
Planning for active living

Resources at hand when making environments more walkable

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Degree Project • 30 hec
Landscape Architecture - master's programme
Alnarp 2015

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Planera för en aktiv vardag

Resurser till hands för att skapa promenadvänligare miljöer

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Credits: 30 hec

Project Level: A2E

Course title: Master Project in Landscape Architecture

Course code: EX0775

Programme: Landscape Architecture - master's programme

Place of publication: Alnarp

Year of publication: 2015

Online publication: <http://stud.epsilon.slu.se>

Keywords: *walking, built environment, walkability, active living, behavior, adults, public health, planning, landscape architecture, urban design*



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FOREWORD

This thesis is the final work of a master degree in Landscape Architecture at the Swedish University of Agricultural Sciences. During this project I had the opportunity to explore a subject of a great interest. I have been inspired and educated by writings, lectures, and research made by people from all over the world. I have explored a wide spectrum of knowledge, spoken to inspiring people about the topic and additionally reflected on my own everyday environment. This has resulted in a development of my own critical thinking and a certain degree of understanding about the issue that will strengthen me in my coming profession as a landscape architect. This time of work has sparked even a greater dedication and interest in the topic and will probably only be a small part of my hopefully lifetime exploration and thinking.

Special thanks to...

...my supervisor, Fredrika Mårtensson, for guiding me through the work with resourcefulness and precision. Also for giving me inspirations on the topic and motivating me into following my interests.

...those who gave their time and effort to read through my work and give valuable comments; Hanna Seger and Lina Fors.

...Ingi for endless support during the whole process and our Eyrún Vala for being the sunshine in my life.

Sigríður Dúna Sverrisdóttir
Alnarp, August 2015

ABSTRACT

Encouraging physical activity is considered as an urgent public health priority. The influences of built environments on physical activity have gained a growing interest over the last years. Walking in particular as a form of physical activity, has received an increased attention when it comes to health promotion approaches, but also due to its benefits for the environment, economy, physical and mental health, and potential of integration into people's everyday life. Environments that encourage walking are furthermore considered to possess many of the urban qualities that are integral to people's healthy lifestyles and well-being, as well as contributing to sustainability. This thesis is an exploration into how active living can be promoted by creating more walkable environments. More specifically it investigates conceptually and theoretically how outdoor environments can influence walking activity and encourage physical activity in general at a population level. It gives insights into the different tools, methods and other knowledge sources available that are useful and can support planners and designers in making outdoor built environments more walkable.

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INTRODUCTION

In this first section I describe my personal motivation for the project and the reasons for why I chose the respective topic. The section will introduce the fundamental concepts of this thesis, such as physical activity, walking, built environment, and health on a general level and further how these terms can be related. This is for the purpose of building a broader context to the main topic of this thesis, understanding healthy walking behavior within built environment. The aims of this thesis will be put forward together with the research questions which the project is intended to answer. Moreover the methods and materials used in the project will be described, together with the projects delimitations.

Why study environments for walking?

The design of outdoor environments can affect people's health and well-being

After about five years of studies within environmental planning and landscape architecture I have been occupied with the thinking about functionality of outdoor spaces, about the constant interaction between people and their environment, and how design and form of surrounding landscapes can affect people's health and well-being in various ways. I have come to realize that in reality; despite of all the knowledge gained through research and investigations, the design and creation of built environments¹ sometimes do not support healthy choices of people, such as being physically active. Such disregard can cause negative effects for individuals, even whole communities, and can be difficult to reverse.

Creating walkable living environments is one way of improving public health

The fundamental motivation for this project is my personal interest in how designers of outdoor environments can directly and indirectly affect population health. Since creation of highly walkable environment has proven to promote physical activity and benefit many other aspects of health and well-being, I have chosen to explore that particular link between environmental design and health. I find it important for the profession of urban design and landscape architecture to create living environments that are at a human scale, livable and attractive. Creating walkable environments draw together these goals and my basic concern is therefore what resources are available when a planner is to create environments that support walking. With this study I am hoping for a greater understanding of what makes a walkable environment and how the creation can result in increased levels of physical activity. I want to encourage further research to improve the understanding of how environments can be created to support active lifestyles. I also want to be able to argue for the importance of creating walkable environments within urban planning and design, and encourage creation of environments that hopefully will sustain livability and well-being of future generations to come.

¹ *Built environment* refers to public outdoor environments that can be accessed by anyone (at least in theory) and is made or arranged by humans. These environments are manifold and complex and include all the things that have been to some degree affected by human activities; green spaces, buildings, roads, presence and condition of public spaces, land use, population density, and even perceptions of security and traffic flow (Bartuska, 2007).

The challenge

Chronic diseases or lifestyle related diseases are increasing among populations worldwide, and especially in the developed world² (De Vries, 2010). Diseases of this genre are for example obesity, type 2 diabetes, cardiovascular disease, and mental illness. These diseases can often be traced to unhealthy habits, mostly caused by behaviors that can be modified or controlled in one way or another and are therefore often said to be preventable (Frank, Engelke, & Schmid, 2003). Physical inactivity is one of the main factors found to be contributing to chronic diseases and bad quality of life, and is moreover the fourth leading risk factor for global mortality (WHO, 2010). Physical inactivity is a serious public health³ problem and illness related to it has huge costs for the health care (Dunn, Andersen, & Jakicic, 1998). Physical activity has with time become less a part of people's everyday patterns of life. Causes are partly found to be that many employments demand less or no physical activity. But causes can also be traced to the design and arrangement of people's everyday environments. Built environment factors have been realized to influence people's behavior and lifestyle in multiple ways, where living environment can create either opportunities or barriers for people to live healthy lives, such as being physically active.

Built environment factors can create either opportunities or barriers for people to be physically active in everyday life

Without a doubt the human being is still a pedestrian with needs as such. People are highly exposed when walking outdoors and experience the environment with all senses (Frank, Engelke, & Schmid, 2003). How people perceive their surroundings is influenced by the condition of the walking environment and can in turn be transformed into their walking behavior. One might choose a specific walking route over another for some reasons related to the environment, walk less or even not walk at all. Planners and developers have up to present time been creating living environments found to lack the touch of elaboration to foster and promote pedestrian activity. For decades has walking been undesirable to prioritize over motorized transportation and become a minority transportation mode in many societies. Improving transportation system quality has often been by increasing road and parking capacity, vehicle speed, vehicle ownership, and the affordability of driving. Increased travel speed in that sense has been considered to benefit society. This high value placed on driving and low value placed on walking reflects how transportation systems are being measured

People's walking behavior can be directly traced to the condition of the walking environment

² *The developed world* refers to countries that are advanced economically, i.e. have many industries and a complicated economic system (Oxford Advanced Learner's Dictionary, 2013).

³ *Public health* refers to all organized measures (whether public or private) to prevent disease, promote health, and prolong life among the population as a whole. Its activities aim to provide conditions in which people can be healthy and focus on entire populations, not on individual patients or diseases" (WHO, 2014).

and also funded (Litman, 2003). This trend has often resulted in car-dependent societies where urban sprawl and monotony in land use have made a contribution to increased travel distances. The built environment can then make active transportation and walking between places in everyday life difficult or even impossible. In addition it has often resulted in unsafe and unattractive environments for pedestrians.

“We think that we “choose” to drive the car, but essentially the system; that is the urban structure, its sprawl, quality and the lack of transportation alternatives; has made the selection for us.” (Ståhle, 2015, p. 52; transl. by author).

The challenge in environmental planning and design is to bring the human being in focus and counteract car-dependence

The dominance of the car in planning of built environments has brought second thoughts to developers worldwide. People are turning more and more eager to counteract car-dependence. They have come to realize the way we built our living environments affects people’s lives and health in multiple ways. Environments found to be inconvenient and unsafe for pedestrians can partly be traced to the great focus on the car in planning, but we need to keep in mind that there are multiple of other factors as well. Rapidly increasing urban areas around the world are in urgent need of strategies about how to create built environments that harmonize with both humans and nature. Making environments that enable people to live healthy lives is essential to that. Taking on that challenge is urgent and creating environments with the human being in focus and environments that are highly walkable has been found to be a potential piece in that puzzle. But it can be time consuming to change priorities in the already built environment and what the best strategies are for that purpose remains challenging.

Understanding the foundations

Living active lives benefits sustainability in multiple ways

Active living, health and sustainability

Planning and design of highly walkable living environments has awakened increased interest in contemporary practice. Not only in order to raise physical activity levels, but also generating from the fact that it has many other benefits related to sustainability. It can be beneficial for the economy, the environment, health and social life, for individuals and whole societies. Walkable neighborhoods have proven to support social interaction among residents. When residents perceive higher social capital it has been correlated with better mental health. It has also been associated with less overweight, lower reports of depression, and less reported alcohol abuse (Renalds, Smith, & Hale, 2010). Increased walking and cycling can help to reduce carbon dioxide and small particle emissions. People living in more walkable neighborhoods are more physically and socially active and therefore healthier, both physically and mentally. A more walkable environment that supports active living⁴ among people is found to be a more sustainable one.

“Health is a core component of thriving communities” (Urban Land Institute, 2013, p. ii).

Health inequality is a concept worth to consider in this context, since health inequalities are often a result of other forms of inequality within society. Low income communities are often characterized by low quality environments or poor access to outdoor environments, which in turn contribute to poorer health of inhabitants. The issue of getting low income people and disabled people more active is important. For these groups the local outdoor environment plays an important role since they are readily available and free of charge (Thompson, 2013).

Physical activity types, levels and recommendations

Physical activity can vary along several dimensions. It can vary in its intensity (moderate or vigorous), its purpose (transport or recreational), the amount and type of barriers it faces (easy or difficult for the individual to get about), time needed to perform, and so forth. A number of researches have pointed out the importance of isolating different forms of physical activity (running, walking, transport purpose, recreational purpose etc.) each to specific factors of the built environment (accessibility, safety, surface, etc.).

⁴ Active living is a way of life that integrates physical activity into daily routines (Active living by design).

Different intensity levels of physical activity refer to the rate at which an activity is being performed or the level of the effort required to perform an activity or exercise. Intensity varies between people based on the physical form of each individual. The World Health Organization (WHO) provides definitions of the different intensity levels. Moderate-intense physical activity is for example brisk walking, gardening, active involvement in play with children and housework. Vigorous-intense physical activity is for example walking up a hill, fast cycling or swimming, running, carrying heavy loads or doing aerobics (WHO, 2010).

For adults⁵ WHO recommends at least 150 minutes of moderate-intensity physical activity throughout a week or at least 75 minutes of vigorous-intensity physical activity during the same time, or a combination of these two. These recommendations are applicable to all adults, no matter of gender, ethnicity, or income level (WHO, 2010). According to the Public Health Agency of Sweden (Folkhälsomyndigheten), the recommended amount of physical activity for health benefits is at least 30 minutes each day throughout the week. Statistics indicate that there are 65% of the Swedish adult population who reach these 30 minutes per day recommendations, 37% who are physically active at least 60 minutes per day, and moreover, there are 14% totally sedentary⁶ (Folkhälsomyndigheten, 2014).

Activities for health benefits can be accumulated in short sessions rather than in a long session of continuous activity. That means that performed activity can last for perhaps ten minutes and then be accumulated throughout the week to reach recommendations. Noticeable in this context is also that inactive people will have added health benefits by going from being totally sedentary to having some levels of activity, without reaching recommended levels of physical activity. Reaching the recommended amount of physical activity can be very beneficial and lower the risks of diabetes and metabolic syndrome significantly (WHO, 2010). This is good to have in mind when considering activities which levels can be affected by the environment. According to this activities which are often accumulative can be taken into account, such as lifestyle activities or other daily activities. The concept of *lifestyle physical activity* has been defined as activities that can easily fit into people's daily routine, such as gardening, walking for errands, or cycling to work. These are often unstructured activities and research indicate that people can more easily adapt to those kinds in the long-term, rather than structured activities such as going to the gym or other formal settings. Unstructured activities are said to be especially supportive for

Physical activity can be both of moderate-intensity and accumulated in time to benefit health

⁵ The definition of the subgroup of adults is the same here as defined by the World Health Organization, population of the age 18-65 years old (WHO, 2010).

⁶ Sedentary means spending a lot of time sitting down and not moving (Oxford Advanced Learner's Dictionary, 2013). The term is often seen in the composition of sedentary lifestyle and then it indicates that people live lifestyles with no or irregular physical activity.

sedentary people to become more active in their daily life (Dunn, Andersen, & Jakicic, 1998). Therefore creating environments that support active lifestyles must be of great importance to increase moderate forms of physical activity, such as walking (Frank, Engelke, & Schmid, 2003).

Walking as human behavior

Walking as a particular type of physical activity has received an increased focus of researchers and other practitioners of different professions and has become a potential strategy towards better health on a population level (Thompson, 2013). Walking is defined as a moderate-intense physical activity, meaning that walking needs relatively low levels of effort to perform. Out of all the different physical activities that can take place within the outdoor environment, walking is said to be the most common form among adults (Owen, Humpel, Leslie, Bauman, & Sallis, 2004). If walking is measured in terms of distance travelled, it is insignificant compared to other travel modes, but significant when evaluated in terms of the number of trips, travel time and most interestingly, exposure to outdoor and street environments (Litman, 2003). Walking is considered to possess a number of advantages beyond other forms of physical activity when adopting and maintaining over the long term (Frank, Engelke, & Schmid, 2003). This can be explained by stating that walking is easy to come about for a majority of people, rich and poor, young and old, free of charge, and requires no skills, training or special facilities (Thompson, 2013). This in turn might also explain the popularity of walking.

Walking is as form of physical activity that can easily be greater supported through urban design and integrated into people's daily lives

Walking is an interesting activity in the way that it has been predominately unchanged through human history. It means that it is a behavior possessing a possible evolutionary baseline in the form of perceptual needs and preferable characteristics of the walking environment (Rapoport, 1987). But walking behavior is said to be not fully understood and theoretically complex (Rhodes, Courneya, Blanchard, & Plotnikoff, 2007). Walking is influenced by multiple factors, internal and external. When one is walking in an outdoor environment there is a constant process going on, as the individual perceives properties of the environment and behave according to what he or she perceives. Built environment factors can influence people's movement and walking behavior, both consciously and unconsciously (Bartuska, 2007). The built outdoor environment is inherently complex and behavior in it is difficult to study and comprehend (Frank, Engelke, & Schmid, 2003).

Walking behavior is influenced by the built environment through a constant and complex perception process of the individual

Different types of walking have been identified and looked at separately since they are found to have different mechanisms and different factors of the environment influencing them (Owen, Humpel, Leslie, Bauman, & Sallis, 2004). These types of walking or different purposes of walking are said to be either walking during leisure time or walking to reach a destination (Saelens & Handy, 2008). They have different labels on them in the literature; the former recreational walking, exercise walking, strolling walking, walking for

pleasure, or walking for leisure; the latter destination-oriented walking, walking for transportation, active travel, non-motorized travel, or utilitarian walking. To distinguish these two terms in this thesis the former will be called walking for recreation or *recreational walking* and the latter walking for transport or *transportation walking*. It has been argued that the potential of walking for transportation are even greater for that matter than recreational because it can be integrated more easily into daily activity patterns (Frank, Engelke, & Schmid, 2003).

Jan Gehl's theory (Gehl, 2011) about the relationship between the occurrence of different outdoor activities and the quality of outdoor spaces is interesting to look at in the relation to walking as an activity in outdoor environment. In Gehl's theory three types of activities are included and these are *necessary activities*, *optional activities*, and *social activities*. These activity categories are the main thread in his writings about livability in urban environments. What is noteworthy and relevant here is when outdoor environment are of poor quality, only minimum of activities take place, and interestingly, almost only necessary activities. When the environment is of high quality, optional activities increase significantly but necessary activities keep approximately the same frequency, though they might take a longer time (Gehl, 2011). From this it can be assumed that people might be drawn into unplanned activities because the environment makes it easy and enjoyable (Thompson, 2013). Gehl's theory also harmonize with other study results about the environment supporting differently transportation walking and recreational walking.

People are more likely to walk more and spend more time outside if the environment is of high quality



Objectives and research questions

The overall goal with this thesis is to explore how active living can be promoted by creating walkable environments. A more specific aim is to investigate how and to what extent outdoor environments can influence walking activity and encourage physical activity in general at a population level. The purpose is to come closer to understanding the correlations between the pedestrian, the environment and health, in order to evaluate how active lifestyles among people can be supported through urban design. As a part of these aims I intend to give insights into the different tools, methods, concepts, theories and other knowledge sources available that are useful and can support the planner when making built environments more walkable.

The aims above together with following questions will guide the exploration:

- How does outdoor built environment explain walking behavior?
- What kind of tools, methods and other knowledge sources exist to assess and create walkable environments?
- How can creation of more walkable environments support more active lifestyles and improve health among populations?

Method and material

The content of the project is mainly a result from literature studies where different aspects are drawn together on walkable environments. A reflective discussion will follow where the findings from the literature studies are reflected upon. To support the reflection on physical activity promoting environments are some existing theories on people and environment brought up. Within the discussion will also be reflections about the project itself together with future considerations. At last there is a concluding part drawing together overall lessons learned throughout this project.

The material used in the project is primarily published literature from across the world. Additional material is more informal, such as dialogues and existing environment. These were only used as sub material for reflections, in order to contribute to the understanding of the issue. The available literature on the subject is extensive. The focus has been on examining review articles, published books and book sections. Additional material has been published guidelines for designing environments suitable for walking. These were looked at with the fact in mind that they are not always based on scientific evidence and are also predominately from American and Australian contexts. The academic library in Alnarp and online search machines such as SLU library Primo, Web of Science, PubMed and Google Scholar were used to gather information. Key words or phrases searched on the web were:

walking, walking behavior, local walking, neighborhood walking, walkability, neighborhood walkability, walkable environment, physical activity, built environment, physical environment, environmental perception, landscape perception, and more.

Key writings and references in the project:

Books:

- *Innovative Approaches to Researching Landscape and Health: Open Space: People Space 2* (2010) – editors Catharine Ward Thompson, Peter Aspinall & Simon Bell.
- *Making Healthy Places: Designing and Building for Health, Well-being, and Sustainability* (2011) – editors Andrew L. Dannenberg, Howard Frumkin & Richard J. Jackson.
- *Life Between Buildings: Using Public Space* (2011) and *Cities for People* (2010) – by Jan Gehl.

Articles:

- *Activity, Exercise and the Planning and Design of Outdoor Spaces* (2013) – by Catharine Ward Thompson.
- *To Walk or Not to Walk? The Hierarchy of Walking Needs* (2005) – by Mariela A. Alfonzo.
- *Understanding Environmental Influences on Walking: Review and Research Agenda* (2004) – by Neville Owen, Nancy Humpel, Eva Leslie, Adrian Bauman & James F. Sallis.
- *Developing a Framework for Assessment of the Environmental Determinants of Walking and Cycling* (2003) – by Terri Pikora, Billie Giles-Corti, Fiona Bull, Konrad Jamrozik & Rob Donovan.
- *Built Environment Correlates of Walking: A Review* (2008) – by Brian E. Saelens & Susan L. Handy.
- *Environmental Correlates of Walking and Cycling: Findings from the Transportation, Urban Design, and Planning Literatures* (2003) – by Brian E. Saelens, James F. Sallis & Lawrence D. Frank.
- *Measuring the Unmeasurable: Urban Design Qualities Related to Walkability* (2009) – by Reid Ewing & Susan L. Handy.

Delimitation

I have chosen to limit my exploration in the following respect:

- attributes of built environments; that is public outdoor spaces
- walking as a particular form of physical activity
- adults (age 18-65) as a specific population subgroup

Why these delimitations were chosen is firstly in order to narrow the focus in the project. It has been noticed that there are different factors of the environment that affect the various physical activity forms and walking types. Different factors of the environment stimulate physical activity and walking among different subgroups of people. For example, adults have other preferences and may need different settings than children to become active (De Vries, 2010). Walking in particular is said to be the most popular form of physical activity and has even a greater potential beyond other forms of physical activity when it comes to raising activity levels among populations in the long term perspective. Adults moreover dominate the discussion and decision making on outdoor spaces.

PLANNING FOR ACTIVE LIVING

This section is an exploration into how planners can take on the challenge of creating walkable environments. The section will look at the various aspects about the links between built environment and walking behavior in order to contribute to the understanding of how active lifestyles can be promoted.

Walkable environments are considered more sustainable ones

Creation of walkable environments has been increasingly in focus in urban planning and design during recent years. The reason generate not only from the fact that it can raise physical activity levels among people but also because it can have various of benefits related to physical and mental health, well-being, environment, and economy. More walkable environments are considered more sustainable ones. In the attempt of gaining understanding of the links between built environment and walking it is fundamental to investigate how the state of knowledge has come about. How far have researchers and alike come in understanding these correlations? Who have contributed to and formed the knowledge base, under what circumstances, and with what tools and methods?

To understand the term of walkability it requires a conceptual, theoretical and practical assessment

Within the challenge of creating active living environments it is interesting to consider where landscape architecture and professions alike stand. What kind of tools and methods are available for practice for both assessing and creating walkable environments? What attributes of the built environment are considered supportive for walking activity and why? How can creation of environments be encouraged that foster livability and sustainability through walking? What are the possible steps towards greater understanding about the environment-walking correlations? What are the future challenges, potentials and limitations in planning such environments? What theories are relevant to the greater understanding of the correlation between environment and people's behavior? How can the knowledge be brought together to a comprehensive understanding? The concept of walkability will be introduced and how research on walkability has been carried out. Further how measures and methods used in those researches has formed the walkability research field. The speculations above, among other aspects, will be taken into consideration in this chapter. The spectrum from defining the problem to practice and implementation will be covered in order to understand the past and present state of knowledge and future directions in planning for activity promoting environments.

The professional role

Planners, architects, developers, and politicians are generally those who are responsible for deciding and designing layouts of outdoor settings for people to act in. They make crucial planning decisions that can be whether or not to build a highway, where to place it, housing density, arrangement and material use, or where to place parks, schools and other features of our surroundings. It might be realized that much of urban pattern and built form will last for decades or even centuries to come. Planners and architects engage in creating places that present and future generations will come to use. These places owe to be well designed and serve the needs of the people using them.

Planners of the outdoor environment play a crucial role in health outcomes of populations

Research has manifested the built environment being a foundation for human health and well-being (Renalds, Smith, & Hale, 2010). People's behavior choices in outdoor settings are partly personal but always more evidence show that they are influenced by the environment itself. The layout and condition of the environment people live in can shape people's lifestyles and health. Planners and alike therefore directly play a crucial role in health outcomes of populations. These decision makers usually do not have proper knowledge about public health issues (Dannenberg, Frumkin, & Jackson, 2011). After decades of creating environments where motorized vehicles are generally prioritized beyond other more active travel modes, planning and design practice have come to realize the need of balancing the different travel modes, walking there included. The focus in contemporary urban planning has been shifting towards creation of more active living environments where the design is more human-oriented. This has resulted in trends about creating highly walkable environments and along a rapid increase in walkability studies intended to provide evidences on environmental factors supporting walking.

"The built environment is part of the health problem. But it is also part of the solution" (Urban Land Institute, 2013, p. v).

Walking behavior is influenced on multiple levels and need interdisciplinary approach to be both understood and successfully effected

Providing people with highly walkable environment is not enough though to increase walking levels. As theories have shown (further argued later on in this project), the influences on people's behavior, including walking behavior, are highly complex; being related to physical environment, policies, individual-, psychological- and social factors. These multileveled influences all hold hands and therefore understanding the correlations between built environment and walking behavior is a challenging task. When the goal is to promote walking on a population level, interventions are said to be needed on several or even all influencing levels (Sallis, Owen, & Fisher, 2008). The book "Making healthy places" (Dannenberg, Frumkin, & Jackson, 2011) is interesting in terms of its main message of the urgent need for better communication between public health professionals and those who make design decisions about the built environment. According to this it might be obvious that different fields of professions, including planners and landscape architects, need to work together to make a success, both in research and practice.

Contributions in the planning field

In the attempt of understanding the state of knowledge about walkable environments and active living, it is useful to be aware of who have contributed within the field. Some of the influential thinkers, platforms, concepts, and organizations will be introduced.

Within urban theory several key persons have contributed to the thinking and knowledge of environments supportive for walking. They have in common to be influential worldwide towards creation of more walkable, active, and healthy communities. Some of them have marked a considerable shift of focus within urban planning, architecture and design. One of the first was *Jane Jacobs*, a journalist, author, and activist but best known for her influence on urban studies together with her published book about the issue; *The Death and Life of Great American Cities* (1961); *Amos Rapoport*, an architect and one of the founders of the field of Environment-Behavior Studies, *Jan Gehl*, a Danish architect and urban designer consultant which has focused on improving livability of cities around the world by re-orientating design towards the pedestrian and the cyclist. *Kevin Lynch*, an urban planner and author who was a key figure in linking theory to practice between planning and design. He argued for the focus on peoples activities in outdoor spaces instead of physical elements alone and that behavior observations should be an essential part of design to understand what people actually do on site. *Donald Appleyard*, an urban designer and theorist; *William Whyte*, an American urbanist, best known for his studies on human behavior in urban settings.

Other more present time idealists, writers and effective researchers I found prominent while exploring the issue and considered important contributors within the field: *Catharine Ward Thompson*, a research professor of landscape architecture and the director of OPENspace Research Center in Edinburgh; *Jeff Speck*, a city planner, author of the book *Walkable City* and a recent speaker (in 2013) at TED talks; *Kaid Benfield*, the director of the Sustainable Communities, co-founder of Smart Growth America and an active blogger about urban topics; *James F. Sallis*, a professor of psychology and the director of Active Living Research; *Brian E. Saelens*, a professor of pediatrics and psychiatry & behavioral sciences and an effective researcher; *Billie Giles-Corti*, a professor at the university of Melbourne and the director of the McCaughey VicHealth Centre for Community Wellbeing; *Lawrance D. Frank*, a professor in School of Population and Public Health at The University of British Columbia; *Susan Handy*, a professor in the department of environmental science and policy at the University of California at Davis.

It has been argued (Thompson, 2013) that research findings need to be presented in a way that is attractive and accessible for design practice in

order to be understood and used. A report published by the British Government, *Be Active, Be Healthy: A Plan for Getting the Nation Moving* (DH leading in partnership with OGDs, 2009) is a national policy that sets out a framework for delivery of physical activity. It is a good example where knowledge has been translated into a user-friendly manual. *Active Living Research* is an organization with a focus of providing evidences on the issue to inform practices and policies, especially aimed at the North American context but might be useful for other regions as well. The organization has published for example guidelines on how to design environments that promote physical activity and health and how to enhance experiences on pedestrian sidewalks⁷ (Active Living Research, 2014). *Active Living by Design* is also a national program in the U.S. established in 2002, by the Robert Wood Johnson Foundation. It aims at increasing physical activity in daily life through community design, public policies, and communications strategies (Active living by design). In Sweden the Public Health Agency has published reports and guidelines for the purpose of informing practice, such as *Active Lifestyle in Built Environments: A Manual for Community Planning*⁸ and *The Built Environment Effects on Physical Activity: A Knowledge Summary for the Governmental Project "Built Environment and Physical Activity"*.⁹

There are also organizations that have been established with the purpose of emphasizing the importance of human oriented environments with the strategy of creating more pedestrian-friendly environments. These organizations are more or less based on research evidence showing that walkable environments offer greater opportunities for healthy and active lifestyles. They are therefore important for the link between public health and planning and design of the environment. The organizations are further aimed at translating research evidences into practices with guidelines and policies.

One example of an organization is *Active living research*, established in the United States since 2001. That program has been very effective in supporting research and also sharing research results related to obesity and environmental changes that could encourage more physical activity (Sallis, 2009; Bull, Giles-Corti, & Wood, 2010). Through the program many disciplines have contributed, including public health, planning and transportation (Active Living Research, 2014).

⁷ The guidelines, "Active design guidelines: promoting physical activity and health in design" and "Active design: shaping the sidewalk experience", can be found on <http://activelivingresearch.org/>.

⁸ Translated by author, original title: "Aktivt liv i byggda miljöer: Manual for communal planering".

⁹ Translated by author, original title: "Den byggda miljöns påverkan på fysisk aktivitet: En kunskaps-sammanställning för regeringsuppdraget "Byggd miljö och fysisk aktivitet"".

*OPENS*pace is an organization in association with The University of Edinburgh and Heriot-Watt University, situated in Edinburgh. It was established to bridge academia, policy and practice based on rigorous evidence base. It is a research center for inclusive access to outdoor environments for everyone, with emphasizes on minority groups such as disabled people, elderly, young people, children, and socially and economically disadvantaged groups. Their vision is to recognize the potentials of open space to provide opportunities for outdoor activity and positive engagement to the environment to enhance people's health and wellbeing and to build social capital. Among the works they are focusing on is a research project into how to design places that make pedestrian mobility easy, enjoyable and meaningful for older people (OPENSspace).

Gehl architects is an institute founded by the Danish architect Jan Gehl offering services in the form of consulting strategy visions as well as design and implementation. The organization is established in year 2000 in order to transform theories into practice in cities around the world. It is recognized worldwide for its research-based vision of more human centered approach to urban design in order to promote quality of life. The focus in their urban planning theory is the relationship between people's quality of life and the built environment, people's scale, senses, behavior, interests, movements, and engagement in their surroundings (Gehl Architects).

There are also some concepts within urban planning contributing to the thinking about more walkable living environments. These have been widely recognized within urban planning. Firstly is *New urbanism*, an urban design movement originated from the United States in the early 1980s by architects and planners. Its urban design ideas are influenced by what is called "traditional neighborhood design"; an urban form that was prominent until the rise of the car in the early 20th century. The emphasis is among others on promoting walkable neighborhoods that are diverse in use and population. The notion of looking at people first is highlighted in its planning strategies and positive change in the physical environment has a great force when contributing to the social life of a community. Its emphasis is also on the importance of building communities that are designed for the pedestrian, public transport, as well as the car (Haas, 2008).

Secondly is *Smart growth* a transportation and urban planning theory that advocates growth in compact walkable urban centers to avoid sprawl. The emphasis is on mixed land use with diverse housing, walkable neighborhoods that are bicycle-friendly and public transport-oriented, to foster communities that are distinctive with strong sense of place, and to promote public health. The term *smart growth* is particularly used in North America but in other continents, particularly Europe; similar influential concepts are also known as *compact city* or *urban intensification* (Smart growth online, 1996-2014).

In relation to these contributions it may be noticed that motorized modes of transport are far more popular in the United States than in many parts of

Europe. The built environment arrangement along with patterns of activities differ between continents, e.g. between Europe and United States. In addition are low levels of physical activity along with barriers for people's chances for active lifestyles in the built environment, a greater issue in the U.S. than in Europe (Frank, Engelke, & Schmid, 2003). Realizing that this is a greater problem in urban areas in the U.S., the fact can be explained that many of the existing guidelines and policies along with organizations established are originally from the U.S.

Walkability

Conceptual definition

Walkability is a buzzword within contemporary urban planning and design practice

Before discussing the research aimed at understanding the connection between environment and walking behavior it is relevant to briefly introduce the concept of walkability. Walkability is a frequently used term within urban planning and design and has become a buzzword in contemporary practice (Choi, 2012). Likewise is the term of sustainability and these two concepts often hold hands. Walkability is common in various compositions, such as neighborhood walkability, walkability attributes, walkability research, walkability audits, and walkability city plan. It is a convenient word to use when referring to the connection between walking and environment. But how is walkability defined?

Walkability is the extent to which the built environment is walking friendly

Walkability is a term of which the definition is not very clear. The Oxford dictionary does not define the term but the word can be found in the online Macmillan Dictionary, where it is defined as: "a measure of how easy it is to walk around in an area easily and safely" (2009-2014). In the Oxford University Press Dictionary (2013) is the word "walk (noun)" defined as "a journey on foot, usually for pleasure or exercise" and "walk (verb)" as "to move or go somewhere by putting one foot in front of the other on the ground, but without running". In the same dictionary "ability" is also defined as "the fact that somebody/something is able to do something" and if referred to the word "walkable", the suffix "-able" is described as "that can or must be". In the Walkability Scoping Paper (Abley, 2005) it is stated that walkability is a measure of the success that something is "walking friendly" and then a concluding definition of "walkability" or "walkable" is: "the extent to which the built environment is walking friendly" (Abley, 2005, p. 3).

Walkability research seeks to understand how built environments influence walking behaviors

Research agenda

Research on how built environment influence walking behavior is generally called *walkability research*. The research field is at a relatively early stage and is still evolving. Research has primarily been carried out in two different fields. Since at least the 1980s the urban planning and transportation field has studied how walking as a travel behavior is related to land use, design of communities and design of transportation systems. These studies have predominately been based on objective measures of the environment (Saelens, Sallis, & Frank, 2003). Within transportation studies the efforts in understanding how to raise walking levels was foremost to reduce traffic congestions and improve air quality (Sallis, 2009), rather than aiming at increased physical activity or walking as a contributor to better public health. On the other hand the public health field has long been studying walking as a form of physical activity (Owen, Humpel, Leslie, Bauman, & Sallis, 2004). In contrast to the planning field the health profession has focused on walking as a form of recreation (Nelson, Wright, Lowry, & Mutrie, 2008). Researchers into health focused almost only at first on the psychological and social influences on physical activity behaviors, not environmental influences. Public health research focused at first on vigorous physical activity as contributor to public health and anything less would have little or no long-term health benefits. Only for the last two or three decades, health experts started to focus more on the importance of moderate physical activity to improve long-term health. This has led to the attention of researchers to the built environment in motivating moderate physical activity as well, such as walking and bicycling (Frank, Engelke, & Schmid, 2003).

The professions of planning and public health are the two main fields that have contributed to walkability research, but with different approaches

After 1990's was a rapid increase in this research field and researchers and practitioners started to emphasize greater importance of the built environment in facilitating and promoting physical activity and particularly walking (Sallis, 2009). For several years now the professions of planning and public health have been merging on the issue (Saelens & Handy, 2008). Quite recently numerous of other fields have also contributed to walkability studies, as the nature of walking have been realized to be a very complex phenomenon of physical and perceptual features. A driving force in this research field has largely been funding by the Robert Wood Johnson Foundation through the Active Living Research Program, previously mentioned in this project. The fields of professions contributing in contemporary research include architecture, landscape architecture, sociology sciences, medicine, preventive medicine, environmental protection and environmental psychology (Ewing & Handy, 2009; Alfonzo, 2005). This increase in collaboration of different professionals is considered worthwhile in the increasing understanding on environment-walking behavior correlations (Saelens & Handy, 2008). With this diverse contribution there is a greater opportunity to gain comprehensive overview of the subject and be

better able to support and sustain healthier behaviors of populations (Bull, Giles-Corti, & Wood, 2010).

The number of available studies whatsoever is insufficient to produce definitive findings for a comprehensive overview of what matters when designing walking promoting environments. There is a need for more detailed research on behavior- and environment-specific correlations, the interrelation between environmental, psychological and social factors influencing individual behavior, and research on special population groups related to behavior. It has been noted that in order to be able to identify specific characteristics in the environment, areas or neighborhoods that differ on only one walkability factor need to be compared or behavior changes measured before and after an alteration of an environmental factor in the same neighborhood (Saelens & Handy, 2008).

When the history is explored of where walkability research has been carried out, it appears that a majority of studies have been carried out in North America and Australia. Comparatively few studies have been done up to date in a European context. In Europe such studies have particularly been carried out for some time now in Belgium, The Netherlands and the UK (Holle, et al., 2012). The research area is constantly growing in other European countries as well, including Sweden.

Measures for assessment

No comprehensive method exists to measure environments for walking

Measuring the quality of walking environments is a complicated task, as the walking activity in outdoor environments is a complex phenomenon. It seems that no comprehensive method does exist to measure environments for this purpose. The reason for this is probably due to the still relatively young research field and therefore lack of evidences on the correlation between the environment and walking (Brownson, Hoehner, Day, Forsyth, & Sallis, 2009; Dannenberg & Wendel, 2011). The reason is probably also due to differences in measures and methods used to assess the walking environment, multitude of environmental factors investigated, differences in performance of the assessments, and a lack of conceptual models of the environment-walking correlations (Handy, 2005). It has been said that before any method for this purpose can be simplified and made comprehensive it has to be tested many times (Brownson, Hoehner, Day, Forsyth, & Sallis, 2009). So question like; - What is the best measure to use in environmental assessment for walking? - can probably not be answered at this state.

Some tools and measures exist to measure walkability but they vary along different scales and intensions

Numerous of methods and tools for measuring walkability do exist though and have emerged during the past few years in the efforts of establishing a reliable, efficient, and consistent method. Some of them have been validated to some degree (Ewing & Handy, 2009). Methods for this purpose vary along different scales and intensions and are therefore often difficult to compare. That means their structure depend on what is particularly being investigated. Some measuring methods aim at specific aspects of the built environment

such as green areas, proximity to parks or traffic calming. Others are intended to measure environments for a specific type of walking, such as walking for transportation. They can also aim at different aspects of walking activity; the amount of walking, the choice of walking, the quantity of walking or the quality of walking. Geographic scale of measures also differ, the area assessed can be a whole city down to a single route or a street (Dannenberg & Wendel, 2011). Measures can also require different methods and approaches in performing them. According to Brownson et.al. (2009), there are three categories of measuring methods on built environment for physical activity, each one differing in what is being assessed:

- Individual based method where perception of the environment is documented with interviews or questionnaires for residents.
- Field observations or audits used to systematically assess the attributes of the environment, for example to assess a single street.
- A method including analysis and calculations of data sets with GIS.

Measures have different labels on them, but generally they seem to be called *walking audit instruments* (Ewing & Handy, 2009). Other names that have appeared in the different literature for walking measures are *walkability index* (singular), *walkability indices* (plural), and *walkability ratings*. Examples of such instruments are Systematic Pedestrian and Cycling Environmental Scan (SPACES) and Pedestrian Environmental Data Scan (PEDS), widely used in the US. Many measurements established do require measuring of physical features of the built environment such as building height, sidewalk width, and block length. Other measures try to capture perceptual qualities, such as aesthetics, convenience, pleasurability, etc. These may have a complex and indirect or abstract relationship with physical features in explaining walking behavior. One example of abstract measure is provided by Ewing and Handy (2009) and is a tool applicable to measure perceptual qualities of a street environment contributing to walkability. *Walk score* is also a company offering an online service through website or mobile application where any address in the United States, Canada, and Australia can be numerically scored, due to how walkable the surrounding neighborhood is. The fundamental aim for the service is to help people to evaluate where they want to live according to the walkability factor. The walkability rate is estimated through large scale and public access walkability index (Walk Score, 2014).

More *informal measures*¹⁰ I came across are interesting to consider in this context on estimating the walkability of a neighborhood. These measures are simple and not scientific but actually tell a lot for that matter. They do not

¹⁰ Gathered by Kaid Benfield (director of sustainable communities, energy and transportation program in Washington) on his blog: http://switchboard.nrdc.org/blogs/kbenfield/how_far_will_we_walk_to_someth.html, accessed 13.11.2014.

include any specific built environment specifications but rather reads environmental factors by looking at people's behavioral norms.

- "The popsicle test" – If an eight-year old kid can safely go somewhere and buy a popsicle and get back home before it melts.
- "The Halloween test" – If the neighborhood is good for trick-or-treating its likely to be walkable, at least fairly much.
- "The 20 minute neighborhood" – If a resident can meet most of daily needs within 20 minute walk or public transport ride.
- "The tourist test" – If the neighborhood or the place is good enough that people would like to be on a vacation there.

It is noticeable and important regarding the different methods used to assess the environment, that they can have quite varying outcomes on to what extent the environment is suitable for walking. But all the different methods contribute in some way to measures on the environment for walking but due to the premature field of research there are still improvements needed to be done (Dannenberg & Wendel, 2011; De Vries, 2010).

Built environment attributes related to walkability

This section will explore the links between built environments and walking behavior in order to understand how active lifestyles can be promoted. Moreover it will identify and discuss some of the urban design qualities that are considered supportive for walking. These are identified through recently published articles, study results, and guidelines that appear most influential and reliable for the understanding of environment-walking behavior correlation. The urban design qualities discussed in this section are by no means an exhaustive listing or specifically systematic. The purpose is more to grasp the complex nature of the issue and provide a ground for discussion upon the resources at hand when creating walkable environments.

The context the individual and the environment

How important are the different factors in explaining walking behavior?

The built environment has been manifested to affect walking behavior of individuals. But to what extent and how important are environmental factors in explaining walking activity? Researchers have attempted to identify the relative importance of the different influencing factors on people's physical activity behavior. That is to what extent activity patterns are explained by individual factors and preferences, how much is explained by social, political and cultural factors and how much is explained by the attributes of the built environment. An early study of Giles-Corti and Donovan (2003) conclude that

Environmental factors have been manifested to influence walking behavior but differ in importance according to the context

individual and social factors outweigh environmental factors in a relative importance, but the results show nonetheless a significant importance of the built environment (Giles-Corti & Donovan, 2003). Although, it has been said that it is premature to say that individual and social factors play a larger role than the environment in influencing physical activity, because the two prior factors have been researched for a longer time and there is more known about them than the latter one (Owen, Humpel, Leslie, Bauman, & Sallis, 2004). Environmental factors also differ in importance according to the context and what is particularly being investigated. For example the social factors is far more important for teenagers than for adults and the environment then play a smaller role in comparison (Thompson, 2013). There are also more diverse environmental factors thought to influence recreational walking than transportation walking (Saelens, Sallis, & Frank, 2003). So it is clear that the environment play a part in all of this but it is impossible to say in general to what degree. This has been argued in a recent critical appraisal and the reason said to be that the quality of walkability studies varies a lot (Gebel, Bauman, & Petticrew, 2007).

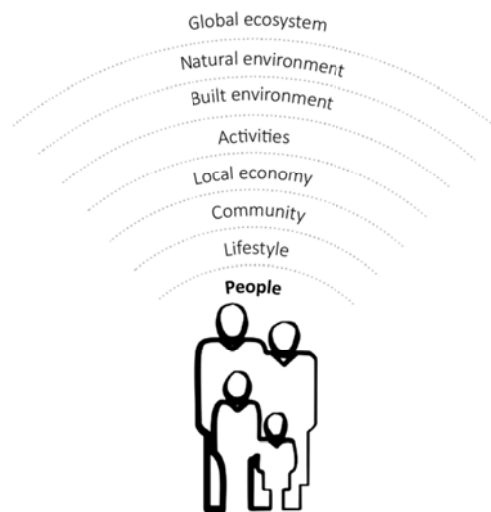
The focus of the various literatures contributing to the understanding of the issue has clearly been changing over a short period of time. Research has noticeably evolved towards considering walking as a more complex phenomenon than previously thought, being influenced by factors of different genre, interpersonal and intrapersonal. The environmental factors operate at different scales and levels, influencing walking from regional and city level down to detailed level of streets and parks and even individual gardens (Thompson, 2013).

Ecological models can help explaining how behavior is conducted by interaction across levels of influences

To help out understanding the context of the environment as an influencing factor on people's behavior, so called *ecological models* have been developed and increasingly applied to walkability studies. These models aim at understanding the individual within a complex context where it recognizes the many forces shaping the individual's behavior and health. The forces span from psychological and social situation up to environmental and policy level, where each of those can affect human well-being directly or indirectly (Sallis, Owen, & Fisher, 2008; Barton & Grant, 2006; Thompson, 2013).

The following illustrated model is developed by Barton and Grant (2006) and is called the health map. It shows the individual as the heart of the model and recognizes therefore personal differences in desires, experiences and needs in relation to the environment. Interestingly, the focus of research has for a long time been on the more proximal factors to the individual in the model as influencing behavior; that is individual and intrapersonal factors such as age, sex, socioeconomic status, educational level, attitudes and beliefs. Only recently more distal factors to the individual in the model, such as the built environment, have been realized to have more influence than previously believed (Barton & Grant, 2006). This is partly the reason for increased focus on the environment as an influencing factor on walking.

Figure 1.
The health map; A model of
public health (modified from
Barton & Grant, 2006, p. 252)



If changes in health behavior
are wanted, interventions on
several or all levels of influences
might be needed

When it comes to directing changes in behavior on a population level, such as increasing walking levels, comprehensive interventions are needed where changes on one level of the model do not necessarily result in changes in behavior. For example, if alterations of the environment are made, such as creating paths to walk on, it does not mean that people start to walk more. It usually takes the combination of both individual-level and environmental/policy-level interventions to achieve substantial changes in health behaviors. Interventions might be needed on several or all affecting levels of the model.

“Behavior change is expected to be maximized when environments and policies support healthful choices, when social norms and social support for healthful choices are strong, and when individuals are motivated and educated to make those choices” (Sallis, Owen, & Fisher, 2008, p. 466).

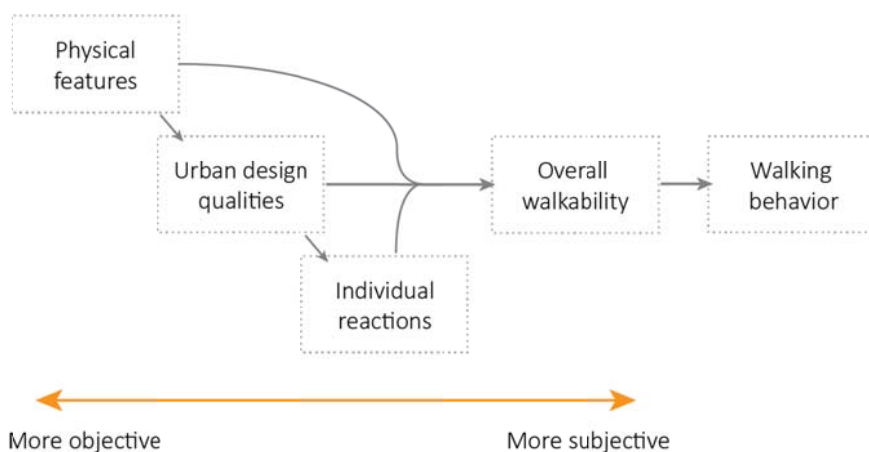
Being aware of this aspect has been particularly useful in the attempts of understanding the correlations between built environment and individual behavior (Sallis, Owen, & Fisher, 2008). Consequently, the main message of ecological models can raise questions about reliability of research results, generating from the fact that people’s behavior are rarely or never influenced by a single factor of the environment. A behavior needs to be seen within a larger context. Regarding interventions aimed at promoting health, improvements in the environment is actually thought to have a greater potential than interventions on an individual level. The reason is said to be that environmental changes can have much longer-lasting effects since they are worked into structures, systems, policies, and socio-cultural norms (De Bourdeaudhuij, Sallis, & Saelens, 2003).

Walking behavior is influenced by both objective and subjective environmental attributes

Objective vs. subjective attributes

Evidently the activity of walking is a complex process with constant interaction between cultural, social, environmental (physical), and perceptual variables (Rapoport, 1987; Ewing & Handy, 2009). Physical features of the built environment do not individually explain how people move about in their surroundings. People's walking behavior is said to be influenced by both objective and subjective environmental attributes. To be able to comprehensively understand the environment-walking correlations it is important to include both of these influences (Humpel, Owen, Iverson, Leslie, & Bauman, 2004). Ewing and Handy (2009) have formulated a conceptual framework of walkability where they include physical features, urban design qualities, and individual reactions as interacting variables contributing to overall walkability. Both objective and subjective features intervene in explaining how an individual may feel about the environment as a place to walk and how this might be translated to walking behavior of the individual.

Figure 2. Conceptual framework of walkability (modified from Ewing & Handy, 2009, p. 67)



Physical features or objective attributes can be walking paths being available and proximity to destinations. Subjective attributes or individual reactions reflect individual assessment of conditions of the environment given their own attitudes and preferences. These can be attractiveness, perceived safety and interesting environment. Urban design qualities are actually in between, subjective, but can be measured in the physical environment. Urban design qualities can be assessed by an outside observer with a connection to the objective environment to some degree, while individual reactions cannot be assessed by looking at the environment alone (Ewing & Handy, 2009).

Physical environment attributes

The built environment refers to the public outdoor space and includes all the things that have been to some degree made or arranged by humans (Bartuska, 2007). The influence of the built environment on walking can be on many different scales. It can range from the structure of the entire city such as placement of service amenities and down to the small scale such as absence of trees in a streetscape or the level of detail at an eye level. In a recent review of reviews made by Saelens and Handy (2008) they list characteristics of the environment that were found to be most strongly correlated with walking. These factors mostly work on the large scale of urban planning.

Physical attributes of the environment correlated with walking:

- Accessibility & proximity
- Mixed land use
- Density
- Street connectivity
- Sidewalks & walking paths

- *Accessibility* and *proximity* appears to be the most consistent factors affecting levels of walking and it seems obvious. These measures tell us that desired destination (shops, school, work, park, etc.) are close to people's location (home or work) and are accessible (Saelens & Handy, 2008). What is considered to be an acceptable walking distance in ordinary daily situation of most adults is around 400 to 500 meters. For old people, children and disabled this walking distance can often be considerably shorter (Gehl, 2011).
- *Mixed land use* is said to support more walking. Mixed land use is strongly associated with accessibility and proximity. With mixed land use there is a greater possibility of having a potential destination within a walking distance (Saelens & Handy, 2008).
- *Density* is one factor affecting walking levels. If there is a high density, destinations are closer to each other and larger number of people needed to support any activity is found within a smaller area. Density is also related to proximity (Saelens & Handy, 2008).
- *Street connectivity* is important for its effect on proximity. Greater street connectivity gives greater opportunities for direct walking routes and therefore shorter distances between destinations (Saelens & Handy, 2008).
- *Sidewalks* and *walking paths* have to be available in order to create safe and viable environment for walking. Many streets and roads are hostile for those who are not travelling in a car. Walking paths are often needed as well to make outdoor environments and destinations accessible. Pedestrian infrastructure need to be well connected and logical to the pedestrian flow, as well as connected to other parts of the transportation system (Saelens & Handy, 2008).

Renalds and colleagues (2010) recently reviewed articles providing information on built environmental factors influencing health. Some of the identified factors were significantly associated with increased walking, such as the presence and condition of sidewalks, trails and lighting, smaller size of neighborhood blocks and close proximity to retail stores. Limitations in possibilities to perform daily activities were associated with limited land use

mix, poor connectivity of sidewalks, less connectivity to public transport, and greater car dependency (Renalds, Smith, & Hale, 2010).

Pikora and colleagues (2003) have also developed a framework of the influencing factors on walking and cycling. They classify the factors into categories of features. First is a *functional* feature reflecting the fundamental structural aspects of the environment, these include the directness of routes and to destinations, traffic volume and speed, and type and width of street. Second is the *safety* feature reflecting personal safety in terms of lighting and weather people walking could be seen by others, and also traffic safety in terms of availability of crossings. Third is the *aesthetic* feature reflecting presence of parks and private gardens, level of pollution, architectural design, and diversity and interest of natural sights. Fourth is the *destination* feature reflecting the availability of facilities within neighborhoods such as post boxes, parks, schools, shops, and public transport facilities (Pikora, Giles-Corti, Bull, Jamrozik, & Donovan, 2003).

Table 1.
The physical environmental factors that may influence walking for recreation in the local neighborhood (modified from Pikora, Giles-Corti, Bull, Jamrozik, & Donovan, 2003, p. 1698)

<p>Functional</p> <ul style="list-style-type: none"> ▪ Direct route ▪ Intersection design and distance ▪ Kerb type ▪ Path continuity, design, type, location, maintenance, surface, width ▪ Street design, type, width ▪ Traffic control devices, speed, volume ▪ Vehicle parking 	<p>Aesthetics</p> <ul style="list-style-type: none"> ▪ Cleanliness ▪ Sights ▪ Garden and street maintenance ▪ Parks ▪ Pollution ▪ Trees ▪ Architecture
<p>Safety</p> <ul style="list-style-type: none"> ▪ Crossings ▪ Lighting ▪ Verge width ▪ Surveillance 	<p>Destination</p> <ul style="list-style-type: none"> ▪ Local facilities ▪ Parks ▪ Public transport ▪ Services ▪ Shops ▪ Vehicle parking facilities

Encouraging walking within the neighborhood or close to home in particular is considered important approach in walking promotion on a population level. Numbers of research have focused on this in order to find out what matters in the environment to encourage local walking or neighborhood walking. Renalds and colleagues (2010) have taken together factors associated with more walking within a neighborhood. These are found to be proximity to grocery stores, smaller block sizes, higher residential density, and clusters of destinations, such as grocery retail stores, and restaurants. Other significant factors within a neighborhood are number of recreational facilities, number of street intersections, and perceptions of safety (Renalds, Smith, & Hale, 2010).

Perceptual attributes

People's experience and perception of the physical environment play a large role in their behavior in outdoor spaces. People are highly exposed to their surroundings when walking outside and perceive the environment with all senses. Therefore it might be obvious that extra elaboration is needed when creating environments that are well suitable for pedestrians.

"Physical features influence the quality of the walking environment, both directly and indirectly, through the perceptions and sensitivities of individuals". (Ewing & Handy, 2009, p. 67).

Thus, the quality of the walking environment is much more complex than can be calculated from a map in means of street connectivity or land use mix (Ewing & Handy, 2009). Though a sidewalk exists beside a road in a neighborhood, it does not tell anything about the experience of walking that particular route. In other words, though a route is technically accessible, it might not be chosen for walking by people. As Jan Gehl (2011) writes about acceptable walking distance, he argues that it is not only the actual length of the walking route, but the quality of the walking route is just as important as the actual length of it. The experienced distance play a large role and affect as well the choice of people walking or not or which route people might choose to walk (Gehl, 2011). To fully assess to what degree the built environment is suitable for walking it is necessary to look at it on the small scale as well. Characteristics of the built environment often operate at the small scale and they might influence the pedestrian's perception and those intangible factors might act motivating or discouraging in the decision process of whether to walk or not to walk (Frank, Engelke, & Schmid, 2003).

Several quite established concepts within the landscape field represent general environmental quality and have been applied to the context of walking environments by Ewing and Handy (2009). They identified these characteristics through literature of different fields and linked to physical features with help from several urban design and planning professionals. The purpose was to be able to measure the characteristics objectively. The study was limited to characteristics of commercial streets and they mention that the results might not apply to other settings. The characteristics they call *perceptual qualities* and contribute to more abstract urban design qualities related to walkability.

Table 2.
Perceptual qualities
 (modified from Ewing &
 Handy, 2009, p. 66)

adaptability	distinctiveness	intricacy	richness
ambiguity	diversity	legibility	sensuousness
centrality	dominance	linkage	singularity
clarity	enclosure	meaning	spaciousness
coherence	expectancy	mystery	territoriality
compatibility	focality	naturalness	texture
comfort	formality	novelty	transparency
complementarity	human scale	openness	unity
complexity	identifiability	ornateness	upkeep
continuity	imageability	prospect	variety
contrast	intelligibility	refuge	visibility
deflection	interest	regularity	vividness
depth	intimacy	rhythm	

Perceptual qualities of the built environment:

- Imageability
- Enclosure
- Human scale
- Transparency
- Complexity

Eight of these perceptual qualities (bold in the table) they selected for further studies based on their importance in the literature and their significance of correlations to walking: imageability, enclosure, human scale, transparency, complexity, legibility, linkage, and coherence. Of the above qualities the first *five* were further selected and successfully operationalized (Ewing & Handy, 2009).

Imageability is elaborately defined by Kevin Lynch (Lynch, 1960) and also by Jan Gehl as “sense of place” (Gehl, 2011). Imageability is said to be the quality of a place that makes it distinct, recognizable and memorable. A place has high imageability when specific physical elements and their arrangement capture attention, evoke feelings and create a lasting impression. Landmarks are believed to be key component of imageability, but also significant features such as number of people visible in a scene (human activity), proportion of historic buildings, number of courtyards, plazas and parks, presence of outdoor dining, number of buildings with non-rectangular silhouettes, noise level, number of major landscape features, and number of buildings with identifiers. All of these have a positive relationship with imageability except noise level (Ewing & Handy, 2009). The strength of the image of a place can be either positive or negative. If a place evokes a strong negative image it might be the ones that people may prefer to forget but naturally urban designers focus on positive images in discussion of what makes a place memorable.

Enclosure refers to the degree to which streets and other public spaces are visually defined by buildings, walls, trees and other vertical elements. Spaces where the height of vertical elements is proportionally related to the width of the space between them have a room-like quality. Many thinkers have tried to identify the optimal ratio for a comfortably enclosed space, but a frequently quoted statement is made by Alexander and colleagues (as cited in Ewing & Handy, 2009) that the total street width, building-to-building, should not exceed the building heights in order to keep a comfortable feeling

of enclosure. In a design guideline from Raleigh is an appropriate minimum ratio for height-to-width 1:6 and appropriate average ratio 1:3. Several of other physical factors than buildings can contribute to the sense of enclosure and help in humanizing the scale of a space, such as rows of trees, proportion of sky visible ahead and across, walls and fences, visually irregular layout of street network, architectural element placed at street end to achieve enclosure in all directions, such as a building, a monument or a fountain. Spaces that are inactive or do not generate human presence create dead spaces and can therefore further erode enclosure, such as empty lots, parking lots, and driveways. Setback of large buildings can also create dead spaces. Noticeably the preferred enclosure of a space varies with context, for example between a dense city and a village (Ewing & Handy, 2009).

Human scale refers to a size, texture, and articulation of physical elements that match the size and proportions of humans and, equally important, correspond to the speed at which human walk. Building heights, pavement texture, street trees, and street furniture and planters are all physical elements contributing to human scale. Additional physical features related to human scale is patterns, parked cars, setback of buildings, spacing of windows and doors on first floor, and details in building facades (Ewing & Handy, 2009).

Transparency refers to the degree to which people can see or perceive what lies beyond the edge of a street, and more specifically see or perceive human activity. Physical elements that influence transparency include walls, windows, doors, fences, landscaping, and openings into mid-block spaces. Additional factors can be outdoor dining, active use, sights into buildings, and interior lighting. Transparency operates often where interactions between indoor and outdoor occur and is therefore most critical at street level. Blank walls and reflective glass at walking level are examples of elements that reduce transparency (Ewing & Handy, 2009).

Complexity refers to the visual richness of a place. The complexity of a place depends on the variety of the physical environment, specifically the numbers and types of buildings, architectural diversity and ornamentation, building shapes, sizes, materials and colors, landscape elements, street furniture, signage, and human activity. Buildings with various arrangement and narrow frontage add to complexity. Other factors found related to complexity are diversity of building ages, diversity of social settings and diversity of uses during the different times of the day (Ewing & Handy, 2009). Complexity is also carefully described by Amos Rapoport (1987) as related to the information load being processed per time unit. Too little difference in the environment can result in one's deprivation or boredom and too much difference can result in too much information to process and therefore overload or chaos. Complexity is relative to the travel speed of the perceiver, pedestrian travelling at a walking speed might think the environment is comfortable while motorist at a higher speed perceives the environment as

chaotic. The same goes for environmental information suitable for motorists travelling at 90 km/hour can appear out of proportions and boring for pedestrians travelling at 5 km/hour (Rapoport, 1987). This indicates that medium range of complexity is appreciated for the environment to be both comfortable and interesting.

Subjective experiences of walking have been argued to be an underestimated dimension in walkability studies (Saelens & Handy, 2008). How the individual experience his/hers environment should be an added focus in urban planning and design (Brown, Werner, Amburgey, & Szalay, 2007; Saelens, Sallis, & Frank, 2003).

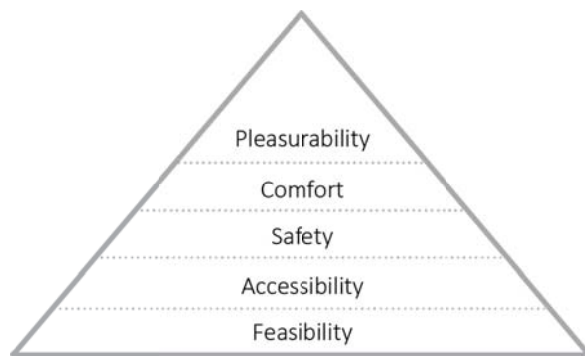
Attributes related to pedestrian needs and walking purposes

Walking needs of the pedestrian in outdoor environments:

- Feasibility
- Accessibility
- Safety
- Comfort
- Pleasurability

The needs of the pedestrian within outdoor environments are fundamental to be aware of when designing for walking. The work of Mariela A. Alfonzo (2005) explains these needs in relation to the built environment. The framework below she calls *the hierarchy of walking needs*. For the hierarchy, Alfonzo applies Abraham Maslow's theory from 1954 (as cited in Alfonzo, 2005), of *human motivation*; saying that people are motivated by variety of needs. The framework operates within a social-ecological model, meaning that deciding to walk is a dynamic, causal process influenced by various factors. She adds the theory into the context of walking behavior by identifying five levels of needs that influence the walking decision-making process. The five needs are *feasibility, accessibility, safety, comfort, and pleasurability*.

Figure 3.
Hierarchy of walking needs
(modified from Alfonzo,
2005, p. 825)



The first, feasibility, is said to be related to personal limits and therefore considered to be a basic need that has to be fulfilled before the person considers other needs. The other four needs are related to urban form and stand later in the prioritization order. This indicates that to which degree the needs are fulfilled it can be transferred to the outcome. That is if many of the needs are met by the walking environment, especially the basic needs, the probability of resulting in action is higher. The affordances and perceived environmental factors can be read through the outcomes; that is the

frequency and duration of walking, along with the type of walk chosen (Alfonzo, 2005). Interesting notion within the walking need theory is that some needs may or may not be consciously considered during the decision-making process of walking. This means that if one is asked about the reasons for choosing a walking route instead of another, he or she might not be able to answer why (Alfonzo, 2005). Several aspects need also to be clarified to understand the connection between walking needs and walking outcomes. No walking need is necessary or adequate for walking to occur. And as Alfonzo puts so nicely:

“Motivation is not the only determinant of behavior, merely being motivated to perform a specific behavior does not necessarily mean that the behavior will occur. Specifically, the satiation of all the needs within the hierarchy of walking needs does not necessarily imply that the person will walk. Neither must all the needs within the hierarchy be fulfilled for a person to decide to walk.” (Alfonzo, 2005, pp. 818-819)

This must imply though that if as many needs as possible are fulfilled, the probability of walking to happen must be higher. But if I refer back to the theory of ecological models, changes in the environment alone might not be enough to change behavior. Interventions on other influencing levels might be needed as well, such as educating the individual or changes in attitudes towards walking. Amos Rapoport is one of the main and early thinkers on suitable environment for pedestrians. He raises the fundamental question: “Which perceptual characteristics of environments are *supportive* for walking?” He emphasizes that the environment does not *cause* walking because that is absolutely not the nature of the environment-walking correlation (Rapoport, 1987). This reminds us that the design of the environment only *supports* walking, because the environment is just one factor of many influencing people’s walking behavior. Alfonzo additionally identified what kind of environmental factors are related to each walking need and how they might be identified within the environment (see table 2).

Table 3.
Walking needs in relation to environmental factors (modified from Alfonzo, 2005, p. 825)

<i>Factors such as...</i>	<i>May be found as...</i>
<p>Feasibility</p> <ul style="list-style-type: none"> ▪ Mobility ▪ Time ▪ Responsibilities 	<ul style="list-style-type: none"> ▪ Number of adults and children in household ▪ Childcare responsibility, etc. ▪ Physical mobility, age or health
<p>Accessibility</p> <ul style="list-style-type: none"> ▪ The pattern, quantity, quality, variety and proximity of activities present ▪ Connectivity between uses ▪ Walking-related infrastructure 	<ul style="list-style-type: none"> ▪ Number of destinations, etc. ▪ Distance to destinations ▪ Presence/completeness of sidewalk network ▪ Presence/number of barriers
<p>Safety</p> <ul style="list-style-type: none"> ▪ Types of land uses ▪ People present ▪ Urban design characteristics related to physical incivilities and fear of crime 	<ul style="list-style-type: none"> ▪ Presence of bars, liquor stores, pawnshops, etc. ▪ Presence of threatening or loitering individuals, etc. ▪ Presence of graffiti, litter, abandoned buildings, 1st-floor windows, etc.
<p>Comfort</p> <ul style="list-style-type: none"> ▪ Urban design characteristics related to the pedestrian walkway system and street network ▪ Urban design characteristics that affect the relationship between pedestrians and motorized traffic ▪ Urban design amenities 	<ul style="list-style-type: none"> ▪ Width of the street, length of blocks, width of sidewalk, presence of sidewalk buffers, street trees, etc. ▪ Presence of traffic calming features such as roundabouts, medians, curbs, crosswalks, etc. ▪ Street furniture, arcades, canopies, water fountains, etc.
<p>Pleasurability</p> <ul style="list-style-type: none"> ▪ Diversity and complexity ▪ Liveliness (activity level) ▪ Architectural coherence and scale ▪ Aesthetic appeal 	<ul style="list-style-type: none"> ▪ Presence of a varied streetscape, mixed uses, architectural elements, historic or unique architecture, color, etc. ▪ Presence of public space ▪ Presence of other people, street vendors, outdoor dining, etc.

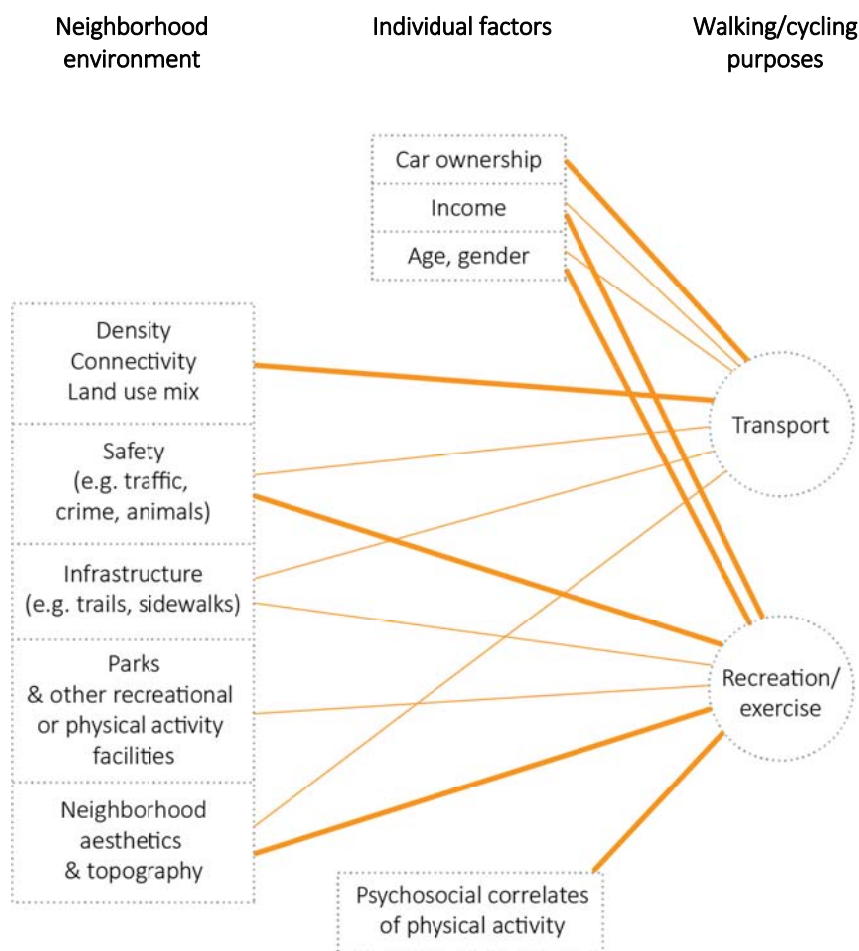
Different purposes of walking differ in nature and therefore as well in which environmental factors influence them

Many studies show that attributes of the built environment may influence the various walking types in different ways and to different degrees (Saelens, Sallis, & Frank, 2003; Humpel, Owen, Iverson, Leslie, & Bauman, 2004). This indicates that different types of walking intend to take place in distinct settings, i.e. walking for transportation intend to take place in one setting and walking for recreation in other kind of a setting. Regarding the difference between the walking types, Pikora and colleagues (2003) claim that there are notably more factors influencing walking for recreation than walking for transportation. They also list the relative importance of environmental factors for walking and classify in terms of importance for recreation or transportation walking. Their study was one of the first, if not the first, in attempting to systematically identify environmental factors related to different walking and cycling purposes. Their main conclusion is that continuity of walking surface was more important for transportation purposes and aesthetics and minimal interaction with traffic was important for recreational purposes (Pikora, Giles-Corti, Bull, Jamrozik, & Donovan, 2003).

Saelens and Handy (2008) summarized built environment factors found to be supportive for transportation walking in particular; these are density, distance to non-residential destinations, and mixed land use. For recreational walking are factors such as well-structured pedestrian infrastructure and aesthetics said to be supportive (Saelens & Handy, 2008). The use of public transport is said to support transportation walking since it often requires walking at one or both ends of a trip (Ewing, Meakins, Bjarnson, & Hilton, 2011). Having a stop for public transport (bus, train, etc.) near home therefore encourage walking.

Owen, et al. (2004) identified in an early review on environmental factors associated with walking: aesthetic nature of the local environment, accessibility of places to walk to (shop, beach), the convenience of facilities for walking (footpaths, trails), and level of traffic on road. All of these factors influence differently walking for particular purpose (Owen, Humpel, Leslie, Bauman, & Sallis, 2004). An early example of ecological model for neighborhood environment influencing walking and cycling was developed and suggested by Saelens and colleges (2003). The framework show how neighborhood attributes influences differently walking/cycling for transportation purposes and recreational purposes (see figure 5).

Figure 4. Ecological model of neighborhood environment influence on walking and cycling (modified from Saelens, Sallis, & Frank, 2003, p. 88). Outstanding lines denote stronger relations; less outstanding denote weaker relations



The environmental factors most strongly associated with walking for transportation are the large scale factors such as density, connectivity and mixture of land use. Car ownership also play a large role in transportation walking to happen, saying that if driving is a more convenient alternative it might substitute walking as a travel mode. For recreational walking the most strongly correlated factors are safety, aesthetics and topography. Aesthetics refer to the attractiveness of the environment and is claimed to have particularly strong link to active recreation (Saelens & Handy, 2008).

In the attempt to bring the different aspects into concise design principles there are some lists existing on attributes that seems to be the most centric of walkable environments. First is a “catch-phrase” frequently used in planning for walkable communities, “*the 5 D’s of development*”. The 5 D’s refer to *density, diversity, design, destination accessibility, and distance to transit*. This concept is discussed for example in an article by Ewing and Cervero (2010) and in the book *Making Healthy Places* (Ewing, Meakins, Bjarnson, & Hilton, 2011). These five factors are predominantly aimed at travel planning and have shown to promote active travel. These are said to be characteristics of healthy communities. The characteristics are further argued to be interconnected and together they support the possibility of walking to many destinations. Interconnection between the factors indicate

The 5 D’s of development

- Density
- Diversity
- Design
- Destination accessibility
- Distance to transit

The 5 C's of good walking networks

- Connected
- Convivial
- Conspicuous
- Comfortable
- Convenient

that a place with diversity but lacking density, or with density but lacking diversity, is likely to have low destination accessibility and therefore be dependent on the private car (Ewing & Cervero, 2010; Ewing, Meakins, Bjarnson, & Hilton, 2011).

In the UK there has been for the last couple of years a great emphasize on sustainable modes of transport, such as walking and cycling. This has particularly been evident in London where walking in particular has been positioned as a crucial part of the city's regeneration strategy. In 2004 Transport for London launched an official walking plan for the city led by the then Mayor, Ken Livingstone, with his vision of making London one of the world's most walking-friendly cities by 2015. In a guide aimed at promoting walkability of the built environment in London is set out a concept called "the 5 Cs" of good walking networks". Those five terms can be used to assess the walking environment (Mayor of London, 2005).

- *Connected*. Walking routes should connect each area with other areas and with key attractors such as public transport stops, schools, work, and leisure destinations. Routes should connect at the local and district level, forming a comprehensive network.
- *Convivial*. Walking routes and public spaces should be pleasant to use, allowing social interaction between people, including other rad users. They should be safe and motivational, with diversity of activity and continuous interest at ground floor level.
- *Conspicuous*. Routes should be clear and readable, if necessary with the help of signposting and way-marking. Street names and property numbers should be comprehensively provided.
- *Comfortable*. Walking should be enjoyed through high quality pavement surfaces, attractive landscape design and architecture, and as much freedom as possible from the noise and harassment arising from proximity to motor traffic. Opportunities for rest and shelter should be provided.
- *Convenient*. Routes should be direct, and designed for the convenience of those on foot, not those in vehicles. This should apply to all users, including those whose mobility is impaired. Road crossing opportunities should be provided, rightly located, and in relation to desired lines (Mayor of London, 2005, p. 21).

These "5 Cs" are only a small part of a more detailed document about how to make London more walkable. Similar things are happening all over the world and cities are finding strategies to make already built environments more walkable. More examples of these are in cities in America and Australia that are strategically aiming at more walkable built environments. In Australia Gehl Architects have been working as counsel to make cities in the country more walkable, with a special focus on city centers. By aiming at more walkable city centers, these cities long for more vibrant and livable environment for the city to thrive (Matan & Newman, 2012).

Natural environments offer qualities that enhance general well-being and might contribute to more walking

Less studied attributes

When comparing activity in different settings it has been claimed that exposure to natural or “green” environments have more positive effects on emotions than other more “synthetic” environments. Various theories have proposed direct benefits of natural elements to human well-being (Bowler, Buyung-Ali, Knight, & Pullin, 2010). The theory by Kaplan and Kaplan (1989), the *attention restoration theory*, states that natural environments are particularly rich in characteristics necessary for restorative experiences. Natural environment have also been shown to reduce chronic stress, facilitating social contacts and cohesion, and enhance a sense of well-being (De Vries, 2010). Natural environments apparently do have a strong relationship with mental health but more an indirect relationship with physical activity and walking. It might be assumed that outdoor spaces offering qualities that enhance general well-being attract people to walk there more often or for longer (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Thompson, 2013).

Cultural and social factors are important when planning for pedestrians

Cultural and social factors influence walking behavior and some factors can be derived from the physical environment. As they can be affected or controlled to some degree by the built environment, it is important for planners and designers to be aware of how these interactions take place in affecting walking. According to Amos Rapoport (Rapoport, 1987) *culture* play a large role in explaining walking behavior in outdoor settings. He emphasizes that the relation of people and environment is a result of a complex interaction between cultural, physical environmental and perceptual variables. This specifically applies the pedestrian use of public spaces and streets. He explains that an activity in a given setting is culturally based in the way that it contains unwritten rules, traditions, habits, and dominant activities and lifestyles that might be appropriate to a particular setting.

“Culture influences how acceptable walking is, who walks, where, when, how and with whom” (Rapoport, 1987, p. 83).

This further supports Rapoport’s theory and also suggestions of others (for example Sundquist, et al., 2011) that a design of a setting for physical activity should be based on cultural norms in that particular place in question. Therefore theories and evidences for that matter often need to be place-specific to be applicable (Rapoport, 1987). The social context of an individual does also play a role in explaining walking behavior. Social factors might support walking as an incidental benefit, such as providing places for social contact within a walking distance, dog ownership, and having others to walk with (Giles-Corti & Donovan, 2003).

ANALYSIS AND REFLECTIVE DISCUSSION

This section is a reflective discussion on the content of previous parts of the project. Fundamental questions were asked in the beginning of the project which answers were searched under the project's progression. To sum up, these questions were kept in mind during this discussion, reflected upon and final conclusions drawn on them. Reflections are made upon which of the existing knowledge, theories and thinking, together with tools and methods on environment-walking correlations, are useful for planners of environments aimed at promoting physical activity. Possible potentials and limitations within the field will be discussed together with future considerations. In the end, a reflection will be made back on the project itself, its process and method.

Built environments influencing walking behavior

The interaction between people and their environment is emerging as a focus in understanding health. A rapid increase has been in research into how built environments influence human behavior, there among physical activity behavior and walking. Still, there seems to be a considerable gap in the knowledge base, firstly about walking in particular as a physical activity behavior and secondly about the interaction between walking and the environment.

One thing is certain; the built environment does have a part in explaining walking behavior. But walking within built environments was found to be more multileveled and complex than expected, being related to the many influencing factors of diverse domains that interact in the process of walking; physical features, social and cultural factors, and personal characteristics. Regarding walking and environment correlations was walking found to occur under constant interactions between the individual's perception and preferences, and environmental factors of various scales and genre. These interactions can differ considerably according to the environmental setting and the individual in question. Consequently, the answer to the question asked in the beginning of the project of how outdoor built environments explain walking activity, turned out to be far from simple. Susan Handy, though she does not refer directly to walking activity, she approaches the answer appropriately and in a way that I agree upon:

"It depends, on the type of physical activity, the aspect of the built environment, and the characteristics of the individual" (Handy, 2005, p. 43).

Walkability studies have extensively pointed out this importance of understanding the built environment correlation of physical activity and walking as an interaction across levels of influences. The complexity of the relationship between walking and the environment has been claimed to be challenging for present and future research, making it difficult to provide reliable studies, along with study tools and measurements (Nelson, Wright, Lowry, & Mutrie, 2008). Until recently walkability studies mainly provided information about large scale environmental factors, such as proximity and accessibility. Those have been found significant in influencing the likelihood of walking to happen and in comparison micro scale factors are insignificant (Alfonzo, 2005; Saelens & Handy, 2008). Macro scale factors generally directly influence walking and can be assessed in cross-sectional studies, which study method have been prevailing within walkability studies. Factors that indirectly affect walking might be more challenging to address since they can be difficult to measure in cross-sectional studies. When looked at more closely, the macro scale factors often seem to either allow or prohibit

walking, such as the factor of availability of destinations or paths being present to walk on. Micro scale factors are not as profoundly correlated with the possibilities in itself of performing walking activity; and therefore in some studies considered to be insignificant. Within this perspective it is interesting to refer to a discussion in a PhD thesis by Choi (2012) saying that it is important to consider the context of researches and the results gained from them. If they are performed where the environment makes it difficult or almost impossible to walk (as is often the case in North-American and Australian contexts), the results show the major environmental factors being significant while other factors on a more detailed level, such as aesthetics and convenience, are insignificant in comparison to the major ones (Choi, 2012). This tells us that it remains challenging to address which factors of the environment play a larger role than others in explaining walking behavior. Often the large scale factors outweigh the micro scale factors.

The complex correlations between walking and built environment, are not either yet fully understood; making it impossible to draw definite conclusions on how walkable environments can be created in the best possible way. It can therefore be said that the complexity of the issue is both generated from the complicated nature of the walking-environment correlations, and also due to the not fully understood subject. Therefore the explorations into the issue turned out to include even greater challenges.

The individual behind the behavior

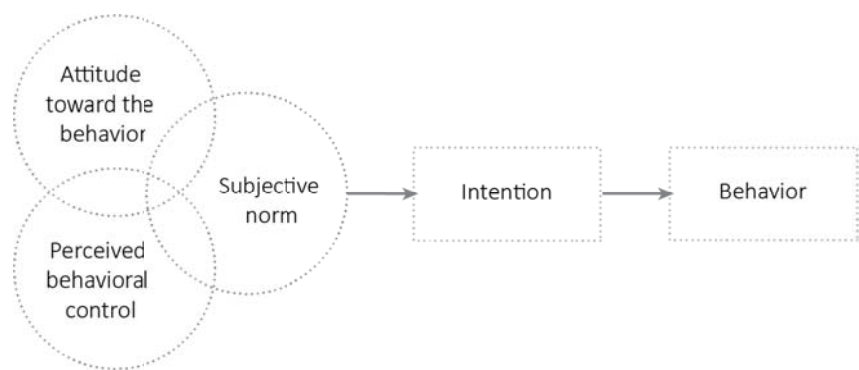
Existing research have frequently focused on measuring the objective factors of the environment, resulting in statements like subjective factors do not matter in the environment-walking relationship. A study carried out in seven European countries (Bamana, Tessier, & Vuillemin, 2008) support the importance of individual perception and the subjective dimension within environmental influences on walking behavior. The study results show that an individual who possess greater personal motivation (self-efficacy), perception of opportunities for physical activity (access to facilities), and positive perception of social support are more likely to reach physical activity recommendations. Even more interesting results show that body mass index (BMI) had no effects on individuals meeting recommendations (Bamana, Tessier, & Vuillemin, 2008).

In fact there are theories that support that behavior is fundamentally derived through individual perception of the environment. Let's say a person's environment is considered suitable for walking but that does not result in one's increased physical activity levels. Icek Ajzen's *theory of planned behavior (TPB)* (2005) could contribute here to the understanding of the links between people's perceptions of the environment and their behavior. The theory presumes that specific behavior or action is controlled by intention. Apparent is that not all intentions result in actions. If one's intention is to go out for a walk, but ends up not doing so, the theory involve a framework of

Theory of planned behavior is a framework for understanding the links between environmental perception and individual behavior

which can be the causing factors making intention not carried out (Ajzen, 2005). Intention is said to be influenced by three basic determinants; personal nature, social influence, and issues of control. Personal nature elaborates more specifically on *attitude towards a behavior*, which is the individual's positive or negative evaluation of performing a behavior. Social influence is the perceived social pressure to perform or not to perform a behavior and is also termed *subjective norm*. And the third factor of control implies the sense of ability to perform a behavior and is also termed *perceived behavioral control* (Ajzen, 2005). If the intention to walk is not carried out, one of these factors might be perceived negatively by the individual at play.

Figure 5.
A theory of planned
behavior (modified from
Ajzen, 2005, p. 118)



This framework has actually been applied extensively to studies and predictions of participation in physical activity (Nelson, Wright, Lowry, & Mutrie, 2008). The framework implies that environmental factors play an important role in influencing people's intentions to be active, but the influences are likely to be indirect. The decision of walking is always made by the individual. This is what the theory of walking needs also implies.

Walking in an everyday life context

Walking is an interesting activity in terms of its complexity. It might be needed to think about walking in outdoor settings as many things and having purposes other than just walking. Or perhaps it might be seen as having more diverse purposes that either for transportation or recreation. Walking can entail many things other than walking contributing to well-being, and many things can also lead to walking for health benefits. Research need to widen the perspective on walking and take into account the complexity of walking itself as a behavior. Like Jan Gehl has emphasized in his writings:

"There is more to walking than walking" (Gehl, 2010, p. 120).

Walking can include being active, having social interaction, reducing stress, restoration, and enjoying interesting elements such as vegetation and water. Then while walking, people can change direction, change speed or switch to

a different kind of activity, start running, sitting or lying down, standing still or dancing. Consequently, thinking about walking as an isolated phenomenon, or only a journey from one place to another, might be limited.

“Walking is a form of transport, but it is also a potential beginning or an occasion for many other activities” (Gehl, 2010, p. 120).

When the walking process is considered with all those things in mind, designing and planning of urban environments might be made differently and perhaps with the user in more focus. Middleton (2011) for example and also other more early theorists, have described walking as an activity being intertwined with people’s everyday routines. The decision to walk needs to be understood not only in relation to motivations and barriers in the built environment but also in relation to people’s *habitual behavior*. That means walking needs to be understood as an integral part of everyday life and its multitude of habits. People might walk a specific route because of a habit and that route might therefore be seen as highly walkable beyond other routes. This has been claimed to be a dimension adding to the complexity of walking activity (Middleton, 2011). In a modern society where people generally have tight schedules and time is limited, it might be noticed that if one could perform daily activities, such as go to the store, walk the dog, get fresh air, enjoy the songs of the birds when the spring is arriving, and pick up the children from school, all in the same walking trip, it might be realized that people might “happen” to walk more and be healthier. Another dimension to this is if you have many necessities close to home, preferably within a walking distance, it might be translated into less everyday stress not having to spend great amount of time getting between places for daily errands. That per se can have added health benefits. This needs to be widely understood by the ones making decisions about the layout of outdoor environments in general. The diversity of walking and interaction between walking and other activities in the outdoor realm needs to be recognized by those who plan activity promoting environments. It seems to be important to consider diverse activity forms when creating environments supportive for physical activity, and how these activities might interact.

A study done by Giles-Corti and Donovan (2003) showed that very few of those who walk only for transportation or only for recreation reach the recommended physical activity levels. This might support the argument that walking needs to be a part of a wider range of physical activity forms to benefit health sufficiently. The relatively new health recommendation of moderate-intense physical activity accumulated throughout the day also emphasizes the importance of creating environments that support diverse forms of physical activity and walking. Walking is relatively convenient and effortless compared to other modes of physical activity, so if the environment supports its performance it will most likely be chosen to a much greater extent. In this relation it is useful to have James J. Gibson’s (1979) concept of *affordances* in mind. The concept offers a framework for thinking

Affordances are the functional properties of the environment that give possibilities for a certain action

about functional properties of the environment. Affordances are the set of environmental properties that give possibilities for a certain action, as well as indicating what action is prohibited or left out. As such, affordances are meaningful to people as they provide opportunity for particular kinds of behavior (Gibson, 1979). One's walking route for example is determined by where it is possible to walk, or even safe and pleasurable. This indicates the importance of environmental design to take into consideration the very needs of the user for the outcome to have the desired function. It is important to have in mind in this context that the same environmental feature affords different action by different people, e.g. a child and an elderly person. Affordances do not necessarily cause an action (Heft, 2010). Heft (2010) further emphasizes the importance of considering the affordances in the environment by stating:

“Concepts such as complexity and coherence as properties of an environment might be useful when assessing a place but that does not tell us anything in terms of functional possibilities and meaningful experiences” (Heft, 2010, p. 24).

The main message of the concept is recognizing that when people move about in outdoor environments it facilitates a constant process of observing its properties, or with other words, perceiving what the environment affords. Environmental perception is fundamentally a process that supports action and exploration (Heft, 2010).

“The behavior of observers depends on their perception of the environment...” (Gibson, 1979, p. 129).

The fundamental conclusion here is again, the built environment give possibilities and supports an action of an individual, but it is essentially the individual himself that is the centric force of the behavior. Ecological models explained earlier can certainly help in conceptualizing the complex relationship between walking and the environment. The models also seem to be specifically useful when approaching the challenge of promoting physical activity among populations, due to its recognition of a behavior being influenced by interacting factors across levels. When the aim is to raise levels of physical activity and improve population health through urban design, are certain aspects that might be suggested to particularly have in mind. These features might be fundamental for the possibility of adaptation and maintenance of active living. One aspect is to provide walkable outdoor environments near people's dwellings, homes or workplaces, where the low threshold of performing walking is kept as low as possible. That involves making walking easily performed and enjoyable and also accessible for majority of people, independent of people's status or abilities. This has furthermore shown to help in reducing the risk of health inequalities and social inequalities within societies. Another aspect is to support integration of walking into daily routines of people. This might include environmental diversity in its various forms, provide destinations and services within

Potential strategies to focus on in environmental design for active living:

- Local environment
- Accessibility
- Support walking in daily routines
- Localize strategies

walking distance, encourage local social interaction, create environments that afford other activities for various subgroups of society, etc. One last suggestion, whether the aim is to study, measure, assess, or create walkable environments, is to localize all strategies. Though an environment might be seen as walkable at one place, the same strategies might not apply to another place within another context. This will be further discussed in the following chapter.

The walkability dialogue brought to a spatial context

As already discussed within this thesis are majority of sources available on walkability and related issues originally from America and Australia, and nowadays increasing in European countries as well. From this it might be assumed that the focus in the field is and has been within economically well-established countries where car-oriented societies and lifestyle related diseases are already an established fact. These facts also seem to be the driving forces for increased interest on more walkable urban environment. The discussion is therefore often shaped by the fact that these negative effects within societies need to be counteracted. But what can be noticed here is the high relevance and importance of bringing this dialogue to the developing world to a greater extend, where countries are seeing changes towards greater car-dependency and poorer health status, probably partly related to changes in the built environment. It might be important to have resources at hand based on the situation in these countries to be able to prevent negative effects of the built environment on people's health and make way for active and healthy living instead.

Walkability is important to discuss in developing countries to make way for active and healthy living

Regarding the European context or even more specifically the Nordic context it is a fact that the built environment and problems regarding lifestyle related diseases do look different from for example America or Australia. There is a limited local research on the environment-walking correlations in European countries and it has been argued not being relevant yet to transfer findings across continents (Holle, et al., 2012). Sundquist and colleagues (2011) argue after performing walkability research in Sweden, that in order to create policies, research evidences along with guidelines and policies need to be based on evidences from that particular place in question. This is claimed because of differences in the built environment between countries as well as social and cultural differences. Some similarities have been found in evidence about factors influencing walking from different continents of the world (for example Europe vs. North America), but more local investigation is clearly needed to get a better picture of the issue (Sundquist, et al., 2011).

It might be assumed that planning for active living is better established in many European countries, Sweden there included, than in many other parts

of the world, for example in America. But the case is perhaps that urban environments in Europe are sometimes built up before the car existed and environment where the pedestrian is in focus is and has been more a norm. There can clear cultural differences be seen where the built environment does not create as high barriers for the chances for people to live active lives and health problems have not either become as extensive in the first place. Nonetheless, contemporary planning practices in Europe often put the car as a first priority and that can be seen in many of the recently built environments, especially in urban outskirts of many European and Swedish cities. Visions in planning for pedestrians are often bold, but when it comes to real construction the elaboration is often missing.

Realizing the fact that planning for pedestrians do not face the same challenges in different countries and in different continents, some questions rise regarding how planning for pedestrians look like in Sweden? Are researches and knowledge sources from different parts of the world relevant in the Swedish context? And most importantly, what is perhaps already known in Sweden and what is new information in the planning field for walking?

Research on planning for active living along with tools for walkability practice can be found within the Swedish context. There is for example a report *The built environment effects on physical activity* (Faskunger, 2007), published by the Public Health Agency of Sweden. The report is published in 2007 and quite a lot has happened since then regarding research and practice, but it is a very good reading nonetheless. The report gives a good overview of the knowledge sources available on how the correlation between built environment and physical activity can be understood and also what needs to be done within this field in Sweden. The report claims that more local research is urgent to be able to work more efficiently towards societies that support physical activity. Another report, also published by the Public Health Agency, is a manual, *Active lifestyle in built environments* (Statens Folkhälsoinstitut, 2010), aimed at planning administrative in Swedish municipalities. It is the first published manual for this purpose in Sweden. It focuses on diverse forms of physical activity and how planning of outdoor environments can contribute to active living and public health. It emphasizes three main concepts that are important when planning for active living: proximity, accessibility and usability. The manual also go into more detail about attributes of the built environment supportive for physical activity and then focuses on how these visions can be carried out in the planning process. In the back of the report are listed some methods and audit tools for assessing physical activity promotive environments. A recently published series of reports called *Transport for an attractive city*¹¹ (Sveriges Kommuner och Landsting & Trafikverket, 2013), attempts to provide a comprehensive

¹¹ Translated by author, original title: "Trafik för en attraktiv stad" (TRAST).

and accessible guidance on how to plan for different transport modes, with a special report on walking. The report on walking has the aim of drawing together practical advice for planning and give overview of the material that exists to support planners and decision makers. In the back of the report is a good list of the published material that can be found about the topic.

A recent and a major study, *Planning and shaping for increased walking – Systematic conditional improvement of outdoor environment for travelling on foot*¹² (Luleå Tekniska Universitet, 2013), funded by the Swedish Transport Administration and running from 2010-2013, is a great contribution to the field of planning for walking within Swedish context. Five reports were published as results of the study, of which lift multiple questions on the various aspects of planning for walking. The strength of this project is that it focuses on walking in particular, instead of physical activity in general. It also makes use of several study methods and approaches in order to capture the various aspects, such as literature review, interview with traffic- and city planners, a workshop for planning professionals, a questionnaire survey and user perspectives gathered by mapping and focus groups, all carried out in Sweden. The project acknowledges the complex nature of walking itself and also the today's situation and challenges in planning for pedestrians. Conclusions are made, and statements support the discussion mentioned earlier that there is often a gap between the knowledge base and planning visions regarding walking on one hand, and how planners then actually shape and develop societies and the built environment on the other hand. Many of the professionals interviewed during the project were employers within municipality administrations dealing with transportation questions and agreed upon that a particular approach or information regarding planning for pedestrians was generally lacking. Other major acknowledgement in the report was the need of taking up the discussion about walkability from the very beginning of the planning process (Luleå Tekniska Universitet, 2013). The report attempts to gather the information gained through these studies and form a guideline (Trafikverket, 2013), which is a great addition to tools for planning practitioners in Sweden.

Some organizations in Sweden are also effective in contributing to the walkability research field; The Swedish University of Agricultural Sciences (SLU), which took part in the Swedish Transport Administration project mentioned above. The organization is also behind another project, *Children on Foot*¹³, focusing on everyday mobility of children in the public realm. That particular study has shown partly other results than have international study results, such as commercial facilities not promoting physical activity among young girls in Sweden but has shown promotive in other parts of the world.

¹² Translated by author, original title: "Planering och utformning för ett ökat gående – Systematisk förbättring av förutsättning i utemiljö för att färdas till fots".

¹³ Original title: "Barn till fots. Stadsmiljö och uthållig vardagsrörlighet".

Cultural difference might explain this variation but it also supports the conclusion that international findings might not be applicable to the Swedish context. Lund University (LTH) has also recently performed a project on urban walking (Lindelöw, Svensson, Sternudd, & Johansson, 2014) where the focus was on understanding environmental perception and the affective experience. It shows that the Swedish practice has a focus on both understanding objective as well as subjective factors of the built environment as influences on walking behavior.

Potentials and limitations within walkability studies and practices

Research and general interest on walkability seems to be growing worldwide but is still at a premature stage. In Sweden and other European countries the history of research and creation of tools for practice seem to span a shorter time than in for example Australia and America. In Sweden the number of studies, reports and guidelines on planning for active living is rapidly increasing and walking as a particular form of physical activity has gained remarkably more interest within planning the last five years or so. The Swedish material on walkability seems to be already quite comprehensive in terms of acknowledging the complex nature of walking, the various forms of walking and the manifold influences on walking activity. A possible limitation regarding much of recently published material is that walking is often predefined as a mode of transport and guidelines on how to plan for walking are marked by that aspect. As international research has approved, it is important to look at different types of walking separately since they are found to be influenced differently by the environment. Consequently, if other forms of walking and activities connected to walking are taken more into account, it might benefit the more comprehensive discussion of walkability. There seems to be still some way to go until we see planning for walking on an equal level as planning for driving. The reason might be that attitudes and knowledge about active living need to be improved.

To be able to work with walkability questions efficiently within planning processes are policies also needed. Policies are important tools for transferring knowledge between research and practice. A gap seems to be between research and practice where evidences on environmental factors supportive for walking are not sufficiently translated into guidelines and policies. Research findings have been translated to some extent into policies, programs and recommendations for practice on creating built environments that support walking and active living. The evidence base needs to continue growing to create reliable policies and further strengthen the tools for practitioners (Bull, Giles-Corti, & Wood, 2010), this applies everywhere, in Sweden and worldwide. Still it seems to be insufficient evidences to say what and how much international findings are applicable in the Nordic context.

It is noticeable that plans and policies and recommendations are often aimed at walking for transportation or down town streets. There seems to be a gap

in the total image on walking in urban environments. Majority of guidelines within the planning field focus on walking as a travel mode (see for example the report Transport for London (Mayor of London, 2005). Walking can have greater and other meaningful purposes than getting between places. As described earlier, walking needs to be seen with all those diverse aspects in mind and these have to be translated into tools for practice. As described earlier the planning field has previously been mostly focusing on walking for travel and the health field focusing on walking for recreation. The fact that planning and health professions are increasingly merging on the issue is promising evolution and has already resulted in more comprehensive approach on how to understand the influences of the environment on walking. For my opinion would research benefit from identifying more precisely the different types of walking and how the built environment influences those types differently. It seems unreliable to talk about walking in general or physical activity in general. The issue seems to be much more complex than that. Knowledge about how human beings act in outdoor environments, their preferences in outdoor spaces and theories in behaviorism need to be transferred to walkability studies to a greater extent. When evidences have been provided for walking types separately the findings can be brought together to inform practice.

It is evident that subjective attributes of the environment is becoming a larger focus within urban planning and design for walking. This can be seen in Sweden for example where the Swedish Transport Administration have recently funded researches aimed at understanding the perception and experiences of the walking environment (Lindelöw, Svensson, Sternudd, & Johansson, 2014). Interestingly, regarding the discussion about professions cooperating, this same study engaged researchers from various fields; architecture, urban design, environmental psychology, transport planning and traffic safety. This step towards greater cooperation and wider perspective on walking as a behavior is a step into the right direction.

Some limitations have been found within the walkability studies and practice field that are worth to mention. Measurements and methods in assessing the environment for walking have for example frequently been argued to have some weaknesses that can bring inaccuracy to study results. For example do few studies take into account the possibility that the walking taking place and measured might substitute other forms of physical activity. The whole picture might not be seen; though walking increases according to measurements it might not be an actual increase in overall physical activity levels (Saelens & Handy, 2008). Adkins and colleagues (2012) have mentioned limitations of previous walkability studies in terms of mainly having a focus on the quantity of walking; measuring walking in frequency or duration (Adkins, Dill, Luhr, & Neal, 2012). This is said not capturing the full aspect of the environment-walking relationship and walkability studies should also include the measure of the quality of walking (Rapoport, 1987). It

might also be noticed that many measured factors included in walkability studies and considered supporting for walking can be generalized and perhaps vague in assessment. For example, it might be considered as a walkability factor to have a bus stop close to one's home. But without further investigations it is impossible to say so, that is if people will frequently walk to take the bus. Other profound factors can play an important role in the walking decision, such as if the route to the stop is accessible, safe and convenient, or if the bus comes frequently. A bus stop where the bus comes every 10 minutes compared to where the bus comes once an hour, is quite different. Walkability factors need to be investigated within the particular context in question.

Some terms widely known and used within walkability research have frequently been said to bring inaccuracy to study results. One is *Self-selection*, a common term said to bring inaccuracy to study results. The term can be explained as an individual who prefer to walk in his or hers living environment, chose to live in a walkable neighborhood. That person might be relatively healthy and active without any connection to the surrounding environment. Another term is *Cross-sectional methods* that have widely been used in studies on the relationship between the built environment and walking. Those have been argued to have limitations and bringing a potential validity weakness to study outcomes. This means that observations carried out in many studies have sampled a population group at the same point in time (Handy, 2005). *Causal relationship studies* are considered more useful methods where behavior is investigated before and after a change in the built environment or before and after a person move from one environment to another (Handy, 2005). It has been discussed that causality studies are costly, complex and time consuming. Some argue that before studies have been carried out with such methods, it is not possible to say with certainty that changes in the environment will increase walking levels (Saelens & Handy, 2008).

Theories and thinking from different disciplines on people and environment are undeniably of great relevance to planners and designers of walkable environments. The theories referred to throughout this project, draw together thinking from different professions, such as behavioral, cognitive, health, ecological, and environmental and environmental psychological sciences. The theoretical ground has in fact frequently been argued to be an underestimated segment in the efforts of understanding the correlations of built environment and physical activity (Nelson, Wright, Lowry, & Mutrie, 2008; Handy, 2005). But the theoretical recognition is increasing among researchers and alike. According to Amos Rapoport (1987), in order for landscape design to be valid it has to be based on theory. In return, a valid theory must be based on the broadest evidence available about environment-behavior interaction. Theories provide a particular framework that helps knowing what implications to draw from research result (Handy,

2005). The increased attention made to theories from different professions might hold hands with the fact that planners, researchers and others alike are widely realizing the complexity of the issue. Together this might also be a part of the reason that research on walkability has rapidly increased; tempting to figure out how walking is really conducted within outdoor environments. I agree with those (see for example Handy, 2005 and Nelson, Wright, Lowry, & Mutrie, 2008) saying that the theoretical ground is an undervalued resource when understanding walking behavior within built environments. Theoretical backdrop is rarely referred to in the literature related to the topic, but has noticeably increased in the last couple of years. Other theories that are not mentioned in this project but might be useful in this context are *person-environment fit theory* and *social-cognitive theory*.

As mentioned before, many characteristics typical for car-oriented environments do not harmonize with environmental qualities for pedestrians, such as large scale structures, great distances between places, safety, noise, etc. The prioritization of the car and its accessibility is strongly integrated into both professionals and the public. The human being is a pedestrian and will continue to be, with needs as such. Planners and designers need to plan outdoor spaces with people itself in more focus. Planners do also need to work towards a better balance between the different travelling modes within urban design. This needs to be balanced and integrated without diminishing the environmental quality for people itself. What would the environment look like if the pedestrian was always prioritized first in planning? If the pedestrian would be the one to be first provided with safe, smooth, convenient, and direct routes between places?

There are potential barriers in relation to creation of walkable environments, such as lack of political will, lack of awareness of the benefits of walkable environments, tradition for other planning strategies that does not support the pedestrian aspect. It is evident that attempting to change focus and priorities in planning and within already built environments can be challenging. People, both professionals and non-professionals, are realizing and appreciating the benefits of walkable environments to a greater extent, but more needs to be done. When designing environments for walking it might be suggested that the function of the space along with the needs of the user is carefully considered in the design process.

Reflections on the project

Exploring the subject has been an educating and rewarding process but at the same time confusing and frustrating. I have come to realize how manifold human behavior, such as walking, can be. Studying this at the point of time where the research area is at a premature stage and evidences on the environment-walking correlation are not fully formulated or translated has been challenging on its own. It is understandable for such a complex

phenomenon that many incomparable methods and measures have been used to examine the correlations. It will probably take considerably longer time and more effort until we see solid evidences and conclusions about what matters when creating more walkable environments.

The exploration has taught me something beyond the importance of being able to walk outside and how designers can create such settings. Having access to quality public space is the wider context of having available walkable environments. But it's evident that many different factors hold hands in making successful places for people. Many urban planning principles and strategies related to walkability, support healthy living of people in many other ways; whether walking or not walking. Living and moving in an environment that fulfill at least our basic needs as human beings, being able to walk outside, get the service we need in a relatively short time, enjoying nature and fresh air with low effort, should be a basic human right in modern times. Enhancing people's quality of life concerns the opportunity for everyone to live in a functioning, healthy community that supports healthy choices of individuals.

Method, material and process

The methodology chosen in the project brought about both advantages and disadvantages. The subject was scanned on a broad level; which has given a profound knowledge base and opportunity to reflect upon the topic in a comprehensive way. Consequently, as this is a very extensive subject, only a small part of available material could be fitted within the frame of this project. Furthermore it has only been possible to investigate each aspect to a limited level of detail. Personally I think this just reflects the nature of landscape architecture as a profession; being able to scan the wide spectrum of information and attempt to bring the different aspects together into a totality.

It might be noticed that this project is performed within landscape architecture and there is a considerable lack of background and knowledge in other professional fields that are in fact touched upon in this project, such as social or behavioral sciences. That means that the author is trying to connect fields that has taken time to figure out what is meant with concepts and connections. But these fields of professions are in many ways interconnected and this actually emphasizes the interdisciplinary nature of landscape architecture. Perhaps the future will include not only close cooperation between developers, architects and planners, but also social and behavioral scientists, health professionals, economists and others in order to create truly sustainable environments. This project is thought to be an ideal starting point for further explorations into this interesting and challenging subject.

As described, the information and writings available on the topic of the project is extensive. Myriad of sources are available seeking to build a

knowledge base on how to create environments supporting physical activity and walking. Multiple review articles have been published in order to scan research results on the issue and additionally many guidelines and writings with the aim of informing practitioners and researchers about how walking may be encouraged through urban design. Some of the guidelines available are notably based on research results but others perhaps more on a feeling or informal observations. Comparing and identifying which guidelines and writings are evidence-based and which are not can be problematic. It can also be difficult to figure out to what environmental scale these guidelines are applicable. For example are some guidelines aimed at down town streets, such as shopping streets, that clearly have different context and potentials than other streets in the urban fabric.

The wide scope of the project brought an overwhelming amount of material; leading up to time consuming process of identifying the core literature to include in the study. The focus was to look at material such as review articles and published books and it might have brought some weaknesses to the project. Instead of studying directly research results, the information was gained by looking at how others (authors of review articles and books) have represented the various research results and translated them into words. This might bring about some aspects being left out or misinterpreted. The different writings, articles and guidelines were also hard to evaluate and compare in terms of quality and reliability; on what information these writings were based, under what circumstances and with what methods and measures the primary sources were produced. This would have been an extensive task in itself and could for sure be a topic for a whole another project.

Future considerations

A rapid progress has been into the understanding of the correlations between built environments and walking during recent years. More research is clearly needed on these correlations in order to understand how active lifestyles among populations can be encouraged. Research findings also need to be translated to greater extent into policies and recommendations for the practice of planning and design. It will be interesting to follow how the state of knowledge within the field will evolve in the nearest future. Furthermore it will be interesting to see if tools and methods for practice will merge and become more reliable and comprehensive, and additionally if these will include more diverse aspects on the issue. Most of all it will be interesting if the general public will come to realize and appreciate to greater extent the benefits of walkable living environments. In the coming years walkable neighborhoods will probably become more a desirable attribute of living environments. It concerns overall quality of life, physical and mental health and the importance of it should be realized more widely within societies.

Additionally it could be recognized within various professions, but particularly those who are responsible for designing the built environment.

Except for being a greatly interesting topic it is also a relatively young and growing research field with many possibilities. Creating highly walkable living environment has been recognized as a priority strategy towards better health on a population level. Multiple ideas have ignited during the process of this project on how to continue the work. It would for example be interesting to deepen the understanding of the issue to investigate further the methods available for assessing environments for walking. Also assess into more detail the different methods used within urban planning and look at how those responsible for planning and designing neighborhoods approach walkability issues in practice and design processes. How important they see walkability within planning and what knowledge they possess as professionals. Also what methods and strategies they might use regarding physical activity and walking in living environments. Further it would be interesting to investigate a master plan regarding walkability and environment supporting healthy behavior of the inhabitants. Furthermore it would be interesting to look closer at examples where increased walking has been a success and what strategies were used.

The possibilities are probably endless of how to go on from this point of departure. Study other groups of society in relation to walkability would also be interesting, elderly, children, teenagers, socially and economically disadvantaged groups, etc. As walkable environments are also found to possess characteristics that are integral to other urban qualities contributing to healthy societies, it would be interesting to explore those connections. Regarding methods within research on how the environment influences the pedestrian, a technique which is relatively new and on the rise, might be suggested to be useful. It has not been tested within this field, not that I am aware of, but has already been applied within some fields of environmental psychology. A technique of virtual reality where a three dimensional (3D) outdoor setting is created and an individual placed within it. A known variable is tested by adding or changing it within the setting and the person's reactions and experience is measured. It might be useful up to some degree in the effort of understanding the influences of environmental factors on walking behavior.

CONCLUSION

After the explorations during this thesis I am more convinced than before that walkable urban environments are an integral component of sustainable and thriving communities. Placing the pedestrian in primary focus in planning and design of outdoor spaces can without a doubt bring profound benefits to both individuals and society. Understanding the correlations between built environment attributes and walking behavior is a complicated task due to its complexity. The correlations are said to be constant interplay between the different properties of the environment, individual attitudes and habits, social and cultural norms, and conscious and unconscious decisions. The process of walking differs therefore between individuals, environmental settings and the purpose of walking. Studying and understanding those correlations is found to be challenging, but nevertheless essential to be successful in design and planning for walking.

Planners, researchers and others involved are acknowledging the complexity of the issue and already merging on the attempt to comprehensively understand how walking is conducted within built environments. Existing evidences are still insufficient on the issue as research is at a relatively early stage. Definite conclusions on how to create walkable environments in the best possible way cannot be drawn at this stage. But walkability research is growing rapidly, now especially in European countries, and findings up to date are promising in explaining environment-walking relationships. This progression can be seen by the increased amount of studies, guidelines and policies aimed at those who are involved in the design of outdoor spaces.

Though evidences are not fully formulated on how to create walkable environments, there is a lot already known. When planners are to create activity promoting environments and ensure that people adapt to more walking in their everyday lives, the built environment can have a crucial role for making that possible. The large scale factors that have been found to be most strongly correlated with walking, such as connectivity of routes and proximity to destinations, are essential for people's possibilities of walking in urban environments. Other attributes that are more abstract in nature and often operate at the small scale of urban environment, has to be better understood because they are probably no less important. These micro scale factors often have more indirect effects on walking since the perceptions and preferences of the individual play a centric role in how the behavior is conducted. These might therefore be harder to assess.

The built environment does not alone adequate when raising levels of physical activity. Improvements in the environment alone do not necessarily result in people taking up more walking. Multileveled interventions seem to

be needed from the individual level up to the environmental and policy level to result in changes in behavior. This emphasizes the need of a greater interdisciplinary approach within the walkability field and further cooperation on building a conceptual and theoretical ground to base walkability studies on.

It seems clear that if people get outdoors in general they are more likely to engage in physical activity, weather walking or engaging in other activities, than if they stay indoors. For this reason it might be obvious that providing people with readily accessible local environments, that are free from as many barriers as possible, attractive and safe, might for sure get people to be more active. Aiming at raising levels of recreational walking does have a great potential in this relation and aesthetics seem to play a key role in fostering that kind of physical activity. The built environment can be created to support healthy lifestyles of individuals and communities which in turn can have a greater potential of being sustainable for future generations to come.

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