while over half of the population does not actively move at all on the reference day. We therefore suggest carrying out a similar analysis using Swiss data: using walking and cycling speeds and converting them into metabolic equivalents (METs), we could quantify what frequent walking (and cycling) bring to the general public health status of the country. We would even suggest going a step further and undertaking an economic valuation of this walking and cycling. Then a combined health impact assessment (HIA) (Simos & Arrizabalaga, 2006) and economic assessment could show to politicians what a substantial increase of walking distances would bring to a country such as Switzerland – or anywhere else for that matter. The HIA approach would be particularly useful because it looks into the distribution of potential effects of a measure within a population or society, and as we have seen walking is very unequally distributed and potential increases in walking (e.g. following infrastructural improvements) are also distributed in an unequal and no doubt inequitable way as well.

Ageing and gender issues

Also as mentioned in the Quantitative section, more research is needed to investigate the gendered patterns of walking. With other researchers in the field (Pollard & Wagnild, 2017), we argue that we still need to improve our understanding of how walking fits into the lives of women and men across the life-course and into old age. Particular attention should be paid to the impact of aging on walking, but also to the impact of walking on aging. In fact, we would favour an open research project investigating walking and aging without any ex ante hypotheses regarding causality. As expressed by Pollard and Wagnild (2017), we must seek to understand walking as "a social practice, embedded in, and shaped by, complex social worlds in which gender plays a powerful role". A method for investigating these questions is supplied by the concept of "structural stories" (Freudendal-Pedersen, 2009) which could be applied here. The idea would be to get frequent walkers to discuss in groups (rather than individually as we have done in this thesis) their ideas about their everyday mobility behaviours – and the justifications that they give for them. Examples of structural stories around frequent walking might be: "walking in the city is OK as long as you don't have to talk to anyone", "if you want to walk in the countryside, you need a car" or "if you want to walk in the city, you have to use public transport". These are just a few ideas related to our research and that might form a useful basis for future focus groups trying to get to grips with the structural stories around frequent walking.

Public transport

The link between public transport and walking is a strong one, but our data suggest that train journeys and urban public transport are experienced very differently by frequent walkers. Since several of our participants expressed interest and satisfaction with transport by train, but disappointment (if not disgust or anger) at buses, we believe there needs to be more work done to disentangle the attitudes of

urban residents and visitors towards these transport modes that are too often lumped together. Similar to the work that we have done in this thesis to try to disentangle walking from cycling, we now require targeted research to understand why buses get such bad press compared to trains, and what might be the status of intermediate types of vehicle such as the tram and light railways or metros. Such a research project would combine quantitative, qualitative and spatial methods to create a typology of users and a typology of public transport vehicles and/or services. The objective would be to deliver to public transport operators and supervising agencies the information that they need to improve service and attract more ridership – in conjunction with more walking, of course. Such a project could be carried out in Geneva (that has a tram system) and Lausanne (with its automatic metro). It would be advisable to select 2-3 other medium-sized European cities for comparison.

Cohort study

We wish to plead for more research along the lines of what we have done for this thesis, but with a few important differences. We have essentially conducted a cross-sectional study: people have tried to recollect how they were before they became frequent walkers but we were never able to "catch" them while they were changing behaviours, nor even interview them before and after the eventual change. This would be very difficult to organise: frequent walkers are rare and finding them at a particular time juncture would make recruitment almost impossible. What we suggest, therefore, is a mixed-methods approach that would catch the same people at different times, i.e. a cohort study. Its objective would be to try to understand what internal and external factors appear before, during and after someone changes their level of walking. Because relapses are likely to happen, such a study could use the trans-theoretical framework.

Intervention study

To go a step further, we suggest carrying out an intervention study investigating the effect of "prescribing" a public transport pass to people who do not already have one, because we know that using public transport is significantly associated with more walking. using such an approach, it may be possible to observe frequent walkers "in the making". A study design likely to lead to the highest level of evidence would be advisable, so that the information can be used for informing policy at all levels: the randomised controlled trial. Indeed, one of the reasons why detailed guidance on promoting walking is not being supplied by WHO and the UN may the absence of such epidemiological evidence in the field of mobility. It is high time for such an important policy sector be given that opportunity.

9 APPENDIX

9.1 Bibliography

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9.2 Curriculum vitae

Mr Derek P. T. H. Christie, MSc MPH
Born 1st November 1965
Nationalities: British and Swiss
Address: 29, rue des Gares – 1201 Geneva, Switzerland
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University education

2009 Master of Public Health (MAS-MPH). University of Geneva, Switzerland
2003 MSc Tobacco Control. University of Montpellier, France
1998 MSc Statistics. University of Neuchâtel, Switzerland
1995 MSc Biology (Medical Genetics). University of Geneva
1993 BSc Biology. University of Geneva

Courses attended with certificate (selection)

2017 – Streamlining Health Impact Assessment (Barcelona Institute for Global Health)
2012 – Meta-analysis methods of the Cochrane Library (University of Geneva)
2009 – Environment and health (University of Basel)

Work experience (overlaps due to part-time positions)

Since 2011	Laboratory of urban sociology, EPFL. Researcher and PhD student.
2008-2011	Technical Officer at WHO (Interventions for Healthy Environments) and UNAIDS (Office of the Chief Scientific Officer).
2003-2010	Researcher and science writer, Institute for social and preventive medicine, Faculty of Medicine, University of Geneva.
2006-2008	Health educator for adolescents in state schools in Geneva.
2000-2008	Science writer, *energie-environnement.ch* and other publications, Geneva.
1998-2000	Chief editor of *Campus*, the magazine of the University of Geneva.
1995-1998	Science writer for *Horizons/Horizonte*, *Human Frontier Science Programme*, etc.

Book chapter

D. P. T. H. Christie, E. Ravalet and V. Kaufmann. Walking in Switzerland: urban and not so leisurely. *In*: Routledge International Handbook of Walking (2018).

Peer-reviewed abstracts and publications (selection)

D Christie, I Guessous, E Ravalet, V Kaufmann. Associations between daily walking and subclinical health markers in a Swiss City. *Journal of Transport & Health* **5,** S3-S4 (2017).
D Christie, A Koymans, T Chanard, JM Lasgouttes, V Kaufmann. Pioneering driverless electric vehicles in Europe: the City Automated Transport System (CATS). *Transportation Research Procedia* (2016).
D Christie, E Ravalet, V Kaufmann. Looking for "frequent walkers" among the resident population of Switzerland. *Journal of Transport & Health* **2(2),** S64 (2015).
S. Munafò, V. Kaufmann, D. P. Christie, S. Vincent-Geslin and E. Ravalet. Dispositions et usages de l'automobile et des transports publics entre 1994 et 2011: Berne, Genève et Lausanne, *Revue d'économie régionale et urbaine*, **5**, pp. 753-782 (2015).
JF Etter, C Ritter, DH Christie, M Kunz, JP Rieder, JP Humair, H Wolff, A Eytan, C Wahl, B Elger. Implementation and impact of anti-smoking interventions in three prisons in the absence of appropriate legislation. *Preventive Medicine* **55 (5)**, 475-481 (2012).

A Kumagai, Z Carr, O Akira, D Christie, S Yamashita. Survey of the WHO-REMPAN network's capability for strengthening preparedness for radiological and nuclear emergencies. *Radiation Protection Dosimetry* 151(4), pp. 607-610 (2012).
DH Christie, MC Chu, Z Carr. Global networking for biodosimetry laboratory capacity surge in radiation emergencies. *Health Physics* **98(2)**, pp. 168-171 (2010).
DH Christie, Jean-François Etter. Validation of English-language versions of three scales measuring Attitudes towards smoking, self-efficacy and self-change strategies". *Addictive Behaviors* **30(5),** pp. 981-988 (2005).
D Christie, JF Etter. Utilization and impact of cigarette pack covers illustrated with anti-smoking messages. *Evaluation and the Health Professions* **27(2),** pp. 107-118 (2004).
JL Blouin, DH Christie, A Gos, A Lynn, MA Morris, DH Ledbetter, A Chakravarti, SE Antonarakis. A new dinucleotide repeat polymorphism at the telomere of chromosome 21q reveals a significant difference between male and female rates of recombination. *American Journal of Human Genetics* **57**, pp. 388-394 (1995).

Public presentations (selection)
D. P. Christie, J. Simos, E. de Leeuw, E. Ravalet and V. Kaufmann. Why is promoting daily walking not a priority in European cities? A review and research agenda. International conference on urban health. Coimbra, Portugal (2017).
D. P. Christie, V. Kaufmann and E. Ravalet. Frequent walkers are multimodal in their actions and individualistic in their motivations, according to a qualitative study in two Swiss cities. Desirable Transport Futures, 3rd international workshop, Freiburg, Germany (2016).
D. P. Christie, E. Ravalet, V. Kaufmann, N. Cantoreggi and J. Simos. Positive association of walking with the use of public transport in Switzerland. Swiss Public Health Conference, Geneva (2015).
D. P. Christie, E. Ravalet and V. Kaufmann. Big walkers over non-walking drivers: a walking-related metric for evaluating the success of transportation and public health policies. Walk21, Vienna (2015).
D. P. Christie, E. Ravalet and V. Kaufmann. Transport mode choice in alpine resorts in Switzerland. Perth III: Mountains of Our Future Earth, Perth, Scotland (2015).
D. P. Christie, A. Koymans, T. Chanard, P. Vollichard, S. Lavadinho et al. City automated transport system (CATS): the legacy of an innovative European project. European Transport Conference, Frankfurt (2015).
A. Audikana, D. P. Christie. Exploring urban speed in the context of slow-oriented urbanism. Congress of the Swiss Sociological Association, Lausanne (2015).
D. P. Christie, V. Kaufmann and E. Ravalet. Analysing the distribution of walking in the Swiss population. 15th Swiss Transport Research Conference, Monte Verità, Ascona, Switzerland (2015).
E. Ravalet, D. P. Christie and V. Kaufmann. Walking for transport in Zurich and Geneva. *Differential Mobilities*, Concordia University, Montreal (2013).

Voluntary activities
1996-present. Member of the board of the Association for transport and environment
2015-present Member of the commission on environmental issues, Geneva Airport.
2010-present Veteran soccer player. FC Crans (Crans-près-Céligny).

9.3 Interview guide

PROJET DE RECHERCHE SUR LES GRANDS MARCHEURS
Canevas d'entretien – Entretiens préalables
Version du 15 mai 2016

NOTER OÙ ET QUAND S'EST FAIT LE PREMIER CONTACT AVEC LA PERSONNE
Se présenter et expliquer la démarche: réaliser un entretien dans le cadre d'un projet de recherche consacré aux Grands marcheurs. Demander si la personne serait disposée à consacrer environ 50 minutes à un entretien. Lui montrer l'intérêt personnel, scientifique et institutionnel de la recherche. **Indiquer à la personne que l'entretien sera enregistré (audio). La confidentialité est garantie. Des citations pourront apparaître dans des publications scientifiques, ainsi que des extraits audio. Dans ce cas, un pseudo sera utilisé.**

FAIRE SIGNER LA FEUILLE DE CONSENTEMENT ÉCLAIRÉ

I. Situation actuelle par rapport à la marche à pied + historique et anamnèse

Etes-vous d'accord que j'utilise votre VOIX dans des extraits audio, avec un but scientifique (non commercial)?

1. Combien marchez-vous par jour / par semaine ? (distance, temps et/ou pas)
   - ➔ Marchez-vous davantage la semaine ou le week-end?
   - ➔ S'agit-il du même type de marche pour aller au travail ou pour les loisirs?
   - ➔ Depuis quand marchez-vous (autant)? -> passer en revue les 10-15 dernières années par rapport à la mobilité (déménagements, changements professionnels, etc.)
   - ➔ Marchiez-vous beaucoup pendant votre enfance/adolescence?
   - ➔ Est-ce que vous marchez davantage ou moins qu'il y a quelques années?
   - ➔ Quel est le moment de votre vie ou vous avez le plus marché?
   - ➔ À quel étage êtes-vous (au travail / à votre domicile)? -> escaliers ou ascenseur?
   - ➔ Combien de pas aviez-vous à la campagne *ça marche avec mon podomètre*? (et combien de fois avez-vous participé)

2. Depuis quand marchez-vous régulièrement?
   - ➔ Quelle est la période de votre vie où vous avez le plus / le moins marché?

3. Est-ce que vous avez commencé à marcher suite à un événement ponctuel, ou s'agit-il d'une lente évolution?

4. Pourquoi marchez-vous? (question TRES ouverte, chercher à comprendre la motivation)

5. EST-CE QUE BEAUCOUP MARCHER EST UNE CONTRAINTE OU UN CHOIX? (échelle de 0=contrainte totale à 10=choix total)

6. Pour quel motif marchez-vous? (chercher à comprendre si la marche est générale ou réservée à certaines fonctions/destinations)
   a) Relance parcours travail/études (commuting)
   b) Relance achats (courses / comissions)
   c) Relance loisirs

7. Avez-vous un horaire / des horaires réguliers pour le travail?
8. Avez-vous un horaire / des horaires réguliers pour vos trajets à pied?

9. Avez-vous un parcours / des parcours réguliers pour vos trajets à pied?
   a) Si possible, indiquer le parcours en détail et/ou sur une carte
   b) Quels sont les éléments/événements qui peuvent vous faire changer d'itinéraire?

10. Privilégiez-vous plutôt les trajets directs ou les trajets agréables?
    - ➔ Relance sur les cartes, papier, téléphone, ou internet.

11. Comment intégrez-vous cette marche dans votre quotidien? Avez-vous dû faire des sacrifices? (question ouverte)

12. Comment vous orientez-vous dans l'espace?
    - Cartes (papier, sur téléphone, sur ordinateur ou iPad…)
    - Repères visuels (lesquels)
    - Pensez-vous avoir un bon sens de l'orientation?

13. Pour vous, quels sont les principaux éléments favorables/défavorables à la marche ?
    a) Relance feux de signalisation / passages piétons
    b) Relance trottoirs (qualité, largeur, encombrement)
    c) Relance barrières entre les propriétés
    d) Relance voitures et motos
    e) Relance pollution de l'air
    f) Relance bruit
    g) Relance conflits avec les vélos
    h) Relance douche/transpiration (importance de la douche au travail)
    i) Y a-t-il des endroits que vous recherchez particulièrement ? (capable de faire un détour pour y passer)
    j) Y a-t-il des endroits que vous évitez particulièrement ? (capable de faire un détour pour l'éviter)

14. Qu'est-ce que les autorités publiques pourraient faire pour rendre la marche plus facile, plus agréable (dans les zones urbaines)?
    ➔ Relance zone piétonne, zone 20 et zone 30
    ➔ Qualité du sol

15. Est-que vous avez déjà pensé à vos engager politiquement ou au sein d'une association (ou dans votre entreprise) en faveur de la marche?

16. Marchez-vous généralement seul(e) ou accompagné(e)?

17. Est-ce que la météo influence votre comportement de marcheur / marcheuse?

18. Question multimodalité en général. Dans quelle mesure pratiquez-vous aussi les autres moyens de transport ? (question ouverte)
    a) Relance vélo: kilomètres par jour/semaine avec motifs. A un vélo : oui/non.
    b) Relance voiture/moto: kilomètres par jour/semaine avec motifs. Propriétaire d'un véhicule?
    c) Relance transports publics: kilomètres par jour/semaine avec motifs. Titulaire d'un abonnement: si oui, lequel et depuis combien de temps.

19. Question multimodalité sur le même déplacement. Vous arrive-t-il de marcher sur une assez grande distance (> 1 km) pour ensuite prendre le bus, le tram ou le train?

20. Question sur les vacances / loisirs : marchez-vous aussi le week-end ou en vacances? Si oui, est-ce que vous marchez de la même manière et qu'est-ce qui change par rapport à la semaine? (vitesse, habillement, seul ou à plusieurs, etc.)

21. Est-ce que d'autres personnes dans votre ménage privilégient aussi la marche? Sinon, comment se déplacent-elles?

22. Est-ce que d'autres personnes parmi vos amis et vos collègues pratiquent aussi la marche? Sinon, comment se déplacent-elles?

23. Avez-vous eu des douleurs musculaires ou articulaires liées à la marche (soit provoquées par la marche, soit guéries par la marche)?

24. Qu'est-ce que ces autres personnes disent de votre activité? (question ouverte)
    a) Relance: est-ce que vous avez déjà essuyé des remarques désobligeantes ou des moqueries?
    b) Relance: est-ce que vous avez déjà reçu des compliments?

25. Vous pensez à quoi pendant que vous marchez?

26. Avez-vous des chaussures et/ou un habillement particulier pour pouvoir marcher en de bonnes conditions? (insister sur le chapeau, le parapluie et le sac à dos)
    - ➔ Avec des écouteurs?
    - ➔ Est-ce que vous utilisez votre téléphone portable pendant que vous marchez?

27. Est-ce que vous vous considérez comme un grand marcheur / grande marcheuse?
28. Est-ce que vous connaissez des / d'autres grand marcheurs / grande marcheuses ?

29. Est-ce que vous avez déjà constaté que vous croisez les mêmes personnes à peu près au même endroit et/ou aux mêmes heures?

30. Est-ce qu'il vous est déjà arrivé d'échanger un sourire, un signe de la main avec d'autres marcheurs?

31. Est-ce qu'il vous est déjà arrivé d'échanger quelques mots avec d'autres marcheurs, a) Par exemple pour indiquer la présence de travaux, de parcours alternatifs, etc.?

32. Question complémentaire aux 3 précédentes: et par rapport à des personnes circulant en voiture/moto/vélo, ou par rapport à des riverains ? (personnes habitant ou travaillant le long du parcours)

II. Caractéristiques professionnelles et sociodémographiques

33. Age
34. Sexe
35. Formation
36. Profession exercée, depuis combien de temps, plein temps ou temps partiel
37. Horaires de travail réguliers ou irréguliers
38. Situation familiale. Enfants ou autres personnes dépendantes dans le ménage ?
39. Lieu de résidence, depuis combien de temps. Adresse (ne pas insister, le quartier ou la rue suffit)
40. Lieu de travail/formation, depuis combien de temps.
41. DEMANDER LE REVENU DU MENAGE ?? – SUR 5 NIVEAUX SELON OFS/BFS.

III. Questions médicales et sur le style de vie

42. Comment évaluez-vous votre niveau de santé, de 0 à 10 ? (0: très mauvais, 10: excellent)

43. Fondamentalement, est-ce que vous marchez pour votre santé, ou est-ce pour d'autres raisons?

44. Est-ce que vous choisissez vos parcours selon des critères de pollution de l'air, de bruit, de présence d'espaces verts?

45. Seriez-vous d'accord de me donner votre BMI? (possibilité de le calculer en ligne)
    - ➔ Avez-vous eu des fluctuations de poids?

46. Fumez-vous ou avez-vous été fumeur/fumeuse? Autres médicaments? Café? Alcool?
    - Est-ce que cela vous surprend qu'on pose des questions de santé dans un entretien sur la marche?

47. Dans quelle mesure faites-vous attention à votre alimentation (échelle de 0 à 10)

48. Est-ce que vous pratiquez un sport ?
    a) Si oui, alors depuis combien de temps et à quelle fréquence, et quel moyen de transport empruntez-vous pour y aller ? (si la question n'a pas déjà été posée)
    b) Si non, avez-vous pratiqué un sport auparavant, lequel, pendant combien de temps, quand et pourquoi avez-vous arrêté ?

49. Est-ce que vous considérez que la marche est un sport, ou qu'elle peut remplacer le sport?

50. Avez-vous déjà utilisé un podomètre ou un accéléromètre ? – Avec quel résultat?

➔ Leur parler de l'application MOVES sur iPhone et sur Android

51. Avez-vous déjà parlé avec votre médecin du fait que vous marchez beaucoup ?
    a) Pensez-vous que c'est le genre de choses qui devrait être discuté entre un médecin et ses patients?
    b) A quelle vitesse marchez-vous, à votre avis? (donner l'info sur le seuil recommandé de 5 km/h)

QUESTIONS SUPPLEMENTAIRES 1: ajoutées le 4 décembre 2015

a. **ENVIRONNEMENT : demander si la personne a des motivations liées à l'environnement dans son comportement de marche**
   - ➔ **[Eurobaromètre QF1] Quelle est l'importance de la protection de l'environnement pour vous personnellement?**

   Très important – plutôt important – moyennement – pas très – pas important
   - ➔ **[Eurobaromètre QF15.2] A titre personnel, vous pouvez jouer un rôle dans la protection de l'environnement.**

   Tout à fait d'accord – plutôt d'accord – moyennement – pas très d'accord – pas du tout d'accord
   - ➔ **Est-ce que vous privilégiez des aliments bio?**
   - ➔ **Est-ce que vous privilégiez des aliments locaux?**
   - ➔ **Est-ce que vous mangez 5 fruits et légumes par jour?**
   - ➔ **Est-ce que vous vous brossez les dents à midi? (combien de fois par jour)**

b. **GENE LIEE A LA CIGARETTE/POLLUTION: demander si la personne a une forte perception de la (non) qualité de l'air**
   - ➔ **Est-ce qu'il vous arrive d'éviter ou de dépasser une personne qui fume, alors que vous marchez?**
   - ➔ **Est-ce qu'il vous arrive de retenir votre respiration lorsque vous traversez une route ou lorsque vous passez derrière un véhicule qui a le moteur allumé?**
   - ➔ **Qu'est-ce qui est plus gênant, la fumée de cigarette ou les gaz d'échappement?**

c. **QU'EST-CE QU'ON PEUT FAIRE POUR AMELIORER L'EXPERIENCE DU PIETON?**
   - ➔ **C'est la responsabilité de qui de s'en occuper? (strictement personnel, quartier, commune, canton, Confédération, associations…)**
   - ➔ **Que pensez-vous des zones piétonnes, des zones 20 et 30 km/h…**

QUESTIONS SUPPLEMENTAIRES 2: ajoutées le 16 février 2016

d. **Tri des déchets: combien de matériaux différents triez-vous à votre domicile?**
e. **Réglage de la température au domicile: 1-2 fois par année / plus souvent / jamais**
f. **Sommeil: qualité, dépendant ou non de la quantité de marche effectuée dans la journée?**
g. **Télévision, autres passe-temps (chronophages)?**
h. **Pourquoi n'y a-t-il pas davantage de gens qui marchent?**
i. **Que pourrait-on faire pour que davantage de gens deviennent marcheurs?**

L'ENTRETIEN EST TERMINÉ

I. Remercier la personne.
II. L'informer au sujet de la phase GPS de l'étude. Pas besoin de décider maintenant.
III. Lui demander si elle peut nous donner des noms d'autres grands marcheurs (snowballing). Lui donner le flyer de l'étude avec nos coordonnées.

POUR LES PARTICIPANTS RÉFÉRÉS PAR LE BUS SANTE GENEVE
Est-ce que vous nous autorisez à consulter les données récoltées par le Bus Santé Genève dans le cadre de cette recherche ? (si oui, leur demander de signer une autorisation en ce sens)

9.4 Maps of the five largest conurbations

These are larger versions of the maps presented in the Quantitative section. They were created by our geographer colleague, Sébastien Munafò, to whom we are most indebted.

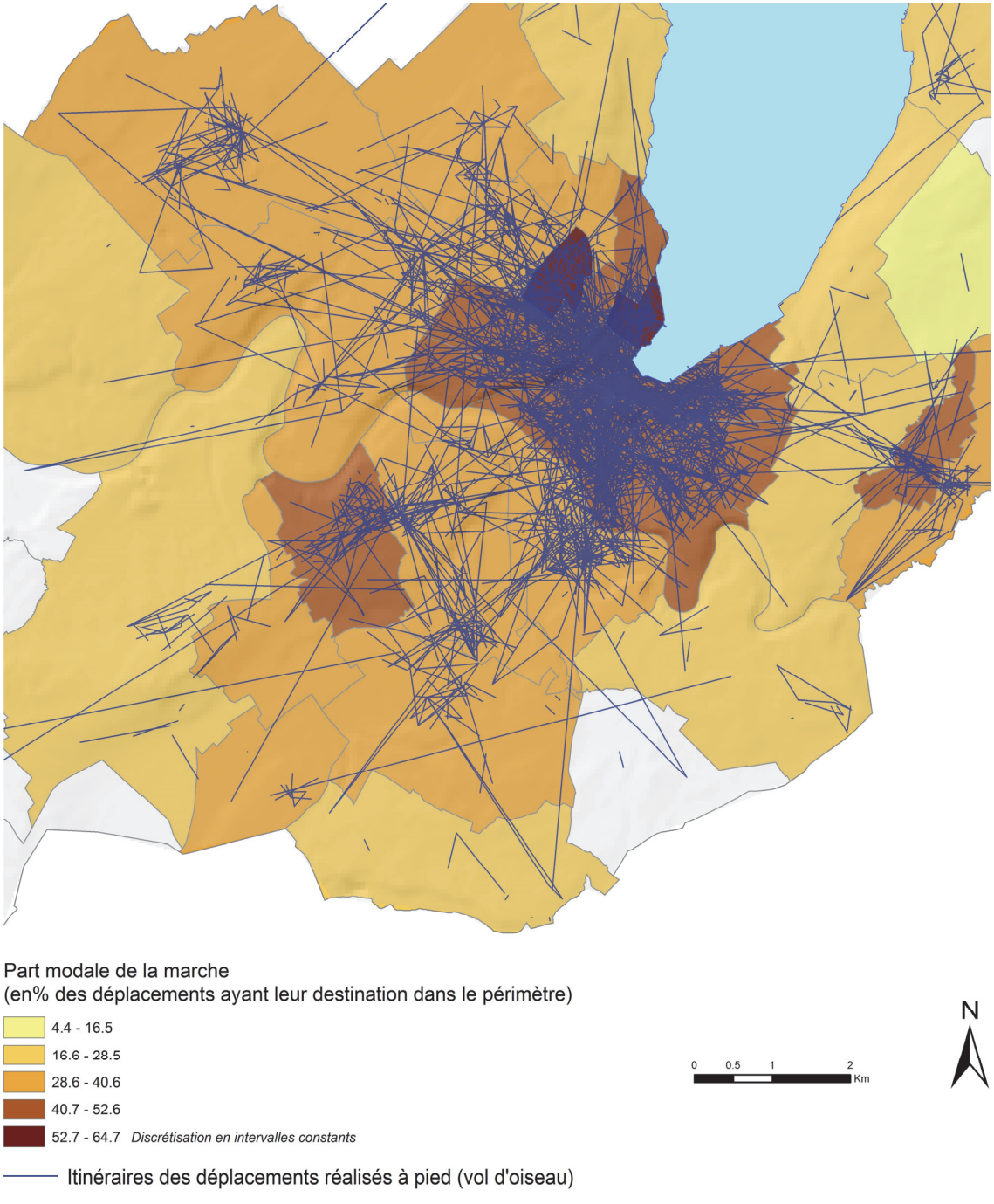

Figure 9-1. Walking stages in the Geneva conurbation. Source: MRTM2010. Courtesy of S. Munafò.

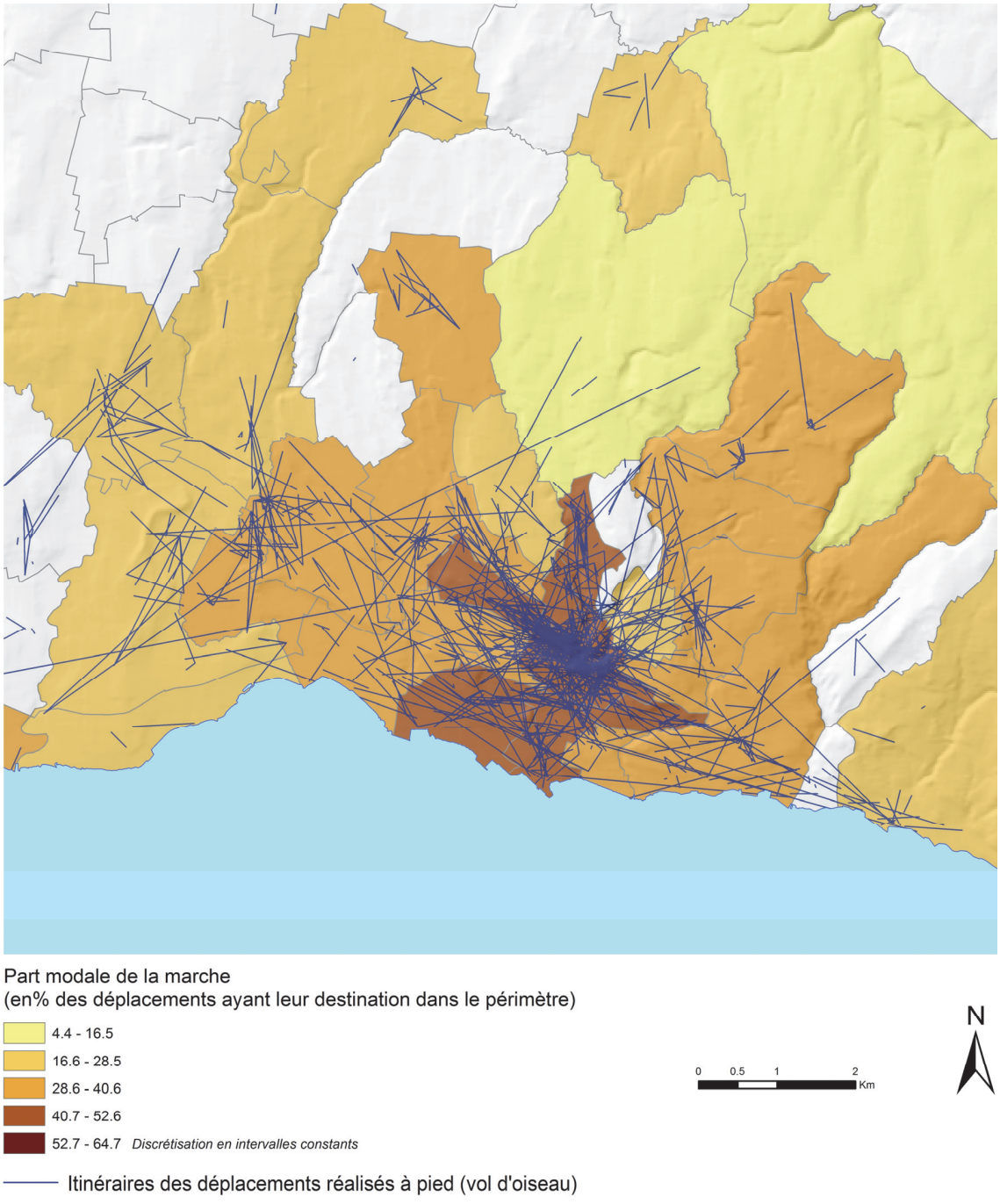

Figure 9-2. Walking stages in the Lausanne conurbation. Source: MRTM2010. Courtesy of S. Munafò.

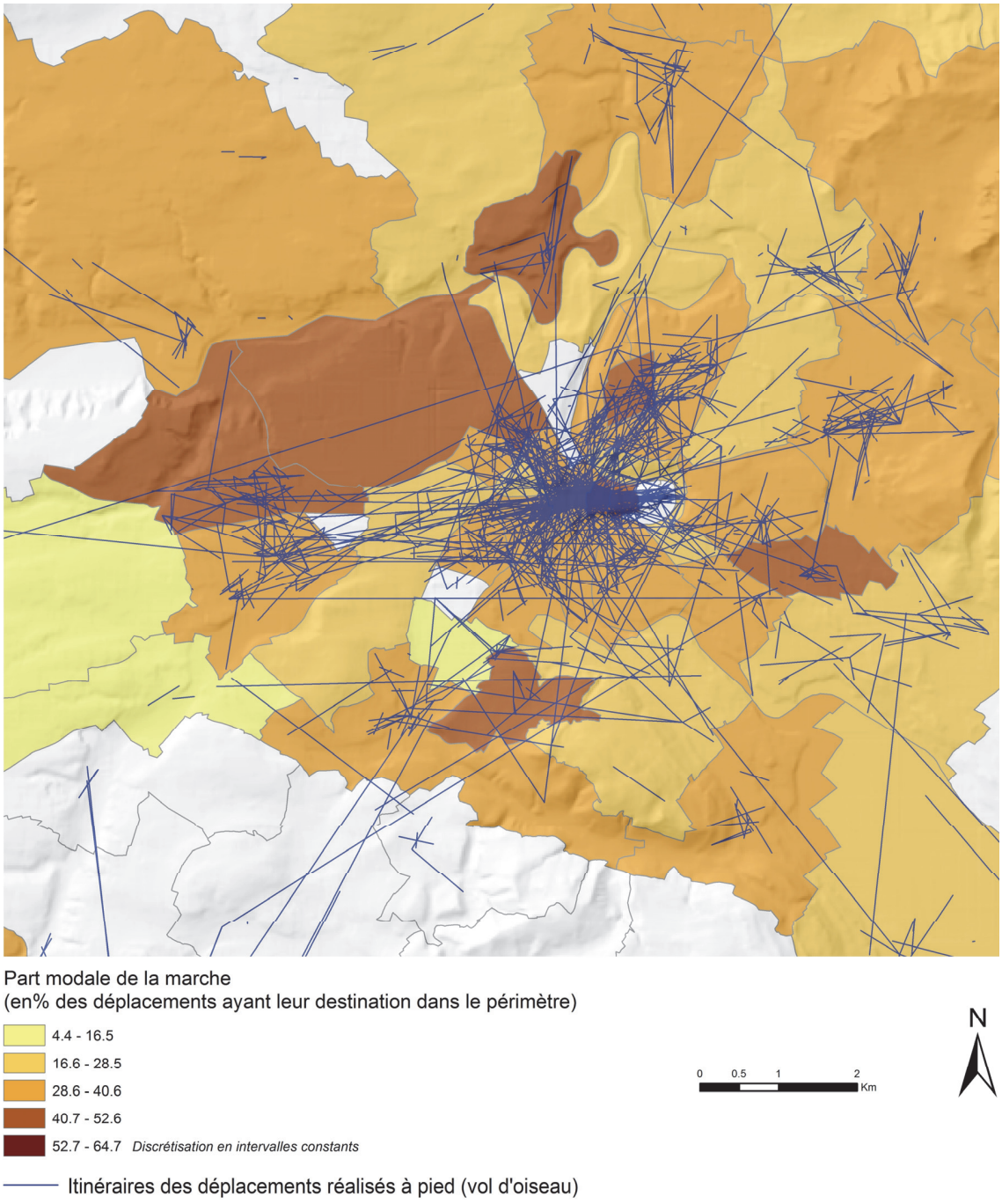

Figure 9-3. Walking stages in the Bern conurbation. Source: MRTM2010. Courtesy of S. Munafò.

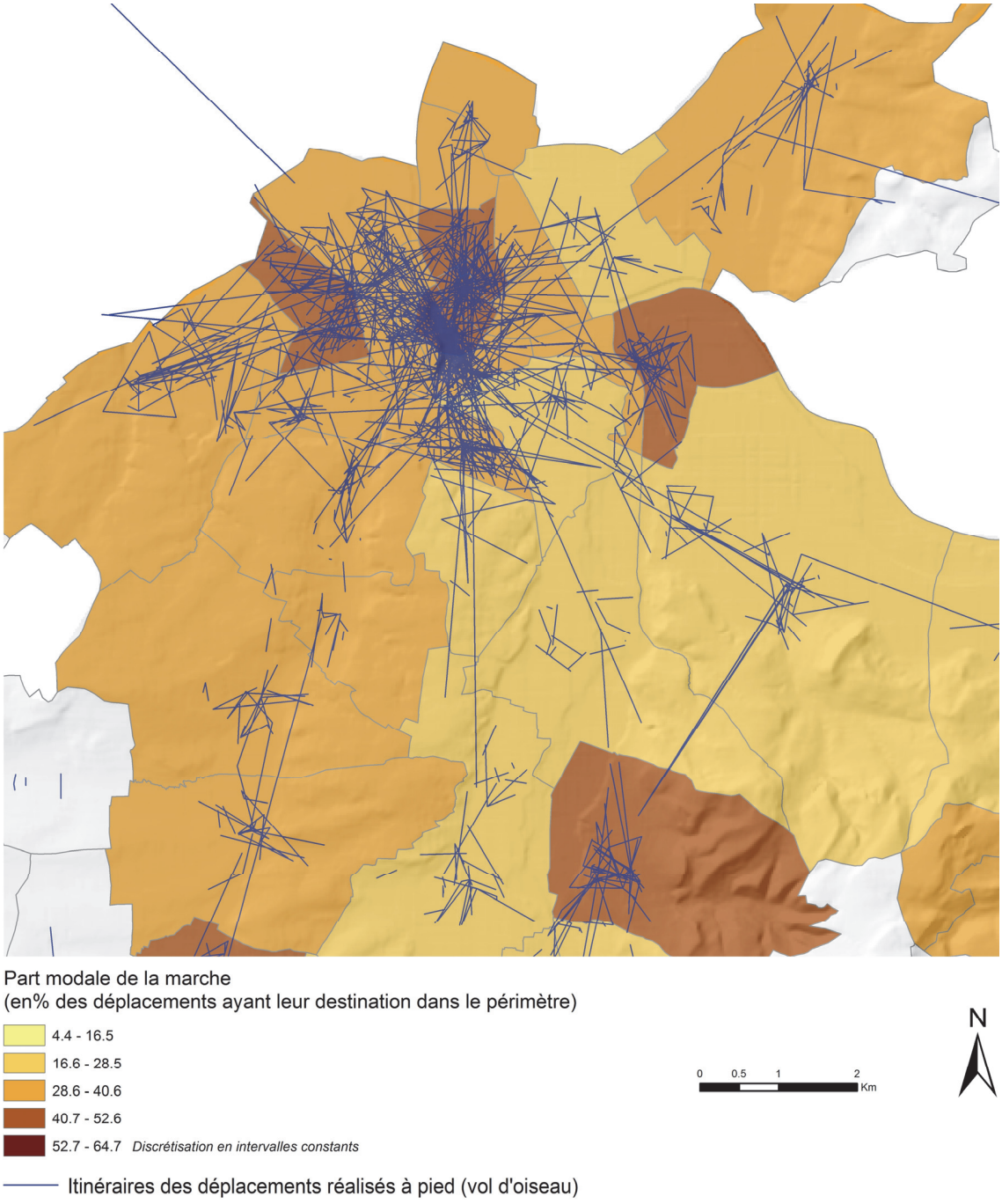

Figure 9-4. Walking stages in the Basel conurbation. Source: MRTM2010. Courtesy of S. Munafò.

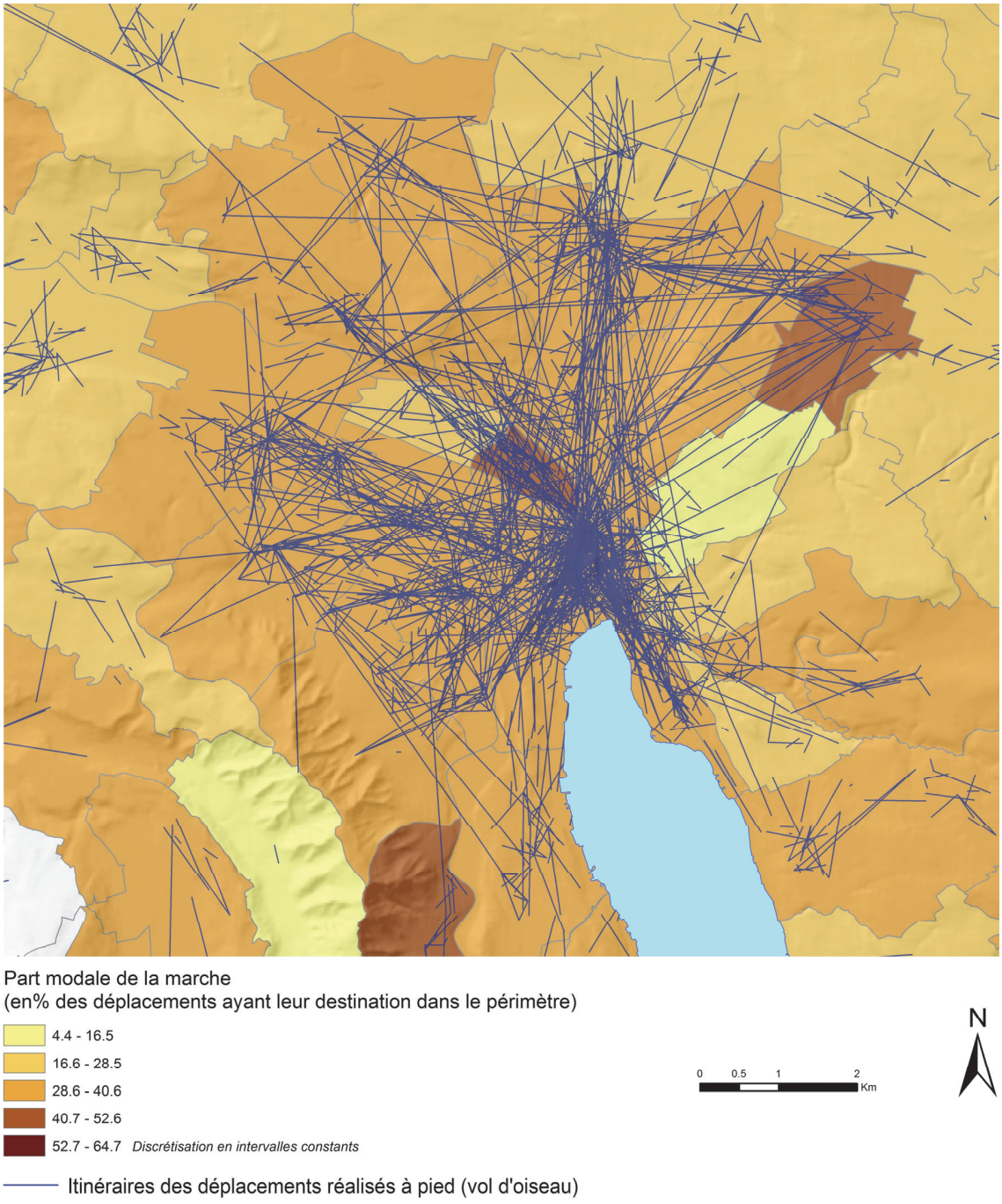

Figure 9-5. Walking stages in the Zurich conurbation. Source: MRTM2010. Courtesy of S. Munafò.

9.5 Initial results from the Qualitative phase

We are presenting our initial results here, as they emerged from the prior interviews and before we started organising them into the groups described in the Qualitative section. The table below is intended to give an idea of the type of ideas that initially came up, and that contributed to our creation of hypotheses H_4 and H_5 (and to the dropping of some other hypotheses). It can be seen that some of the ideas found here were ultimately dropped (e.g. the dietary habits) because they were ultimately found to be of little relevance to frequent walking. It can be seen that we initially believed our participants when they said their sense of orientation was not very good; this was revised thanks to additional analysis of the prior interviews and confirmed by the Spatial / GPS tracking phase.

Present walking routines	Skills (motility?)	Life history	Links to other activities	Motivation
Commute with or without public transport. Only walking is rare. (N=2)	Explore and vary the paths used	Has always walked a lot. Maximum = present (75%)	Running, jogging	Well-being (90%)
Walking the dog (N=5). Dropping off another person (N=1)	Map reading on phone, tablet or paper	Attraction and knowledge towards the countryside (N=10)	Cycling (rare)	Pleasure (often mentioned with wellbeing)
Gym/Fitness, step, walking or running on belt (N=5) or golf (1)	Phone use for GPS, pedometer, phone calls, music, dictating notes to oneself	Lives in central city and/or enjoys life in central city	Fitness	Health (rarely mentioned); cardiovascular (N=1)
Regular (or regular in an irregular frame)	Public transport pass, vehicle at home. Juggle with modes	Rapid behaviour change: challenge, pedometer, accident	Sport (rare)	Weight loss (N=5)
Shortest or prettiest route (often one on the way out and the other one the way back)	Use stairs instead of lift (90%)	Gradual behaviour change: health, age, weight…	5 fruit or veg per day (50%)	Environment (N=1) No link between walking and the environment
Drive car to work (N=8)	Thinking and/or daydreaming while walking	Specific behaviour change: the ça marche… campaign	Organic food (< 50%)	Walking to be alone (90%)
Run to work (N=1). Walk at night (N=2). Pauses for walking (N=1). Walk > 3 km	Shoes, clothes, backpack or other practical bag	Behaviour change in life course: marriage, children, moving house	Eat local food in season (80-90 %)	Avoid public transport and associated crowding
Prefer green spaces, avoid heavy traffic when possible (90%)	Overtake smokers (common), avoid car exhaust (rare) or traffic noise (intermediate)	No knowledge of any other frequent walkers (95%)	Nordic walking or hiking (mostly in the mountains: Alps or Jura)	No sports or no "other" sports.
H1. Difficult to integrate walking: yes. Getting up early is part of the solution (70% of respondents)	Viewing the distance to a bus stop/train station/ parking space as an advantage, an opportunity to walk.	H3: Choice of pleasant routes (walkability), only partly vindicated.	Environmental motivation: NONE. Interest in the environment is common, but NOT connected to walking.	For those engaging in other sports, walking is seen as a useful complement.
Zahavi. No. Travel time is high for all participants	H2: No. Orientation in space is variable and not always good		Pro-environmental behaviour is common (recycling, etc.) but not related to walking	Walking for pleasure and well-being rather than health. Health as a primer in action phase for some.

Table 9-1. Initial results from the qualitative interviewing

9.6 Health pre-study

Part of this information was presented at the International Conference of Transport and Health, in Barcelona in June 2017. A related abstract was published in the Journal of Transport and Health (Christie et al., 2017a). doi.org/10.1016/j.jth.2017.05.279

This phase is an add-on to the Qualitative and Spatial phases which contain most of the empirical data in this thesis. The Health data presented here are quantitative rather than qualitative, but have little in common with the transportation data presented in the Quantitative section. Furthermore, the aim of this section was not to answer the project hypotheses or the research question, but to kick-start research in this very interdisciplinary area, between public health and transportation science. For all these reasons, this pre-study is presented as part of the Appendix.

9.6.1 Background

The objective of this health pre-study is to pursue one of the underlying questions in our thesis, which was already investigated in the Quantitative section: who are the frequent walkers, and in what respect are they similar or different from the bulk of the population? In the Quantitative phase, where we saw that frequent walkers, on balance, were not very different from other members of the public on most socio-demographic issues. There was limited data on BMI in the MRMT2010 data set, however nothing else on health issues. And as discussed in the Quantitative section, the Swiss Health Survey yielded very little useable information about daily walking. What we want from this health section is the answers to 3 questions, which have an indirect link to motivation and to skills (hence the ticks in brackets in the table above).

First, we want to find out whether frequent walkers are different from the rest of the population on pre-clinical cardiovascular health markers such as blood pressure, resting heart rate, glycaemia, cholesterol, BMI, etc. This is because walking has been pinpointed as a key intervention for the promotion of cardiovascular health (Murtagh et al., 2010), and because the pre-clinical health markers just mentioned (as well as gender, smoking status and age) are considered good predictors of cardiovascular health (D'Agostino et al., 2008). These markers have the advantage of being more common and appearing earlier than the clinical signs themselves (a cardiovascular disease diagnosis or event) as well as being relatively simple to measure. Although there are various ways of combining these risk factors using scores or algorithms, it is important to bear in mind that their predictive power is generally very strong over 10-30 year periods (Pencina et al., 2009). Furthermore, measuring several pre-clinical health markers is better than using just one or two of them (Grundy et al., 1999).

At population level, we approached this question by obtaining Bus Santé data for two years (2013-2014) and comparing those who did or did not declare high levels of walking, using SPSS. This approach has the statistical advantage of covering over 2000 participants, but the disadvantage of resting entirely on self-declaration as far as walking is concerned (albeit with a scientifically recognised and many-times tested questionnaire). This was the part of

the analysis presented at the International Conference on Transport and Health in Barcelona in June 2017.

Second, we wanted an answer to the same questions, but using the data pertaining to our study participants – with the advantage that we have detailed GPS data for them, in particular the amount of walking that they did during the GPS tracking phase. There are several caveats and limitations here, and it is clear that our mainly qualitative, mixed-methods approach, with a limited number of participants, will make it difficult to find statistically significant answers to some of these questions. It should however be reminded that the health phase of this thesis is intended as a pilot-project in its own right. Its objective is to find out whether certain elements linking frequent walking to health markers are worthy of further study.

Finally, the use of GPS tracking data and of the Bus Santé questionnaires on the same people (albeit at different times) should help us begin to understand the basic differences between these two ways of measuring walking. The objective here is not to suggest any inherent superiority of one method over the other, but to underline the similarities and discrepancies between the two methods, with a view to suggesting new avenues for future research (such as the simultaneous use of various methods).

9.6.2 Bus Santé

The Health Bus or *Bus Santé* in French (full name: *Bus Santé Genève*) is a medicalised bus present on various sites in the city of Geneva during the week. It is not an open-access bus (contrary to its counterpart in Canton Vaud): it is necessary to have an appointment and in practice it is the Bus Santé staff who invite the participants. There are two main thrusts to the action of the Bus Santé. The first is the selection of a representative sample of 1000 persons per year to be monitored for basic health data at population level. The second is a variable array of biomedical and/or public health studies. Our research falls clearly into the latter category.

There are several potential pitfalls regarding the use of the Bus Santé for a research project such as this one on frequent walkers. The first is that the standard procedure of the Bus Santé for its 1000 persons per year should be followed as closely as possible, but this would have implied a full blood test with a view to collecting, storing and analysing genetic data. This clearly would have been excessive given the objectives of our study, so we opted for a simpler finger-prick collection of 2-3 drops of blood, which were collected in a capillary.

Another quandary was that people visiting the Bus Santé for the canton-wide monitoring (whom we referred to as "The Thousand") were expected to be fasting. This had the double inconveniency of taking up valuable slots in the morning, and of making the apparatus for glycated haemoglobin testing not always available. This is because such a test is not necessary if the person is fasting, but is very useful if the person is not fasting (glycated haemoglobin gives the average glycaemia over the past 3 months, see below for a more detailed description).

Health data for a subset of subjects who participated in the GPS tracking phase was collected in collaboration with the Bus Santé Genève and was ultimately a success, but took a considerable amount of time and effort. Among the many pitfalls were the acceptance of the collaboration by the Geneva ethics committee. Then the PhD student had to come to grips with a whole new realm of applied research: the work involved going onto the bus and either assisting nurses or, in some cases, actually doing the measurements himself. Then the questionnaires posed an extra challenge, because they were long and in different parts which were not supposed to be administered in the same way.

9.6.3 Health questionnaires

In our study, there were 5 questionnaires, 4 of which were administered to each participant (there were 27 participants, among which 25 completed all relevant questionnaires):

- General health questionnaire for men
- General health questionnaire for women
- Nutrition questionnaire
- Physical activity questionnaire
- Final round-up questionnaire or "interview"

The general health questionnaire was administered either in its female or male form to each participant (they are separate because the female one contains several questions regarding obstetric health and childbirth). The nutrition and physical activity questionnaires were given to everyone. The final "interview" questionnaire was very short, but essential because it contained potentially sensitive non-medical information such as the salary level. For the data to be collected in a standardised manner, the usual process at the Bus Santé was for the questionnaires to be sent to the participant

9.6.4 Biomedical data

For organisational reasons, it was not always possible to acquire the same data for each participant. This is because people could not be asked to turn up without having eaten anything in the morning, and because the glycated haemoglobin machine was not always present on the bus (there are several locations where the limited number of machines can be called for). Essentially, the measures which we attempted to retrieve were those in the table below. The cut-off points are the limits above which the standard Bus Santé procedure is to give medical advice to the participant, such as asking their general practitioner to further investigate the person's health status.

Type of biodata	Units	Cut-off point
Glycaemia	mmol/l	6.1 (if fasting) 11.0 (if not fasting)
Glycated haemoglobin	mmol/l	6.5 (result of a calculation)
Total cholesterol	g/l	6.5 (ideal max. level) 5.0 (if other risk factors)
Blood pressure (systolic)	mm Hg	120 (ideal max. level) 140 (refer to doctor)
Blood pressure (diastolic)	mm Hg	80 (ideal max. level) 90 (refer to doctor)
Pulse (resting heart rate)	beats per minute	None given

Table 9-2. Subclinical health markers collected by the Bus Santé

Glycated haemoglobin was a very useful diagnostic in this pre-study, because our participants could not be interviewed early in the morning and therefore were almost never fasting. According to the scientific literature, the measurement of glycated haemoglobin (usually abbreviated as HbA1c) is a reliable diagnostic able to identify individuals at high risk for cardiovascular disease and/or diabetes. HbA1c is expected to become the reference method globally, despite some challenges regarding the necessary standardisation of the technique (Di Pino et al., 2016). The importance of measuring glycated haemoglobin was recently recognised in Switzerland in the context of the unfolding type 2 diabetes epidemic:

"Chronic non-communicable diseases are reaching epidemic proportions, and they affect people of all ages. In Switzerland, 4.7 to 7% of the population suffers from type 2 diabetes mellitus (T2DM). The occurrence of T2DM is gender-dependent: it is lower in women than in men (3.9% vs 5.5%). The prevalence increases to 11.0% in subjects aged 65–74 years and to 12.5% in individuals ≥75 years. The prevalence of T2DM, defined as glycated haemoglobin A_{1c} (HbA_{1c}) ≥6.5% or fasting plasma glucose (FPG) ≥7.0 mmol/l, is rising in our country, with an increase of 1.4% over the last 15 years; the increase in the population aged ≥75 years is even higher (3.2%)." (Medina Escobar et al., 2015)

When we presented part of the results at the International conference on transport and health in Barcelona, in June 2017, we were asked why we chose that particular range of subclinical health markers. We believe it is an important question, because in the trans-disciplinary approach, what is obvious to some people in one field – say, public health or health promotion – is not necessarily obvious to someone operating in another field, such as transportation or town planning.

It would have been easy for us to reply that we simply used the tests that are routinely used by the Bus Santé staff, who base themselves on peer-reviewed publications. This is true, and we certainly wanted to use the same markers for our frequent walkers, so that we could compare them to the base population. But such an answer does not go far enough. First, it was necessary for us to go back to the main publications in the field, which we did, since many are linked to the Framingham study in the USA, as mentioned before (D'Agostino et al., 2008; Pencina et al., 2009).

The measures used are not the only ones possible, but they have many advantages. First, they are relatively non-invasive: they require either no biological sampling at all or only a

couple of drops of blood which can be easily collected using a capillary tube. This is far easier than the process of blood sampling (prise de sang) – no samples need to be sent to a laboratory; the results can be communicated immediately to the subject and to the researcher.

Many of the markers used are also relatively robust, in the sense that they do not vary very much over time. This is the case of the anthropometric measures (height, weight, hip and waist) and total cholesterol. The problem of glycaemia varying during the day can be circumvented by using a special machine able to measure glycated haemoglobin. This gives a measure of the average glycaemia over the past 90 days (since this is the average lifetime of a red blood cell) and has been pinpointed as a good predictor of cardiovascular risk (Selvin et al., 2010).

9.6.5 Waist and hip measurements

The scientific literature assures us that the waist-to-hip ratio is a better predictor of cardiovascular health than the body-mass index (BMI). Indeed, a recent comparison of 5 different anthropometric measures, including BMI, found it to be the best predictor of whole-body fat percentage and visceral adipose tissue mass, which are both correlated with non-communicable diseases (Swainson et al., 2017). We therefore wanted to know whether our frequent walkers had a better or worst ratio than comparable people within the standard Bus Santé cohort. However, this approach proved far more difficult to perform than was planned, for several reasons.

According to a team of medical researchers working in Geneva (Sebo et al., 2015), there is increasing pressure on general practitioners (GPs) to identify patients with abdominal obesity in order to reduce the life-threatening consequences of this condition in the population, and the waist-to-hip ratio is one way of identifying people at risk of abdominal obesity. In their cross-sectional study, 26 GPs were asked to measure weight, height, waist and hip circumference on volunteers within their medical practice. Two trained research assistants repeated the measurements. It was found that all measurements except height were prone to measurement error, the least affected being weight (and therefore body mass index [BMI]). Following training, measurement errors were slightly less prominent but GPs' skills in measuring waist and hip circumference were generally assessed as inadequate, despite improvement after training. According to these researchers, most of the 26 general practitioners surveyed in Geneva, Switzerland, did not know the correct site of tape placement, the WHR formula nor the definition of abdominal obesity. Direct observation by research assistants trained in anthropometry confirmed that the waist and hip measurements were not well performed: several doctors took the measurements over clothing, without palpating the appropriate markers and without marking the site of measurement with a piece of tape. In addition, most doctors did not take the measurements at the right place and did not measure waist circumference at the end of a normal expiration as recommended. However, the doctors' skills improved following training by qualified research assistance in this study.

We are quoting this research rather extensively because it shows the pitfalls that reside in the use of apparently simple measures. If general practitioners find it difficult to perform the

correct measures, then it is clear that a PhD student will also find it a challenge, to say the least. Therefore, whenever possible, the measures were performed by trained staff who were used to doing them on the Bus Santé. This had two advantages: reducing bias, and ensuring that whatever bias may be present would be comparable to the bias (if one exists!) of the Bus Santé population which we will later use for comparison.

According to a pilot study on 50 individuals (Wills & Bhopal, 2010), accurate waist and hip measurement are increasingly important for prevention, but measuring even over light clothing is likely to induce significant errors (in the range of 0.5 cm on average). This study concludes that the effect of clothing is not trivial, and that waist circumference measurements should be made on bare skin and hip circumference measurements over underwear. Self-measurement is even worse: an older but larger study, on over 4000 adult men and women in the UK, showed that this induces errors in the range of 2-3 cm per measurement. The imprecision was linked to bias: underestimations were found to be more frequent among people with higher hip girths and higher BMI (Spencer et al., 2004).

9.6.6 Health results

General reference: D. P. Christie, I. Guessous, E. Ravalet and V. Kaufmann. Associations between Daily Walking and Subclinical Health Markers in a Swiss City, *Journal of Transport and Health*, 5 Suppl, pp S3-S4, 2017. (Christie et al., 2017a).

A previous study (Guessous et al., 2014b) using 1999-2009 Health Bus data had found no association between BMI and sedentariness, defined as spending 10% or less of one's total daily energy expenditure in activities demanding at least 4 MET (metabolic equivalents). The objective of this population-level pre-study was to find out if this non-association remained true with recent data, if daily walking was considered as a single category distinct from other physical activities, or if a range of subclinical endpoints were considered. We obtained approval for this part of the project from the Geneva ethics committee, on 20 July 2016 (Ref. PB_2016-00363/10-030R, amendment 3).

Using data for 1102 women and 1000 men aged 20-80 who attended the Health Bus in 2013-2014, we added up the self-declared minutes per week spent walking normally, walking fast/uphill, or walking while carrying/pulling a load. The result was a new metric for daily walking, including walking for transport, walking for exercise and walking for leisure. Then we fitted a generalised multivariate linear model on SPSS, using the new metric as the independent variable and 8 subclinical endpoints as the dependant or explanatory variables: BMI, WHR, total glycaemia, total cholesterol, total triglycerides, systolic blood pressure (SBP), diastolic blood pressure (DBP) and resting heart rate (RHR). The significance of associations between variables was evaluated using the F-statistic ($p<0.05$).

In our model, neither sedentariness nor our combined walking metric were associated with BMI. RHR was the only variable associated with walking. When the model was adjusted for age, gender, income and level of education, we found significant associations with all investigated endpoints except BMI. Therefore, the adjusted model included: WHR, total glycaemia, total cholesterol, total triglycerides, SBP, DBP and RHR. Using the adjusted model, we separated the walking metric into its three constituents and found that walking

normally was associated with none of the endpoints. Rapid/uphill walking was associated only with waist-to-hip ratio and blood pressure (systolic and diastolic). Walking while carrying/pulling a load was associated only with resting heart rate.

These results on a carefully selected population-based sample suggest that self-declared walking is significantly associated with WHR, total glycaemia, total cholesterol, total triglycerides, SBP, DBP and RHR. Separating walking into three categories and health effects into eight endpoints may provide a useful framework for future research. This retrospective study has a considerable strength: that the subclinical endpoints were measured physically, in a highly standardised manner. However, the walking depends on self-declaration, which is an important limitation. The observed relationship between self-declared walking and measured subclinical factors – but not BMI – is intriguing. The suggested pilot case-control study (see next sub-chapter), aiming at comparing a few volunteer frequent walkers with the general population is all the more interesting.

Variable	var_name	Type (levels)	Treatment in model
Gender	Sex	Categorical (2)	Fixed factor
Age category	Agecat	Categorical (3)	Fixed factor
Education	Higheduc	Categorical (3)	Fixed factor
Income	Newincome	Categorical (2)	Fixed factor
BMI	Bmi	Continuous	Dependent variable
waist-to-hip ratio	RTH	Continuous	Dependent variable
total glycaemia	GLYCEMIE	Continuous	Dependent variable
total cholesterol	CHOL	Continuous	Dependent variable
total triglycerides	TG	Continuous	Dependent variable
blood pressure (systolic)	moy_tamax	Continuous	Dependent variable
blood pressure (diastolic)	moy_tamin	Continuous	Dependent variable
resting heart rate	moy_fc	Continuous	Dependent variable
sedentariness	Seden	Continuous	Dependent variable
Estimated total walking time per day	Perday	Continuous	Covariate

Table 9-3. Variables used in the model (Bus Santé 2013-2014)

	walking h/day	Perday	WTH	Glyc	Chol	TG	HDL	Syst	Dia-syst	HR	BMI
N Valid	2024	1942	2092	2070	2071	2071	2071	2096	2097	2097	2102
Missing	78	160	10	32	31	31	31	6	5	5	0
Mean	1.11	-.153	.86	5.21	5.36	1.22	1.52	120	72	69	27.21
Median	0.86	-.074	.85	5.00	5.30	0.98	1.41	118	71	69	24.22
Std. Deviation	0.95	.82	.099	1.06	1.09	0.95	2.92	16.3	10.58	9.95	25.79
Skewness	1.98	-.39	1.03	4.974	.453	4.07	44.1	.709	.498	.229	9.59
SE skewness	.054	.056	.054	.054	.054	.054	.054	.053	.053	.053	0.53

Table 9-4. Variables in Bus Santé data

In the table above, data are presented for N=2024 subjects in a representative sample of the non-institutionalised population of Canton Geneva. It can be seen that self-declared walking is in the range of 1.1 hours per day, which is significantly higher than the average found in the MRMT data. Furthermore, mean BMI is 27.2 which is rather high, considering the common limit of overweight which is set at BMI = 25. Mean and median blood pressures are very close to each other, which may be indicative of a certain stability in the data. At around 12.0/7.2 the mean blood pressure can be considered rather high. In contrast, the mean and median resting heart rates are at 69 beats/minute, which is relatively low compared to other population-based estimates.

9.6.7 Comparison with the general population

In order to compare our sample of frequent walkers with the general population, we selected the whole Bus Santé dataset as a control group, while controlling not only for household income but also for household composition, defined as the number of people under 15 years of age and the number over 15 years of age. For lack of another method (this part of the PhD is a pilot study, which may be refined later on, using perhaps a larger dataset of cases), we controlled for the 3 variables separately, i.e. we did not combine them into a specific metric. These variables were added to those used for the population-level pre-study (see above).

The six variables controlled for in this pilot study were: age, gender, level of education, income, number of adults (>15 years old) living in the household, number of children (<15 years old) living in the household. One of the problems encountered is the fact that not all clinical endpoints were covered. For example, only total cholesterol was measured, and not LDL, HDL or triglycerides. Our convenience sample of 27 participants in the Health phase was 63% female (against 52% in the population) and had the following characteristics, see Table. There were 2104 people in the database for 2013-2014. We removed ten records due to missing or faulty weight or height measurements, leaving us with 2094 subjects.

Variable	Frequent walker sample (mean)	Frequent walker sample (SD)	Geneva 2013-2014 population (mean)	Geneva 2013-2014 population (SD)
Age	48.3	13.2	46.7	14.7
Glycaemia	5.6	0.7	5.2	1.1
Total cholesterol	5.1	0.9	5.4	1.1
Weight (kg)	69.0	14.2	72.4	15.4
Height (cm)	168.5	8.3	169.8	16.3
Body-mass index (BMI)	24.1	3.4	25.2	7.2
Waist	82.3	11.1	86.6	22.4
Hip	98.1	7.9	101	21.1
Waist-to-hip ratio (WHR)	0.84	0.08	0.86	0.10
Blood pressure (systolic)	12.1	1.8	12.0	1.6
Blood pressure (diasyst.)	6.9	0.9	7.2	1.1
Walking questionnaire (h/day)	2.23	0.66	1.11	0.95
Walking measured GPS (h/day)	1.20	0.42	---	---
Difference Quest – GPS (h/day)	1.03	0.63	---	---
Educational level	8.3	2.2	7.2	3.5
Income	4.1	1.7	3.8	1.5
Number > 15 yrs	2.0	1.3	2.1	2.6
Number < 15 yrs	0.52	0.92	0.55	2.6
Equivalised income level	2.58	--	2.33	--

Table 9-5. Comparison of our sample with Bus Santé baseline data (2013-2014)

The table above shows us that our sample of frequent walkers were of a similar age to the average of the population in canton Geneva: they are around 1 year older but this falls well within the standard deviation brackets. This indicates that our sample of frequent walkers is not very different from the general population.

It has been clear for a long time that simply looking at income per household does not give a satisfactory idea of the effective situation. Income per capita was long considered a better solution (Datta & Meerman, 1980) but more recently the OECD has suggested dividing income by the square root of the number of people in the household, whatever their age (OECD, 2017). So, an income of 100'000 CHF/year would be divided by 1.414 for a couple or a parent living with a child, yielding an equivalised income level of 70'721 CHF/year. In our case, we do not have the true value of the income but an estimate based on the checking by each participant of one of six boxes ranging from 1 (<3000 CHF/year) to 6 (>13'000 CHF/year). Dividing the average of these values ranging from 1 to 6 by the square root of the number of people in the household delivers a metric that presents methodological challenges. What matters to us is that the process is the same for frequent walkers and controls, and that the difference between our sample and the baseline population is confirmed by this new metric.

Then we ran a t-test for all the relevant continuous variables, using gender as a categorical variable in the model as well. In SPSS, the standard Levene's test for equality of variance is automatically included. This allowed us to verify that the variance was indeed similar for almost all our variables. Only gender and blood pressure (systolic and diastolic) had different variances in the two groups. Interestingly, self-declared walking per day was significantly different between the two groups, which was expected, but its variance was similar in the two groups. The consolidated results are presented in the table below.

Variable	Levene test of equality of variance	t-test result 2-tailed	t-test result (p-value)	Mean difference	Standard error difference
Age	0.273	0.57	0.572	1.61	2.85
Gender	< 0.001	1.10	0.279	0.11	0.10
Weight (kg)	0.455	-0.79	0.431	-12.17	15.44
Height (cm)	0.520	-0.62	0.537	-6.59	10.68
BMI	0.494	-0.82	0.410	-1.15	1.39
Waist	0.673	-0.99	0.321	-4.29	4.32
Hip	0.876	-0.63	0.526	-2.63	4.14
Waist-to-hip	0.247	-1.00	0.316	-0.02	0.02
BP systolic	0.370	-214	0.579	1.75	3.16
BP diastolic	0.874	-225	0.088	-3.49	2.05
Glycaemia	0.638	1.65	0.099	0.34	0.21
Cholesterol	0.177	-1.44	0.150	-0.30	0.21
Walking h/day	0.243	5.99	<0.001 ***	1.12	0.19
Eq. income	0.914	4.47	<0.001 ***	0.90	0.20

Table 9-6. Comparison of frequent walkers with population data (2013-2014)

To interpret the table above, it is useful to consider that frequent walkers walk more and have a higher average income than the baseline population, which can be seen in the second column from the right, labelled Mean difference. Negative values in this column imply that frequent walkers have a lower value than the baseline population. For example, they have a BMI that is lower, but a glycaemia level that is slightly higher. However, neither of these differences are statistically significant: this can be seen in the middle column (p-value), where only 2 variables stand out as presenting a significant difference between the two groups: walking per day and income. Body-mass index (BMI) is slightly lower in the sample of frequent walkers, by around 1 point, from 24.1 versus 25.2, which is important when bearing in mind that 25.0 is the "official" frontier for overweight). The waist-to-hip ratio (WHR) was essentially the same in both samples, around 0.85 which is a relatively good value.

Walking, BMI and WHR

The fact that BMI was lower among frequent walkers was expected. However, it should be made clear that 1.1 kilograms per square metres (the unit used for BMI) is an enormous difference. It is all the more important because, in public health, small differences at the individual level can translate into massive gains (e.g. in years of healthy living) at population level.

In the literature, there have been reports of evolutions of less than 0.1 kg/m^2 following a residential relocation to a more walkable area in the USA (Hirsch et al., 2014). In France, the RECORD cohort study integrated nearly 6000 participants and associated living in a walkable area with tiny changes in BMI (in the range of beta = 0.01) and other subclinical markers (Méline et al., 2017). However, the result regarding weight-to-height ratio was somewhat surprising, because this is widely considered to be an excellent measure of cardiovascular fitness, as explained earlier.

Blood pressure was the same as far as systolic blood pressure is concerned (12.0) but diastolic was slightly lower for the frequent walkers. There is no statistically significant difference, however, given the very slight difference between 6.9 and 7.2, and the standard

deviations of around 1. This was confirmed by the t-test results but it is interesting to see that the difference between the two types of blood pressure is confirmed. Indeed, systolic blood pressure is slightly higher in frequent walkers, albeit not significant at all, but for diastolic blood pressure it is both lower for frequent walkers and closer to statistical significance.

Commentary
Blood pressure and walking have a long and complex relationship. At population level, walking is clearly an approved method of lowering blood pressure. However, results are often not very spectacular, unless the subjects involved have a high blood pressure to start with. An intervention study in rural New York State (Marigliano et al., 2016) looked at a small group of middle-aged women with a mean BMI of 30.7 kg/m^2 which descended to 30.2 kg/m^2 after a 10-week walking programme (the difference was statistically significant). In the same group, systolic blood pressure went down from 132 to 127 and diastolic blood pressure from 80 to 79 mm Hg. The former but not the latter was statistically significant (2-tailed t-test with $p=0.05$). We see this as evidence that the two types of blood pressure may react differently to walking. Systolic blood pressure may react more strongly to walking in sedentary populations, and it might be the opposite for those who are physically active.
To pursue this line of enquiry, we looked at other recent publications. In an accompanying commentary (van der Merwe, 2017), we read that "diastolic pressure above optimal is the most important predictor of subsequent hypertension in normotensive patients younger (than) 50 years". This insight is based on a wide-ranging study – 93'000 patients, 8 years of follow-up – conducted in Japan (Kanegae et al., 2017). In a review (Bravata et al., 2007) that we already mentioned in the chapter on pedometers (see the Qualitative section of this thesis), a 27% increase in physical activity was associated with only a 0.38 kg/m^2 drop in BMI and a drop in systolic blood pressure of around 4 mm Hg. No changes were noted regarding cholesterol or blood sugar levels. These were all before/after studies on the same groups of people. Our approach is different – were are comparing a physically active group to what is essentially a reference population – so it is insightful that we should obtain similar results (with the caveat of our small sample size).

9.6.8 Take-home message from the Health section

There were no significant differences between this convenience sample and the general population that attended the Bus Santé in 2013-2014, possibly due to the small sample size. However, the collaboration with the Bus Santé was successful, yielding interesting results and bringing the "proof of concept" that we wanted to justify future study in this area. We therefore recommend repeating this health pre-study with a higher number of frequent walkers.

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