Shifting Gears

Lessons from Copenhagen to Encourage Bicycling in the US

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***with* Ashle Fauvre**

A Publication of the UW Green Futures Lab

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Cover Image by Kasey Klimes

Produced October, 2013

Foreword

The benefits, utility, and joys of traveling by bicycle are countless, and the relative costs affordable. Yet it has been challenging for US cities to develop the kinds of infrastructural facilities that would make cycling available and attractive to large portions of their populations. Copenhagen, Denmark provides an inspiring example of municipal commitment to cycling as the primary mode of travel, with its carefully designed and ever-expanding facilities rendering it a metropolis where everyday cycling has become integral to the city's shared active culture, social vibrancy, and overall happiness.

The UW Green Futures Lab (GFL), in collaboration with Gehl Architects (GA) and supported by the ScanlDesign Foundation, is pleased to present this paper and its linked videos that were developed by Peter Cromwell and Ashle Fauvre as part of their Internship with the GFL and GA. We hope that the lessons learned through Peter's and Ashle's study in both Seattle and Copenhagen, and the pair's creativity in presenting those ideas in the illustrated paper and videos, will help propel cities to provide the infrastructure and programs that invite people of all ages and abilities to use bicycles to travel efficiently and economically, for environmental and personal health, and for pure pleasure.

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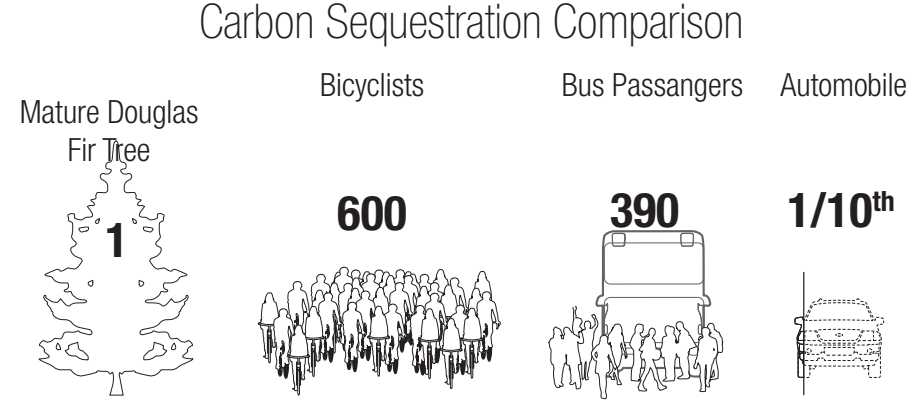
Introduction

Many American cities are challenged with transportation problems. Understandably, city planners are looking for ways to encourage commuters to make a modal shift away from single occupancy automobile trips. One alternative mode of transportation that has been getting increasing attention is bicycling. New York City, Seattle, San Francisco, Portland (OR), and Washington DC are but a few examples of the many US cities looking to establish bicycling as a primary mode of transportation. Modal shift to bicycling has many benefits in addition to reducing automobile congestion. Some of the more recognized benefits are to the environment, health, the economy, and equity. Consider the following statistics:

The Environment

- It was shown in a report developed by the European Cyclists' Federation[1] that when the complete life cycle of the following modes are taken into account, the carbon emissions are approximately:
    - o Bicycle, 21 g CO2/passenger/km traveled
    - o Bus, 101 CO2/passenger/km traveled
    - o Passenger car, 271 g CO2/passenger/km traveled
- According to the Safe Routes to School Partnership[2], half of U.S. schoolchildren are dropped off at school in the family car. If 20% of those living within two miles of school were to bike or walk instead, it would save 4.3 million miles of driving per day. Over a year, that saved by not driving would prevent 356,000 tons of CO2 and 21,500 tons of other pollutants from being emitted.



To help put the CO_2 numbers of each mode of transport into perspective, consider the above comparison. In the United States, one Douglas Fir tree can sequester enough carbon each year to offset approximately 600 bicyclists, 390 bus riders, and 1/10th of one automobile.

Bicycling offers many **environmental, health**, and **economic** benefits as well as creating **equity** between a city's diverse population.

Health

• A study[3] of nearly 2,400 adults found that those who biked to work were fitter, leaner, less likely to be obese, and had better triglyceride levels, blood pressure, and insulin levels than those who didn't use active transportation to commute to work.

• A recent CDC study[4] found that community-based physical activity interventions, such as new bike paths and trails, are "money well spent", meaning they are more cost-effective than traditional preventive strategies in reducing new cases of many chronic diseases and improving quality of life. This study suggests that interventions such as enhanced access to bike paths can reduce new cases of disease by:

- 5-15 cases per 100,000 people for colon cancer
- 15-58 cases per 100,000 for breast cancer
- 59-207 cases per 100,000 for type 2 diabetes
- 140-476 cases per 100,000 for heart disease

The Economy

• By 2017[5], Portland, Oregon residents will have saved $64 million in health care costs thanks to bicycling. By 2040, the city will have invested $138-605 million in bicycling yet saved $388-594 million in health care costs and $143-218 million in fuel costs, a benefit-cost ratio of up to 4-to-1.

• A Dutch study[6] found that cyclists spend less per visit than motorists at supermarkets, but they visit more often. As a result, cyclists account for at least as much spending as people arriving by car.

• When San Francisco made its Valencia Street less conducive to automobile travel and better for bicyclists and pedestrians, nearly 40% of merchants reported increased sales and 60% reported more area residents shopping locally due to reduced travel time and convenience. Two-thirds of merchants said the increased levels of bicycling and walking improved business[7].

Equity

- Children from low-income and minority households, particularly African Americans and Hispanics, are more likely to bike or walk to school than Caucasian or higher-income students[8].

- While estimates vary, one study[9] puts the cost of owning a bicycle at approximately $350/year to own while the 2013 Census[10] estimates that the average vehicle expenditures each year is $7,778/year. This means owning a bicycle cost roughly 4% as much per year as a car.

These statistics and reports offer a broad foundation of support for bicycling, not only as an alternative mode of transportation to automobiles, but also as an active mode of transportation that offers many benefits to the rider and the city.

Where bicycling has become deeply ingrained in the culture, bicycles have evolved to meet most transportation needs. Likewise, bicycle facilties and networks have been developed to meet the needs of a growing and diverse bicyclist population. Photo: Nancy Rottle

Lessons from Copenhagen

In the following sections Washington State and Seattle will be used as examples and points of comparison. However, the topics discussed herein are applicable to any US city looking to develop bicycling ridership and facilities.

Washington State is routinely rated as one of the top five bicycle friendly states[11] in the United States, with Seattle ranked as one of the top bicycle cities in the country[12]. Yet at 3.6% of the mode split[13], bicyclists in Seattle continue to represent a low percentage of the overall mode share. While there are some positive trends in Seattle, there is much room for improvement. Routinely amongst the top ranked bicycle cities in the world[14], Copenhagen, Denmark has many lessons for cities like Seattle that are looking to develop their bicycle facilities and network. A closer look at Copenhagen's bicycle facilities, network and cultural paradigms surrounding bicycling will reveal many useful strategies to encourage modal shift.

Copenhagen has spent decades developing and installing bicycle facilities to create comprehensive networks. While no city is exactly the same there are still lessons that can be learned and applied, adapting them to differing urban contexts. For example, Italy has long been studied by designers to understand how rich urban pedestrian experiences can be emulated (see Jacobs 1993, Crowhurst Lennard 1995, and Gehl 2011). In his 2011 TEDxCarlton talk[15], urbanist Gil Penalosa notes how Copenhageners argued

A closer look at Copenhagen's bicycle **facilities**, **network** and **cultural paradigms** surrounding bicycling will reveal many useful strategies to encourage modal shift.

What lessons can American cities like **Seattle** (left) learn from world class bicycle cities like **Copenhagen** (right) to encourage modal shift toward bicycling? Photo: Kasey Klimes

that their city could never have good pedestrian streets: “We don’t want pedestrian streets. The weather is terrible [in Copenhagen]; it’s cold in the winter and hot in the summer and then it rains all year. [But mostly, being]… pedestrians, is not part of our culture. Pedestrians, that’s for the Italians.” However, in the past fifty years Copenhagen has constructed streets and public spaces that facilitate amazing pedestrian culture (Gehl and Gemzoe 2004). From this it can be said that while many cities do not have similar conditions to Copenhagen, or what are seen as traditionally desirable conditions for bicycling, this does not mean they cannot create healthy and vibrant bicycle cultures like Copenhagen. The best way to do this is to learn what qualities make a great bicycle city and apply them to one’s own context. Therefore, the following 5 lessons are derived from several months studying bicycling in Copenhagen.

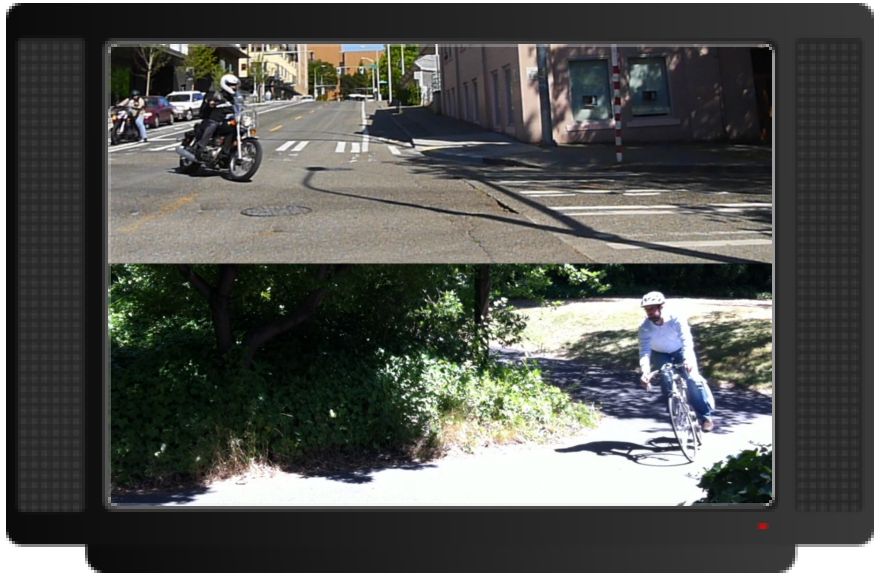
Lesson 1: Foremost, bicycle facilities must be safe and efficient

There are many different types of bicycle facilities and not all of them are equal. Several factors contribute to quality bicycle infrastructure. Probably the two most important characteristics are safety and efficiency, in that order. These are conditions for which cities often need the most help in developing their facilities, and Copenhagen’s bicycle facilities excel. It is important to understand safety and efficiency in relationship to bicycling before exploring how they manifest in bicycle facility design.

It is difficult to establish a metric to measure how safe a bicycle route actually is, as it is significantly dependent on a rider’s confidence and skill level. While actual safety is important, perceived safety is a measurable metric. Perceived safety – whether a person feels safe – can be measured through questionnaires. In preparation for updating the Seattle Bicycle Master Plan polling was conducted to hear Seattle residents’ greatest concerns about bicycling in Seattle. The overwhelming concern was safety[16]. This issue is not isolated to Seattle. Rodger Geller, lead bicycle coordinator for the Portland Office of Transportation, has proposed a categorization of bicyclists based upon perceived safety, positing that any given population can be categorized by their likeliness to ride based upon concerns for safety. In a paper titled *Four Types of Cyclists*[17] Geller splits bicyclists into 4 groups:

In Copenhagen, **76%** of residents say they feel safe while bicycling. In Contrast, “Safety Concerns” was the **#1 barrier** for Seattle residents who were interested in riding a bicycle but concerned.

56% of Copenhagen residents report they bicycle because it is the fastest mode of transportation. While **37%** say it is the most convenient mode of transportation in the city.



Please *click on the above image* to watch the film, **The Race**, a dramatization illustrating the misconception that motor vehicles are more efficient than bicycles. *http://www.youtube.com/watch?v=tQzGNAvSfOM*

Strong and Fearless	<1%
Enthusiastic and Confident	7%
Interested but Concerned	60%
No Way, No How	33%

Geller's numbers illustrate that a large section of the population (60%) will bicycle only if they perceive cycling facilities as safe. Thus, perceived safety is an important issue when talking about bicycle facilities, not only because it is concerned with the actual safety of bicyclists, but because it represents the willingness of large portions of the population to get on a bicycle. In contrast, according to Copenhagen's 2012 Bicycle Account[18], most people in Copenhagen report that they feel safe when bicycling: 76% have a sense of safety while bicycling, 19% feel partially safe, and only 5% feel decidedly unsafe. As will be shown, the divergent responses from residents in Seattle and Copenhagen have a large part to do with the bicycle facilities used in each city.

Efficiency is another vital component of bicycle facilities. Again, according to Copenhagen's 2012 Bicycle Account, the top two reasons people said they bicycle is:

1) 56% because it is faster [than other modes of transportation]

2) 37% because it is the most convenient mode of transportation

Both of these motivators are concerned with efficiency. There is common misconception in automobile oriented cultures that, since cars are much faster than any other mode of transit, they must also always be more efficient. Contrary to this opinion it has been shown that in cities bicycling is often just as efficient or more efficient than automobiles. Harris and Dines (1998, p.341-3) note that for most types of urban trips up to 5 miles, the bicycle and motor vehicle require about the same amount of travel time. Similarly, the automotive show, Top Gear conducted a race[19] to see whether a car, bicycle, public transport, or speedboat would have the shortest travel time across London to the Heathrow Airport. The bicycle wins, followed by the speedboat, then public transport, with the car getting dead last. (**Please see The Race, a companion film to this paper dramatizing the misconception that automobiles are more efficient than bicycles.**) This demonstrates that, while cars can travel faster than bicycles, they are

not necessarily a more efficient mode of transportation. Between traffic congestion, stop lights, construction, the need to find parking, and any other miscellaneous unforeseen hindrance, driving often takes longer than bicycling. Thus, the survey from Copenhagen corroborates that with quality bicycle infrastructure, bicycling can become the most efficient mode of transportation in a city.

Copenhagen has installed a variety of bicycle facilities that are both safe and efficient. Perhaps the most effective are *cycle tracks*. These facilities provide space for bicycling like a bicycle lane, but are often a few feet wider. What makes them unique is that they are raised several inches above the road surface, though slightly below pedestrian facilities. This provides a visual differentiation and physical barrier between automotive, bicycle, and pedestrian facilities. The physical differentiation in height goes a long way towards increasing the actual safety as well as perception of safety for bicyclists and pedestrians. The space provided for bicycle-specific travel means these routes are fast and convenient.

Like bicycle lanes, cycle tracks are located between the road and sidewalk; unlike bicycle lanes, they are placed between parked cars and the sidewalk. This system is known as "Copenhagen-style bicycle lanes" (Gehl 2010, 190). The organization of the street with these facilities uses the parked vehicles to protect bicyclists from moving vehicles, increasing safety. While Copenhagen also has busy automobile streets, cycle tracks allow bicyclists to ride safely, as well as unhindered by congestion.

Another form of bicycle facility gaining popularity in Copenhagen is the *bicycle highway*. Similar to the multi-use trails that exist in the United States, bicycle highways are lanes completely separated from the roadway, often running through parks and green corridors. Though they vary in width, they are generally between ten and twenty feet wide – wider than other bicycle facilities as the trail must account for contra-flow traffic. The routes for these facilities are chosen so there is seldom cross-traffic, meaning few regulatory interventions (such as stop signs or traffic lights) are necessary. This allows for relatively uninterrupted travel while on the trail. Yet, in the city, crossing traffic is inevitable. For this reason, automotive traffic signals on these routes are timed to the speed of bicyclists. Thus, if bicyclists travel at an average speed they will be able to continually hit green lights. The isolated and protected nature of these facilities makes them particularly safe while the timing of the traffic lights provide efficiency.

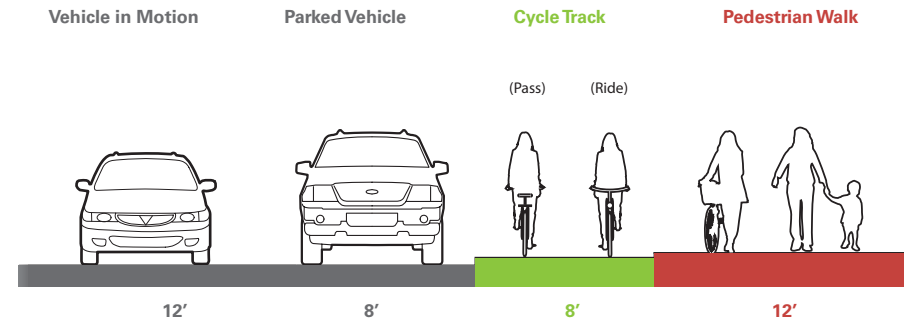


Diagram of a 'Copenhagen Style' cycle-track.

An example of Copenhagen's *bicycle highways.*

A *Bike Box* gives bicyclists a place to wait at the light while providing protectection from right turning vehicles. In Copenhagen bike boxes are often combined with bicycle lights that change several seconds before the vehicle light allowing them to move from in front of cars.

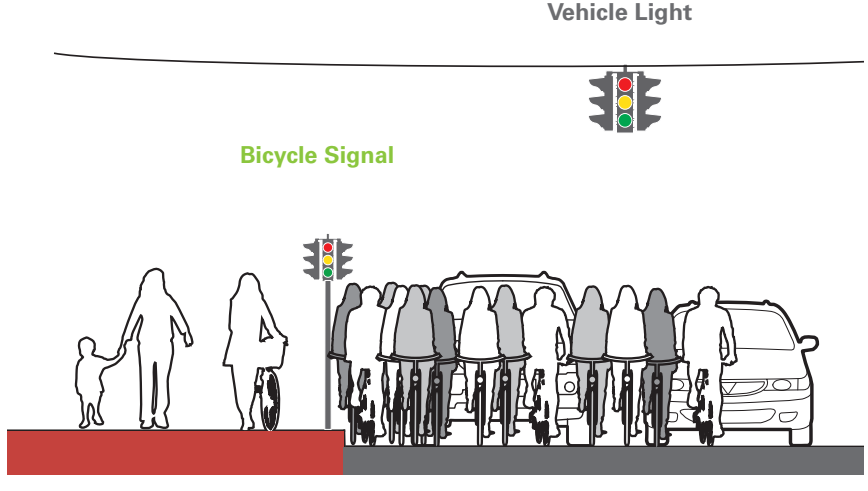


Diagram of an intersection with a *bicycle signal*.

In addition to bicycle facilities for movement are those designed for when bicyclists are at rest. This can occur at traffic intersections when bicyclists are waiting for a traffic signal to change. *Bicycle boxes* are a facility common in Copenhagen and gaining acceptance in the United States. As the name implies, this is a large colored box painted onto the ground plane at intersections. It is placed in front of vehicular lanes but behind the cross walk. Bicycle boxes give priority to bicyclists over automobiles as they wait for the light. They do this by allowing bicyclists to be the first to go when the light changes, as well as provide a place for left turning bicyclists to wait out of the way of traffic. Last, they prevent right-turning automobiles from turning through bicyclists.

While bicycle boxes are beginning to be installed in the United States and are gaining acceptance, they have not been embraced as much as in Copenhagen. To give context to this issue it should be understood that making a left turn from the automobile travel lane while on a bicycle is illegal in Copenhagen, while standard in the United States. The correct procedure in Copenhagen is to cross the street staying to the right and wait for the light to change before proceeding in the direction of the left turn. The result is that left turning bicyclists in Copenhagen end up stacking across the top of the bicycle box while waiting. Since this is not an issue in the US, few bicyclists use the width of the bicycle box. And, who can blame them? Moving in front of vehicles for a few seconds while waiting for the light can be perceived as unsafe (will the cars see me when the light turns green?) and/or rude to automobilists (I am making them wait while I move out of their way). For these reasons, most of the space in bicycle boxes are often under-utilized in the United States.

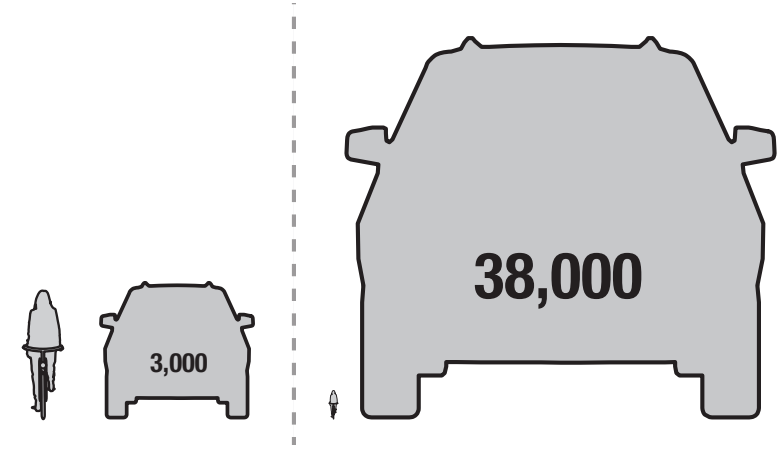
Bicycle boxes are used to great success in Copenhagen because they are combined with another facility, the *bicycle signal*. Like automobile traffic signals, bicycle signals change to let bicyclists know when to move through the intersection. These signals change for bicyclists six seconds before the automobile traffic signal, allowing bicyclists to safely move through the intersection and out of the way of automobiles. With the combination of these two facilities bicyclists can use the whole box without feeling as though they are being rude to automobiles or endangering themselves. Now, the use of the whole bicycle box can increase efficiency by prioritizing the bicyclist; a bicyclist can ‘cut to the head of the line’ without hindering, or being hindered by, automotive traffic. As well, the space provided by the box allows for a place of organization between bicyclists. Faster bicyclists

in Copenhagen will move out into the box and 'sprint' past slower bicyclists when the light changes, knowing they have six seconds to get back in their lane. These places of organization can greatly increase efficiency, while also providing safety to bicyclists as they wait for the light.

As the examples from Seattle and Copenhagen have shown, safety and efficiency are essential qualities of bicycle facilities. Geller's work has shown that safety is an important prerequisite for a person getting on a bicycle, while Copenhageners have expressed that efficiency and ease of transport are the two characteristics they value most about their facilities. If these characteristics do not emerge people will not bicycle. To demonstrate this, consider the following example:

According to the 2012 City of Seattle Department of Transportation data[20], NE 45th street is the busiest street in Seattle with an average weekday seeing 38,000 vehicles. The route is busy because it offers a critical entrance to the interstate highway. However, it is also a vital connecting corridor for bicyclists trying to cross the interstate. To accommodate traffic there are 5 lanes; two in each direction and a center turn lane each only 10 feet wide.

It is hard to imagine anyone bicycling on 45th Avenue given the high automobile flows and narrow lanes. However, because this is an important connector route for bicyclists there are sharrows – a type of low cost, low effort bicycle facility. As a result, there are some who bicycle this route. Perhaps these bicyclists are aided in some small way by the sheer number of vehicles on 45th; there are so many automobiles that a 'grid-lock' condition occurs. Bicyclists were observed to use three different techniques to deal with these conditions: 1) since the lanes are narrow, and there is not enough room to ride between the automobiles and curb, bicyclists will ride between the two stopped lanes of traffic. 2) Bicyclists using the sharrow will take up space in a lane like an automobile, moving and stopping with the flow of traffic. 3) Bicyclists will ride on the sidewalk to avoid these conditions, causing conflicts with pedestrians. Despite the best efforts of bicyclists, none of the observed adaptations are safe or efficient. As a result, few bicyclists go on this street despite its importance as a connecting route. In a similar fashion, if bicycle facilities at large do not offer safety and efficiency then fewer people will choose to bicycle.



The *Velo Quebec* guide to bicycle facility design recommends a maximum of **3,000** vehicles per day on streets with sharrows, creating a balance between vehicles and bicyclists (left). However, some streets in Seattle have as many as **38,000** vehicles per hour, which creates a disproportion between vehicles and bicyclists (right), making bicyclists feel unsafe.

Seattle's NE 45th Avenue during 'grid-lock' conditions. Note the 'sharrow' circled in red.

The city of Copenhagen has
x10 as many bicycle facilities
per square mile,
and **x13.5** greater bicycle
mode share than Seattle.

A map showing Copenhagen's comprehensive primary and secondary bicycling network. The forethought for how to lay this network out has created a high level of bicycle facility connectivity throughout the city. Image: *City of Copenhagen*

Lesson 2: A comprehensive network of connected facilities encourages more people to ride

There is a reason Copenhagen residents report that bicycling is the easiest and most efficient mode of transportation: the city has constructed a comprehensive network of connected safe and efficient facilities. As a result, Copenhagen has one of the highest bicycle mode shares in the world. To better understand Copenhagen's bicycle facilities network consider the comparison to Seattle's bicycle facilities network.

According to the Cascade Bicycle Club Seattle's bicycle mode share is at 3.6%. According to the 2012 US census[21], the city of Seattle covers 83.94 miles^2. The complete designed network of bicycle facilities covers 211.3 miles (2012, 9). Yet, almost 40% of these facilities (81.5 miles) are sharrows. As well, Seattle's network is 33% dedicated bicycle lanes (73 miles), 22% multi-use trails (47.2 miles), and 0% cycle tracks (while some cycle tracks are starting to appear in Seattle over the last year they are few enough to be statistically insignificant). While the city has more than doubled the number of bicycle lanes since 2007, the high number of sharrows is alarming. As was shown in the previous section, sharrows are a form of bicycle facility that provide a low perception of safety and are no more efficient than unmarked roads. If we subtract out these facilities, the city of Seattle has overall 129.8 miles of facilities, or just over 1.5 miles of bicycle facility per square mile.

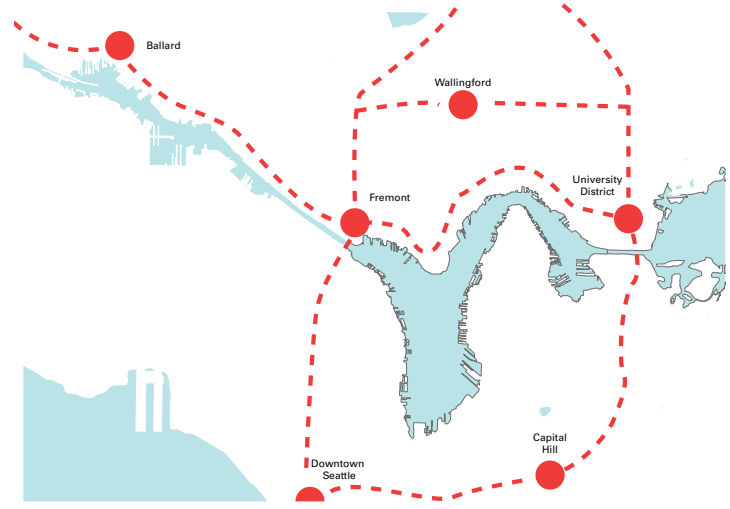
In Copenhagen bicycling has a mode share of 50% (Copenhagen City of Bicycles Bicycle Account 2010, 7), 1350% more than Seattle. According to Statbank Denmark[22], the city of Copenhagen covers 29.8 miles^2. As of June 2012, the city had constructed over 285 miles of bicycle facilities[23]. There are approximately 223 miles (78%) of cycle tracks, 27 miles (9%) of multi-use trails, 20 miles (7%) of bicycle super highways, and 15 miles (5%) of bicycle lanes. This means that Copenhagen has approximately 10 miles of bicycle facilities per square mile.

The first conclusion from these numbers is that Copenhagen not only has a significantly larger network throughout the city, but the bicycle facilities are of a much higher quality. Seattle's highest quality facility (dedicated bicycle lanes) accounts for 33% of the network, while Copenhagen's highest quality facility (cycle tracks) accounts for 78% of the network. The quality of the bicycle facilities network is reflected in Copenhagen's higher bicycle mode share. It is not surprising to find that Copenhagen has 10 times as

many miles of bicycle facility than Seattle per square mile, and a 13.5 times greater bicycle mode share than Seattle. Through this comparison one can deduce that having an expansive network of safe and efficient bicycle facilities is vital to increasing ridership.

While these figures illustrate the size of each network, they do not communicate their level of connectivity. The city of Copenhagen has consciously planned and implemented a network of transportation that radiates out of the city center into the suburbs. As well, there are intersecting green routes that ring out from the city core. As a result, Copenhagen's network of facilities are well connected, allowing bicyclists to move easily from one point in the city to another.

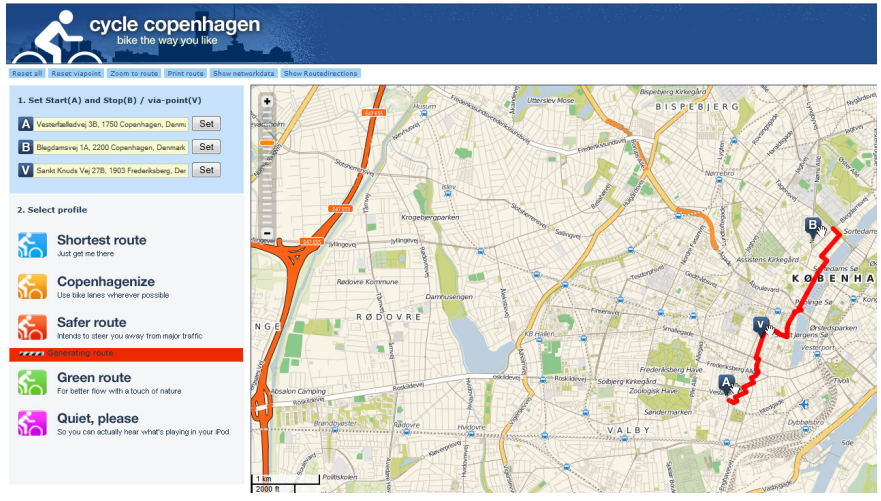
In comparison, Seattle's network is far less connected. Seattle's urban core is bordered by a series of urban villages - nodes of urban infrastructure surrounded by dense single and multi- family housing. Bicycle facilities can be sufficient within a node, but often connection between nodes is missing, as was the case in the 45th Avenue example from the previous lesson. While it is getting better, often the result is difficult transitions into Seattle's urban core or between urban villages. These examples illustrate that a comprehensive network offers lots of good quality bicycle facilities that are well connected. Networks that lack these qualities will discourage people to bicycle.



A diagram showing some of Seattle's urban villages. The distance between these urban nodes have led to a disconnected network of facilities.

Lesson 3: A network that provides a variety of routes supports different types of bicycle activities.

Bicyclists are rarely thought of as conducting a variety of different activities. You get on a bicycle, ride somewhere, and get off again. Yet, whether talking about bicyclists, pedestrians, automobilists, or other transportation users, human activity can broadly be categorized as following into two categories: *necessary*, or *optional*, (Gehl 2011, p.9). Necessary activities are those that people must do, like going to work, getting exercise, running errands, etc. These activities will be done regardless of the quality of the built environment. Optional activities are those that people do by choice, like going out to drink coffee at a café, promenading, sunbathing, or sightseeing. Gehl observes that optional activities are something people do only when, "exterior conditions are favorable, and when weather and place foster them." (Gehl 2011, p.11) This classification system challenges the



The website, Cycle Copenhagen provides bicyclists with of route options to support a variety of bicycling experiences.

homogeneous image of bicycling activity.

Depending upon whether doing necessary or optional activities, different bicycle infrastructures can be more appropriate. For example, one woman in Copenhagen related her daily experience bicycling. On the way to work in the morning she uses the fast and efficient route of the bicycle highway. After work she often goes out for drinks with friends. On the way out to, or in between, bars she is interested in cycle tracks where there are lots of opportunities to see and be seen by others. Unlike in the morning, when heading home at night she did not like to use the bicycle highways because the low lighting and few people make her feel unsafe. In these cases she uses cycle tracks where there are more, as Jane Jacobs would say, "eyes on the street". From this example it is apparent how one bicyclist needs several types of bicycle facilities for different activities.

The need for route choice is beginning to receive greater attention. The website Cycle Copenhagen[24] gives routing suggestions through the city of Copenhagen based upon different criteria. For example, you can get directions from point A-to-B and then qualify you want the *Shortest Route: Just get me there*, or that you want a quiet route *Quiet, please: So you can actually hear what's playing in your iPod*, or even *Copenhagenize: Use bike lanes* [Cycle tracks] *whenever possible*. As well, you can ask the website to get you from A-to-B via point 'V'. The authors of the site note, "[this site] is essentially based on the idea that cyclists have different preferences for their traffic. Central to [this site] is therefore a differentiation of the network, which allows you to organize routes, which better meet your personal preferences." (Brian Haunstrup) Sites like this demonstrate how bicycling can be conducive to a variety of activities when networks offer a diversity of routes. Offering a variety of routes encourages people to do more activities by bicycle. As a result, more people will choose to bicycle.

Lesson 4: Bicycling can contribute to the livability of a city.

(**For more on this section, please see the companion film, "Cycling on Stage"**)

What if bicycle facilities were designed with the same care and attention as a park, plaza, or public square? What if designers began to think about programs of activity when designing for bicyclists? To do so would accomplish a monumental shift in how we think of bicyclists, what they

need from the facilities they use, and how bicycle facilities are designed. When facilities are thoughtfully designed bicyclists, like pedestrians, can contribute to both the livability and sociability of a city.

The previous lessons have emphasized that the primary needs of bicyclists from bicycle facilities are safety and efficiency. While these are the most fundamental characteristics they also create an emphasis on bicycling as a mode of transportation. This is to say, these analyses have focused on how to make bicycle facilities the most efficient road equivalent possible. In turn, this encourages bicyclists to act and be perceived similarly to automobiles: focused on destinations rather than the quality of travel, with a desire to get from A-to-B as quickly and safely as possible. Given this emphasis, one might well consider whether a bicyclist is little more than a deconstructed automobile, or rather, something closer to a pedestrian. Truthfully, they have characteristics of both: they move like automobiles but experience the world like pedestrians. While bicycle facility design as described in the previous lessons demonstrates how to get the most out of *moving like an automobile*, little effort has been made to study or understand how to design for bicyclists *experiencing the world like pedestrians*. Since automobile facilities are designed with a very different emphasis than pedestrian facilities, it is important to recognize how bicyclists experience the world and why the pedestrian experience matters to the health of a city.

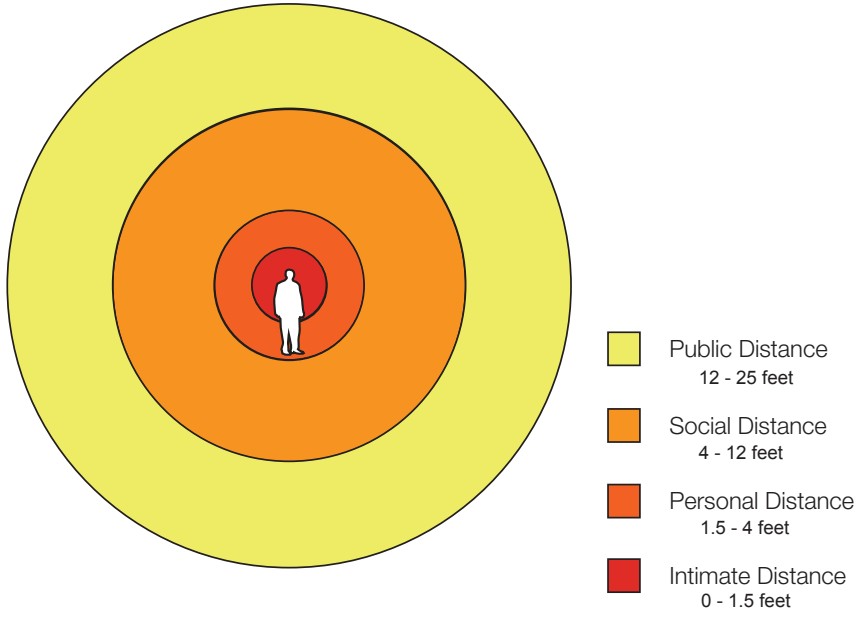
For a time urban landscapes provided a poor quality pedestrian experience. Architect and urbanist Jan Gehl observed,

> During the many years in which pedestrian traffic was primarily treated as a form of transport that belonged under the auspices of traffic planning, city life's bounty of nuances and opportunities was largely overlooked or ignored. The terms used were "walking traffic", "pedestrian streams," "sidewalk capacity," and "crossing the street safely." But in cities there is so much more to walking than walking! (2010, 19)

In response to the Modernist approach to urban design many (including Jane Jacobs, Jan Gehl, William Whyte and others) observed that, when properly designed for, pedestrian activities can contribute to the vitality and livability of a city. Gehl's critique was that Modernist urban design – both the architecture and street design - created a lifeless urban experience for pedestrians, leading to dull cities where people did not want to live or visit. In response he began to analyze the causes of these conditions and what might be done to better design for an enriched urban life.

To learn more about the relationship between bicycle facilities, social interaction, and design, please see the companion film to this paper, **Cycling on Stage**. *Click on the above image to link to the film.* Or: *http://www.youtube.com/watch?v=DqX1AWZ1shA&*

When properly designed, activities can contribute to the **vitality** and **livability** of a city.



The four zones of Hall's *Proxemics*.

Gehl found that what people want, and is the basis for what creates quality urban experiences, is social interaction. He described this as the "need for contact." (2011, p.9) Both Aristotle (in Politics) and contemporary sociologist Daniel Chirot note that people are drawn to forming groups, the later observing that humans have formed societies as a necessity to survival. (1994, p.14) This *need for contact* manifests through the desire to be around others. As urbanist William Whyte noted, "What attracts people most in an urban place is other people." (2000, p.229) In contemporary society this has become less about survival and more about living a fulfilling life. Psychologist Albert Maslow believed that meeting our social needs is necessary for any human to attain self-actualization and a satisfying life. Thus, urban landscapes that foster social interaction will help people live more fulfilling lives, leading to livable cities.

There are two types of social interaction: direct and indirect. Direct social interaction is primarily verbal communication while indirect social interaction is non-verbal. Gehl noted that the latter is of particular importance because it is the most common form of social interaction and the precursor to all other interactions (2011, p.13) Anthropologist Edward Hall made an extensive study of indirect social interaction, observing that eye-contact, body language, olfactory experiences, or just being in proximity to others are all forms of indirect social interaction. Much of his book, The Silent Language focuses on how humans use personal space to communicate. For example, Hall developed a theory called *proxemics* hypothesizing that a person will regulate the distance they will comfortably allow another to get based upon their relationship; the more comfortable we are with someone, they closer they are allowed. Hall defined four approximate territories of space used for different levels of comfort:

Public Distance:	12-25'	Strangers.
Social Distance:	4-12'	People we know, but not well.
Personal Distance:	4-1.5'	Someone we know well and are close to.
Intimate Distance:	0-1.5'	Those we are very close to, such as a dear friend or family.

The implication is, by being in proximity to others a social interaction is triggered, even if it is outside one's awareness: "…most of the distance-sensing process occurs outside awareness…So many things are happening at once it is difficult to sort out the sources of information on which we base

our reactions." (Hall1966, p.115) This is important because many will not attribute indirect social interactions as a component of livable cities since they do not recognize when it is happening. Still, many of the solutions Gehl developed for creating life between buildings simply aims to put people in proximity to one another. This starts with inviting and engaging public places.

Inviting public facilities attract people to be in the same place at the same time. Recall from *Lesson 3* that people go out to conduct necessary and optional activities. It is when people are out doing activities that social interactions occur. Since optional activities only occur when a well-designed infrastructure invites them, it can also be concluded that the greatest potential for social interaction will only occur in these conditions. If optional activities do not occur then fewer people are having social interactions and a city feels less livable. Thus, it is important that a city supports both necessary and optional activities through inviting and engaging urban landscapes.

While this has been recognized for pedestrian environments it has been neither acknowledged nor studied for bicycle facilities. In part this is because bicyclists are seldom thought of as experiencing the world like pedestrians. Yet, those who have bicycled in world class bicycle cities like Copenhagen understand that there is more to the experience than just the facilities. Perhaps it is the sheer number of bicyclists, but there is a feeling of being a part of a movement of people when bicycling – an experience that is missing in cities like Seattle where one is often alone. This suggests bicyclists are open to experiencing social interactions - which brings us full circle to why it is so important to establish that bicyclists experience the world like pedestrians.

That bicyclists and pedestrians have similar sensory experiences has been noted by others. Political scientist and bicycle advocate J. Harry Wray observes: "Put most simply, people see the world differently on a bicycle than from behind the wheel of a car, and they connect differently to people as well." (2008, 7) Wray's point is important because it connects bicyclists' and pedestrians' frames of experience by including the relationship to other people. In Copenhagen there are many pedestrians who will sit at the busiest bicycle arteries and watch bicyclists go by. When asked why one man responded:

> I like to watch cyclists because they are close by…I can see their faces,

Bicyclists are seldom thought of as experiencing the world like **pedestrians**.

The Dronning Louise Bridge that leads to Copenahgen's Nørrebro District is a perfect example of where many different types of social interactions happening between bicyclists and pedestrians can be observed.

Bicycling can be made conducive to social interactions through the **thoughtful design** and **integration** of bicycling facilities within the urban environment.

> I can see their bodies, I can see their attitudes. I don't feel any people riding in cars being present. They're just in a box. People on a bike they're present. They're here. They're observing. (Copenhagen, Denmark Sept. 18th, 2012)

From this man's observations two conclusions can be drawn: first, from the perspective of a pedestrian, bicyclists are much more present and engaging than automobilists, differentiating the two experiences. Second, bicyclists are able to have social interactions. These observations demonstrate the need to incorporate designing for bicyclists to *experiencing the world like a pedestrian*. This is to say, bicycle facilities need to be designed in a way that incorporates social interaction as well as safety and efficiency.

For Gehl, fostering social interaction in pedestrian facilities is the means to creating more livable cities. But, there is a great deal of design that goes into this. Creating an engaging environment, places to stop and stay, the ability to watch others, and protection from the elements are just a few of the component of landscapes that encourage social interaction. Similarly, bicycling can be made conducive to social interactions through the thoughtful design and integration of bicycling facilities within the urban environment. Such fostering of social interaction for bicyclists can help fulfill the human need for contact. If people associate positive experiences with bicycling then they will be more inclined to make it their regular mode of transportation, encouraging modal shift. The increase in bicyclists, and the positive social interactions between them, in turn will contribute vitality and livability in the city.

Lesson 5: Who is riding matters.

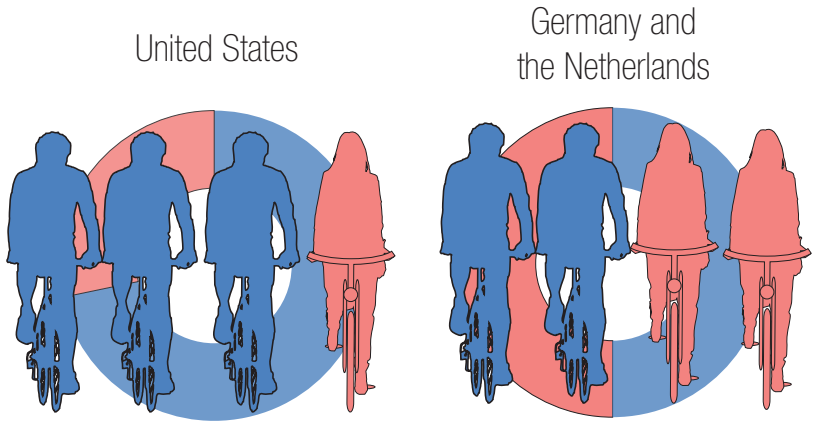
Part of any advocacy campaign is knowing your target audience. In the case of modal shift towards bicycling, this is both because it is important to target the largest potential audience and also because how many people bicycle is intimately connected to who is bicycling. Several studies help clarify who is the largest untapped group of people:

- According to the 2009 National Household travel survey[25] 1% all US trips were made by bicycle, an increase of 25% since 2001.
- However, Pucher et. al (2012) found that almost all of the growth in bicycling in the U.S. over the past two decades has been among men between 25-64 years of age.

Bicycle facilities built for people of all ages and abilities, "provide environments where a broad range of people feel **safe** and **comfortable**."

- Alta Planning *All Ages and Abilities White Paper*
Photo: Kasey Klimes.

We need to stop building cities as if everyone was **30 years old and athletic**. -Gil Penalosa



In the U.S. women bicyclists are currently outnumbered 3:1 by their male counterparts. In Germany 49% of bicyclists are women and in the Netherlands 55% are women.

- According to the 2009 National Household travel survey, the US average gender split for bicycling is 24% Female to 76% Male.
- Data collected by the League of American Bicyclists[26] shows that Seattle has a more balanced gender split than the US average at 30% women to 70% men.

These statistics suggest several conclusions. First, since participation numbers in the United States are very low, few places have inviting bicycle facilities to a broad sector of the population. Second, this means the majority of trips being made are by men conducting necessary activities. Thus, women, children, and the elderly are some of the least likely to bicycle. These observations have prompted an awareness that bicycle facilities need to be designed to invite all types of people to use them.

Commonly referred to as designing for All Ages and Abilities (aka, AAA) this movement has been receiving increasing recognition. For example, University Greenways organizer and bicycle advocate, Eli Goldberg noted[27] at the 2012 Vancouver Velocity Conference that, "AAA is the new normal" for bicycling facility design. As well, the City of Seattle recently released a white paper[28] produced by the design firm Alta Planning focusing on the relationship between AAA and bicycle facility design. On the international stage, former parks director of Bogotá, Columbia and now urban design advocate, Gil Penalosa refers to the issue as 8-80[29] advocating that our bicycle facilities should be designed to invite all peoples from ages eight to eighty. During his TED Talk, Penalosa poses the question: "What if everything we did in our public spaces had to be fantastic for the 8 to 80 year olds? We need to stop building cities as if everyone was 30 years old and athletic." While his quote speaks to the general urban environment, he has also been a key note speaker at both the 2010 Copenhagen and 2012 Vancouver Velocity Conferences, showing his belief in applying this philosophy to bicycling. By designing facilities for AAA, not only do they become more inclusive but they also will attract a larger group of people to bicycle.

While these terms are inclusive of all people, women are a particularly important target group for bicycle mode shift, both because they have the greatest potential to become bicyclists and because they can be indicators of the health of public facilities. As the statistics above show, in the United States men outnumber women 3:1 for bicycling participation. However, this is not the case everywhere. Baker reports in Scientific American[30] that in the

Netherlands 55% of bicyclists are women, and in Germany 49% of bicyclists are women. This suggests that women will bicycle as much or more than men given the right conditions. In an article providing a comprehensive look at the issues surrounding women and bicycling, Garrard, Handy, and Dill (2012) point out that, "In bicycle friendly cities and countries, cycling is an inclusive population-wide activity that includes large numbers of children, seniors, and women. In contrast, in car-oriented cities with low levels of cycling, the majority of cyclists are young to middle-aged men." (p. 211) They then go on to point out that, "…concerns about cycling safety are a major constraint on cycling and a greater constraint for women than men. Women are both more concerned about safety and more affected by safety concerns." (p. 222) These passages suggest that men dominate Geller's strong and fearless and enthused and confident groups, while women make up a significant portion of Geller's 60% interested but concerned group of potential bicyclists. This, in combination with the knowledge that women will ride given the right conditions, suggests that with better design a large group of people will make a modal change towards bicycling. This shift happens both as a result of bicycle facility quality and the presence of social interaction.

The relationship of perceived safety and social conditions is also pertinent for many women. This is best explained through the example of New York City's, Bryant Park. For a time Bryant Park was on the cusp of failure. Associated with illicit crime and unsafe activity[31], there were few who felt safe frequenting the park. Through a series of design interventions that increased the park's image of safety, it has once again become vibrant and inviting to all. One of the tactics used to monitor the ongoing health of the park is daily gender counts. A 2007 New Yorker article[32] investigated why women are an important indicator for the health of public facilities:

> [Dan] Biederman the longtime president of the Bryant Park Corporation, was a protégé of the urban sociologist William (Holly) Whyte, whose theories about the dynamics of public space included the idea that the presence of women indicates civic health. 'Women pick up on visual cues of disorder better than men do,' Biederman said the other day. 'They're your purest customers. And, if women don't see other women, they tend to leave.

This theory suggests that women are more sensitive to low perceptions of safety. The absence of women means that others may have already deemed a facility unsafe. This phenomenon is rooted in social interaction.

Women are key indicators of the health of public facilities. Photo: Kasey Klimes.

Bicycle facilities in the majority of American cities **lack the characteristics** necessary to invite people to make the mode shift from automobiles.

Women are not simply judging the built quality of the park, rather the absence of social interactions with others they trust is what turns them away. In this way, who is doing an activity matters for encouraging others to also do that activity.

On the surface the Bryant Park example is about whether women will go to a park. But, generally, this example prompts several useful conclusions for bicycling. First, it suggests that facilities can be successfully redesigned to invite women to engage in optional activities. Second, social interaction is an important component in how a facility is perceived and whether a person feels safe doing activities there. In this way, the presence of other people can do more than indicate safety, it can both invite and foster an activity. Recall Whyte's observation that what attracts people most in an urban place is other people. Given the Bryant Park example, it might be more accurate to say: while people attract other people, who is doing what activity is an important indicator of whether a facility is inviting to all. Since men outnumber women 3:1 bicycling in the US it is a safe bet that most women do not perceive bicycle facilities as safe. If bicycling facilities are designed to suit women's needs for safety and social interaction, even more women will be attracted by the messages conveyed by early adoptors. In this way, who is bicycling matters for inviting people of all ages and abilities. If modal shift towards bicycling is to be effective then people of all ages and abilities must feel invited to participate.

Conclusions

Gehl observes that people will do necessary activities regardless of the built environment, but that the built environment must invite optional activity. However, this does not capture what mode people will use to conduct their activities given a choice. Most people will select the mode that is most efficient, comfortable, and satisfying to their values and needs. The high bicycle mode share in Copenhagen reveals that the City of Copenhagen has worked hard and succeeded in making bicycling the mode of choice. Conversely, the low numbers of bicyclists and high numbers of automobilists in US cities demonstrate that nowhere is this the case in the United States. Clearly, bicycle facilities in the majority of American cities lack the characteristics necessary to invite people to make the mode shift from automobiles despite the proven benefits cycling confers. To the contrary, bicycle facilities are undercut by a comprehensive automobile network that

can offer an often easier alternative that does meet basic needs to get simply from A-to-B.

Yet, automobile congestion, environmental health, personal health, economic health, and fair access to transportation are issues pandemic in American ciies and sociey. In addition to these issues is the goal of creating a higher quality of life for all and improving the livability of cities. For all of these reasons, achieving modal shift towards active transport is a worthy goal. Clearly, there is much work to be done. The lessons in this report offer directions for where to begin.

A bicycle counter in Copenahgen showing that over five thousand bicyclists have used this route for the day, and almost two million for the year. This fosters a connection to something bigger than what one can see in the moment. It is this kind of vision that must guide our decisions for the design of future bicycle facilities and networks in the US.

Endnotes

1. http://www.ecf.com/wp-content/uploads/ECF_CO2_WEB.pdf
2. http://www.saferoutespartnership.org/sites/default/files/pdf/SRTS_GHG_lo_res.pdf
3. http://archinte.jamanetwork.com/article.aspx?articleid=773531
4. http://www.ajpm-online.net/article/S0749-3797%2808%2900770-8/fulltext
5. http://journals.humankinetics.com/jpah-supplements-special-issues/jpah-volume-8-supplement-january/costs-and-benefits-of-bicycling-investments-in-portland-oregon
6. http://www.fietsberaad.nl/index.cfm?lang=en&repository=Cyclists+spend+as+much+in+supermarket+as+motorists
7. http://www.smartgrowthamerica.org/documents/cs/factsheets/cs-revitalize.pdf
8. http://activelivingresearch.org/critical-factors-active-transportation-school-among-low-income-and-minority-students-evidence-2001
9. http://www.theurbancountry.com/2011/05/americans-work-384-minutes-each-day-to.html
10. http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/pocket_guide_2013_1.pdf
11. http://www.bikeleague.org/bfa
12. http://www.bicycling.com/news/featured-stories/bicyclings-top-50 It should be noted that this ranking is given partially based upon the projected outcome of Seattle's recently revised Bicycle Master Plan, not its existing conditions alone.
13. http://www.cascade.org/pdf/Seattle_Bicycle_Report_Card_2012_web.pdf
14. http://copenhagenize.eu/index/index.html
15. http://www.youtube.com/watch?v=jQWWhnjNUtc
16. http://www.seattle.gov/transporta tion/docs/bmp/919Public%20Engagement%20Summary%20Report2.pdf
17. http://www.portlandoregon.gov/transportation/article/237507
18. http://subsite.kk.dk/sitecore/content/Subsites/CityOfCopenhagen/SubsiteFrontpage/LivingInCopenhagen/CityAndTraffic/CityOfCyclists/CycleStatistics.aspx
19. http://www.topgear.com/uk/videos/london-calling
20. http://www.seattle.gov/transportation/tfdmaps.htm
21. http://quickfacts.census.gov/qfd/states/53/5363000.html
22. www.statistikbanken.dk/
23. http://subsite.kk.dk/sitecore/content/Subsites/CityOfCopenhagen/SubsiteFrontpage/LivingInCopenhagen/CityAndTraffic/CityOfCyclists/CycleStatistics.aspx
24. http://www.cyclecopenhagen.dk/cc/master.php
25. http://nhts.ornl.gov/index.shtml
26. http://korynorthrop.com/flash/bicycle-commuting-trends/
27. http://seattlegreenways.org/wp-content/uploads/Velo-City-2012-notes-from-Eli-Goldberg.pdf
28. http://www.seattle.gov/transportation/docs/bmp/AAA%20WhitePaper%2004%2001%202013%20Final%20R2.pdf
29. http://www.8-80cities.org/
30. http://www.scientificamerican.com/article.cfm?id=getting-more-bicyclists-on-the-road
31. The history of the park can be read on the Project for Public Spaces website: http://www.pps.org/great_public_spaces/one?public_place_id=26
32. http://www.newyorker.com/talk/2007/09/03/070903ta_talk_paumgarten

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Back Page Photo:

Bicycle parking at Norreport Station, Copenhagen, DK