

WORCESTER POLYTECHNIC INSTITUTE

WALKING VACATION IQP

AN INVESTIGATION IN URBAN PLANNING AND ITS EFFECTS ON
WALKING HABITS

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supervised by
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Dedicated to the loving memory of
Paul Fotso Kamga

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1 Introduction

Walking (or ambulation) [1] is one of the most common forms of transportation. It is defined by an 'inverted pendulum' gait. This means that the body rocks from side to side over each stiff leg (or legs). Because of this motion, it is a much slower form of transportation than others such as jogging, running, driving, or cycling. The word walk comes from the old English, meaning "to roll". [2] When a human or other biped runs, their feet leave the ground as they traverse through the environment. However, because of the slow speed of walking, one foot is always touching the ground. This separates walking from running, in which both feet leave the ground at the same time. A pedestrian is a person traveling on foot, whether walking or running.

Many people in the modern world enjoy walking as a leisurely activity. The wide range of benefits of walking allow some people to appreciate nature and the outdoors, while other people use it more for the sport and endurance aspect. [3] Walking not only helps people, but has large economic, environmental, and social impacts.

Walking may be one of the most basic forms of transportation, but it might not be the most popular everywhere. Cars are used throughout the world and have quickly become the most important form of transportation in more developed countries. [4] The use of cars has also introduced dramatic changes in employment patterns, social interactions, infrastructure and the distribution of goods. There are many positive effects on society due to the use of cars, such as access to remote places, speed of travel, and comfort provided by the automobile, allowing people to geographically increase their social and economic interactions. Cars have their negative consequences as well. Such consequences include an increase in emissions of greenhouse gasses, use of non-renewable fuels, air and noise pollution, rate of accidental deaths, disconnection of the local community, generation of urban sprawl and traffic, and the segregation of pedestrians and other active mobility means of transportation.

The aims of this project were to examine walking habits in the Western world

and the interplay between urban planning and pedestrianization.

2 Background

2.1 Personal Experience - A look into our backgrounds

Our team members come from three continents, Africa, Europe, and North America. Our walking experiences are quite different from each other and from the walking experiences of a student on the WPI campus. We start with some personal essays about the walking experience back home. These Essays describe the environment from our home countries and cities, as well as other unique places we have lived or visited up until 2018.

2.1.1 Loic Fotso

Africa, West Africa, Cameroon, according to Wikipedia, is a country which inhabit approximately 23.44 million people. The country is made up of 10 regions; 8 of those regions are French speaking areas while the other two are predominantly English speaking. A walking experience in Cameroon differs from one region to the next. In this paper I will be talking about my personal experience and opinion on walking in the southern region of Cameroon, particularly in Limbe and Buea. My name is Loic Fotso, I am 23 years old and I lived in Cameroon for 18 years.

2.1.1.1 Buea

The main economic activity driving the Buea economy is hugely centered on services that meet up with the needs of the university population. Such include restaurants, bars, convenience shops, and commercial real estate, amongst others. The economic activities further north are more administrative-centered and include government and municipal offices and authorities. Farming is the key economic driver in the villages as these villages cater to the agricultural needs of the town. Farming produces commodities and livestock ranging from tea, rice to cattle.

2.1.1.2 Buea This Time Yesterday

Buea stretching to the early 60's (post-colonial independence) is a hotbed of political activism, trade, and social interaction with people flowing endlessly on its one-way-tarred main road which cuts across the 7000 sq km municipality. The capital of German Cameroon (Kamerun), its pristine heritage, compounded with its post-colonial urban construct have positioned the town at the crossroads between pre and post-colonial socio-economic and infrastructural inner-city development. Delving back and meandering through its less-head-scratching socio-economic and infrastructural history, a plethora of lessons can be learned, leading to impeccable prescriptions which will hugely enhance the socio-economic and infrastructural development fundamentals, hence boosting the walking experience. The town of Buea rests on the foot of Mount Cameroon, West Africa's highest peak stretching well over 4100 meters in height. The imposing and tenacious mountain, with its beautiful scenery is often foggy in the rainy season (July to October) and green in the dry season. This has made Buea a main tourist destination for most tourists who enjoy mountaineering and would often participate in the annual mountain race hosted in February every year. In a bid to appreciate Buea's infrastructural and socio-economic development, it will be imperative to appreciate the old German town from its beginning neighborhood fondly called mile 16/17 all the way up to Bokwango (beyond which the mountain forest lies).

2.1.1.3 Mile 17 – How many more miles to go?

I instinctively split Buea into two when doing any sort of analytics due to the distinct features and characteristics. The walking experience in Buea and the citing from town to town show the pre and post-colonial experience. When hiking through Buea from Mile 17, neighborhoods like Molyko, Bonduma and Great Soppo lie along Buea's main street. One can experience the ripple effect of the post-colonial Francophone system of inner-city planning and development. While Buea's main road is tarred with a decent amount of pot-holes, most of the secondary roads are unmarred. Like most counties, in a rainy season the walking experience is wet and

rocky. During the dry season the walking experience is dry and dusty. The climate is relatively humid due to Buea's dense population. The modern day experience can be seen as an inner city ghetto experience and is more evident in Molyko. Molyko is located next to the University of Buea, Cameroon's first Anglo-Saxon University. There are student hostels, bars, hotels, and motels. The residential buildings are all in disarray and people are seen scrambling for the same tight space. As a result, driving and walking through their packed secondary roads can be described as a nightmare. The University of Buea campus still maintains its Anglo-Saxon heritage of infrastructural decency, tarred campus roads and social serenity. Every experience is different from town to town. Some neighborhoods are less crowded, but the polluted air of the urban ghetto is consistent. The buildings are less high-rise due to the decline in economic activities. However, as you move further towards the mountains to Great Soppo, traffic can be insidiously annoying due to markets on the side road. Until a decade ago, most of the residential infrastructure along the main road was made of "carrabot" (wood). A building culture and philosophy which the natives inherited from their fore-fathers, it is a strong belief that "carrabot" is more resistant to earth tremors, which could result from a potential Mount Cameroon earthquake. However, the modern day inhabitants are increasingly drifting away from using 'carrabot' and using bricks made from concrete to build houses.

2.1.1.4 The Great Soppo

Great Soppo is the Clerks Quarters, a distinctive neighborhood which leads you to the second half of the town. The name of this neighborhood derives from the German colonial times. The official clerks who worked for the senior colonial, and eventually local Administrators at the time lived there. Clerks quarters, alongside other neighborhoods like Gra, Buea Town all sit at the beginning of Mount Cameroon. This town is less congested and crowded, with very cool mountainous air unlike Molyko. The town planning is impeccable with single-spaced houses surrounded by beautifully-flowered and well-trimmed hedges. You would not notice the green and beautifully catered yards as well as historical German colonial infrastructure like the Old Prime-Minister's Lodge. The former Presidency as well

as the German built office buildings are all made of stone and zinc; standing tenaciously and commanding a certain air socio-economic and infrastructural serenity. The walking experience invokes colonial nostalgia, and in hindsight, one would be inclined to believe that Buea would be better under colonial Germany. Transportation along the main tarred road and few secondary paths is largely reliant on shared taxi-cabs. Although the fares are reasonable, the experience might not be. If you like to ride in style these cabs aren't for you. The cars are often very old and worn-out. The cab drivers are also old to the point where they have exceeded their useful lives. Shared cab riders ride at their own risks given the uncertainty of a potential accident. However, this experience is not as bad compared to other more vibrant economic cities like Yaounde and Douala. Further beyond the main road are a plethora of villages (Bakweri villages) whose infrastructural profile still resembles the profile of their forefathers. The single 'carrabot' houses, the villages are still largely forest-occupies with very little economic activity. The villagers rely on their bikes and bicycles for transportation. They travel back and fourth from their farms as they meander through the stony, mountainous rocky footpaths, and few tarred one-way strips.

2.1.1.5 Limbe

Limbe is a touristic city and is close to the Atlantic ocean, the attractiveness of the environment. The beach is the main place where people choose to walk in Limbe; because the sea breeze is relaxing, and it's safe to walk on the beach at anytime of the day. The scenery is beautiful and always busy due to the fish restaurants and fishermen. Limbe also has a beautiful garden and zoo in the center of the city which covers about 6 miles of walking. This mostly attracts tourist rather than the locals and encourages people to walk because cabs are not accessible in this area. The usage of sidewalks is rarely seen in Limbe. The negligence in the paving of accessible sidewalks makes it literally unsafe to walk in the city. The public transportation in Limbe is quite good and very affordable. Every part of Limbe is pretty much accessible. Taxi drivers usually charge a fare of 200 to 1000 frs cfa depending on the distance. The relatively low prices encourages villagers and

tourist carpool instead of walking. The roads are very poor because of the heavy amount of rainfall in the area. This has a huge impact on walking. Many of the locals will prefer to take a cab to their destination which is about a ten minute walk or less.

2.1.2 Ioannis Alexiou

My name is Ioannis Alexiou, I am 21 years old and I was born in Athens Greece. I have lived there for more than 15 years, while I have explored a large part of continental and maritime Greece and Europe. Throughout my time in Greece I have come to understand that people generally enjoy walking in nature, as well as use mass transportation. However it can be easily observed that quite often, they will turn to using their automobiles, due to the perceived convenience that is in offer.

2.1.2.1 Athens - A capital that tries to improve

Athens is the capital of Greece located on the Mediterranean, in Southern Europe [5]. The city is surrounded by four mountains forming a basin, which is very important to the location's weather, as it greatly affects the temperatures, precipitation and wind patterns in the city of Athens [6]. The average annual temperature varies between 14-22°C (58-72F) for lows and highs respectively. Additionally more than 50% of the days annually have sunshine, while precipitation is under 400mm per year [6]. Generally the climate can be described by hot and dry summers and mild cool winters. Therefore we can easily deduce that the weather conditions are strongly encouraging outdoor activity.

In the city of Athens public mass transport plays a very significant role as a means of transportation. Currently there exist 3 subway lines, 2 suburban lines (120km/75miles) as well as multiple bus, trolley and a tram lines (26km/16miles) which are all interconnected so that one can relatively effortlessly combine them to reach virtually any place within the Athenian basin the capital of Greece. Having said that, it can easily be observed that in a rainy day the streets will more often than not be congested, as everyone will use their cars in order to avoid the bad

weather.

From my own observations and opinions I have gathered, it is generally accepted that anyone from low to upper-middle socioeconomic levels would use public transport since it allows for a significantly cheaper, faster and even cleaner means of transportation. However the economic crisis that has struck Greece since 2008 forced many individuals to minimize the use of their cars, or even completely eliminate it. This trend has further been accelerated through the very recent introduction of Uber-like low cost alternatives for the times that someone truly needs a car. There have not been any car-sharing projects yet and most likely will not be introduced, since the road network in Athens is already close to max capacity, making mass transport the only realistic option for future expansion.

Moreover during the past 10 years there has been much effort in improving the cycling network [7], mostly through the construction of bike exclusive lanes. There have been plans to construct a cycling network that would connect the city of Athens with the southern suburbs [8]. This has increased the use of bicycles since people feel safe when commuting by bike. A lot of progress has taken place, but due to the economic crisis any further plans have been indefinitely set aside. Additionally Athens, according to some, is not the most bike friendly destination, due to its location inside a basin that results in uneven terrain [5].

The main reason that people might avoid walking in the city of Athens is the bad weather, on the rare occasion, cleanliness which constitutes a problem mostly in the central-commercial districts as well as personal safety, which becomes of great concern past the first hour after sunset.

In my opinion the existing infrastructure is more than adequate and the problems mentioned above can be solved, or at least improved with minor effort from the local authorities. The most important change that needs to take place is educational, in order to promote pedestrian respect and priority on the streets.

2.1.2.2 Llantwit Major - A pure environment in the Welsh countryside

For two years I lived outside a small coastal village in Wales UK. [9] There the only transportation link between the school and village was a bus line which

connected to the local train line. The distance was covered on average within 20 minutes on foot. As a result most of the students would walk or take the bus line to the village, where most of the local services were located, and from there take the train to any other destination they desired. Occasionally students would hitch-hike to the village on various locals who would pass by the school.

The weather conditions did not regularly encourage walking, with annual average temperatures between 5 and 18°C and an average of 160 days of precipitation annually [9]. However since most of our "commute" took place within the campus, the transportation links were rarely required and therefore proved to be more than sufficient.

2.1.2.3 Island of Hydra - A unique tourist destination

Over the summer I visited the island of Hydra, which has completely banned the use of all vehicles, including bicycles, apart from an ambulance and a garbage collection vehicle. From the tourist's perspective the environment was very clean and peaceful, proving ideal for relaxing during vacation time. On the other hand many of the locals, who mostly make their living from tourism, could argue that those limitations significantly affected their ability to expand businesses, due to the difficulty associated with carrying large amounts of resources over the cobble path network of the island. Due to this, as well as the incredibly compact nature of the villages, the cost of operation is significantly higher than comparable businesses and the effects can be observed by the consumer in the prices of the offered goods and services. All the destinations on the island could be reached on foot or using mules via the cobble paths, while there was an option of taking small ferries that function as a "sea-bus", for the further villages.

2.1.2.4 Worcester and Life around WPI

Currently having lived in the Worcester MA area for more than two years I have explored a significant part of it under several weather conditions. I believe that the public transportation though it exists, is lacking to a great degree. Information about the bus lines is not easily found, while bus stops are not clearly marked.

Moreover there exist no benches near the stops and since Worcester experiences a lot of precipitation, rainfall and snowfall, there should be some kind of roofed spot to wait protected from the elements. Most importantly though there is no posted schedule, which results in inconstant service and frustration. All in all it appears as if the Worcester Regional Transit Authority (WRTA) does not want people to use their services. Having said that for most students in WPI there is no need for public transport, since the vast majority live either on campus, or less than 1 mile away from campus. However this is not an excuse for providing sub-par service, not to mention that students living further away, as well as teaching staff, might have a hard time commuting to campus using the existing infrastructure.

2.1.3 Grant Zahorsky

I was born in Kansas City, Missouri, the 29th largest city in the United States. Kansas City has a metro population of 2,159,159 people. [10] The city itself occupies more than 240 different neighborhoods and almost 320 square miles of space. Due to the geography of Kansas City, the downtown area is quite compact and centralized. Because of this, the city isn't big enough for a subway/railway system and barely big enough for an efficient bus system. To combat this, the state's government has recently invested in a streetcar network that runs through already-existing roads. The route consists of eighteen stops around the city and has drastically improved public transportation in the area. Outside of the downtown area, there is a very large suburban population that makes up the rest of the metropolitan area, spanning into both Kansas and Missouri. [10]

I grew up in Overland Park, Kansas, in the southwest quadrant of the metropolitan area. The suburbs are set up in such a way that everything necessary for day-to-day living is close to each neighborhood. For example, I lived across the street from restaurants, department stores, gyms, my workplace, etc., and I actually went to school across state lines, in Missouri. Outside of the suburbs is an even larger agricultural and rural community. The closeness between the suburbs and rural community has created an environment where people that live in the city don't necessarily need cars to get around. In contrast, almost everyone that lives in the

suburbs owns a car due to the lack of public transportation. However, Uber has a very large industry there, especially in the city. Other forms of popular transportation in Kansas City include biking, running, and roller skating. With trails spanning across the states of Missouri and Kansas, they have become a major form of leisurely transportation in the area.

Coming to Worcester Polytechnic Institute in August of 2015 was quite the change for me compared to the Kansas-living to which I had grown so accustomed. Worcester is a much smaller, more industrial city with a population of just over 180,000 people. [11] This small size and geographical location made for a much older environment and poorer community that could easily be compared to St. Louis. Although the city is small, it is not the safest place to walk around, especially at night.

Worcester Polytechnic Institute was even more of a change than the city of Worcester itself. I had grown up in a small private school that was located less than ten minutes from my house. Coming to WPI, I switched to living on campus, never needing to travel more than a mile away from my room. WPI, in general, does a good job with transportation. Everything is easy to get to and in close proximity to each other. WPI also has systems in place so that one can easily walk to class or favorite restaurant or take a rentable bike provided by campus or SNAP, WPI's Uber-like system with little to no trouble whatsoever.

2.1.4 Dimitrios Tsiakmakis

My name is Dimitrios Tsiakmakis and I come from Kalandra, Greece, which is a small village located in northern Greece. Coming from a small village whose economy is mostly supported by tourism, I can say that walking is a big part of our culture and our daily lifestyle. When people from the country want to visit my hometown to spend their vacations, most of the time they have to use the car to reach the city. But once they are there, the car is no longer necessary because the distances between places of interest are small and can be easily done by walking. Another reason why walking is so frequent in my place is because it's surrounded by beaches and the sea so it is obvious that people want to enjoy walking in this

type of environment. But even though the environment is ideal for walking, the infrastructure is not the best. Throughout my time living there, I have observed how important the environment is in a place that attracts tourism and come to the conclusion that proper infrastructure is required in order to fully entertain a walking lifestyle.

Unfortunately, in my place the infrastructure is not ideal yet. The main reason is because of the lack of funding. This includes pedestrian traffic lights and safe sidewalks that are spacious enough to support a lot of people a. Another huge flaw of the infrastructure in my place for the pedestrians is the lack of lights. This makes walking at night very dangerous and does not really encourage people to do it. But to compensate for this lack of infrastructure, thankfully local people in my place don't really depend on cars for transportation. This is due to the small distances that they have to transport themselves to. Another reason that people don't use cars as well is because gas prices are really high in Greece. Thus people try not to spend a lot of money on car fuel because it can really hurt them financially. Public transport is also not developed in my place. So even though we are lacking the proper infrastructure, walking is still one of the most preferred method of transportation.

Moving away from the negatives, there are some positive aspects that support a walking lifestyle. In some surrounding villages, including my own, cars are forbidden to be used in some areas in times that people are outside walking around the villages and towns, which is usually during the nighttime. This is good since it provides people with a more relaxed and safe environment to walk around and not to be worried about cars and traffic. There are times though were there are too many cars but luckily there is the proper infrastructure to support large traffic movement such as big roads. Traffic is high usually during the summer because that's when people spend their vacation close to the sea. So during all the other times of the year, traffic is not an issue at all. In some villages, you won't even see one car moving around. That's positive since cars are not always a burden to the environment. Another positive thing that I want to talk about my place is that it has clean beaches. Chalkidiki, which is the name of the place where I come from, is one

of the places in Greece that has the cleanest beaches, according to the Blue Flag organization. This means that a walking lifestyle can be supported by these beaches and be enjoyed by people that appreciate this type of environment.

In conclusion, my place may not have the greatest infrastructure compared to other places I have visited such as Worcester or New York City. But some circumstances make my hometown able to support walking as a means of transportation and help people enjoy their vacations in an environment that is clean and friendly.

2.1.5 Dan Perreault

I spent this past spring break 2017 in Reykjavik, Iceland, a country where the popular advice is to rent a car. However, not only was the car rental process incredibly expensive, and unenjoyable, but I ended up walking more anyways! I largely explored the downtown of the city by foot experiencing museums, restaurants, and seeing all sorts of incredible architecture. I returned home inspired to consider applying some of my newly acquired walking techniques to Boston or Worcester.

2.2 Cycling Tourism - Our perspective from a real-life experience

Fall break in WPI is always a great chance to explore the area around us, while not having any courses to attend. As this project started in September of 2017, we (Dimitrios and Ioannis) decided to explore the lower New England on bikes, as a chance to investigate the merits as well as the obstacles one has to overcome during a fossil-fuel free vacation, that involves inter-state traveling. Below is a description of the trip and the unique experiences encountered through it.

2.2.0.1 Worcester to Providence (10.13.2017)

Our trip started on Friday the 13th, October 2017. The first day we cycled from Worcester MA to Providence RI. The journey varied noticeably both in terms of pavement, incline, weather conditions and level of surrounding buildings and facilities. Most importantly though it varied in terms of pedestrian and bike traffic.

In the early stages up until we entered Rhode Island, there was minimal activity outside of people walking short distances. This can be mostly attributed to the fact that the areas were quite remote, which in a way forced many people to own cars due to the long distances that they need to cover on a daily basis. Additionally since the few existing bike paths and sidewalks were poorly maintained, we presumed that people avoided their use as much as they could.

The stage changed completely after some time in Rhode Island. Bike paths started appearing, nicely maintained side walks and people of all ages and physical conditions using them. This could partially be the effect of time and weather conditions, since the temperature was slightly higher, around 20°C (68F), while we passed by during the afternoon, which is a more common time for people to take a leisure walk.

Upon arrival to Providence there was a very noticeable difference compared to Worcester. There were significantly more pedestrians as well as bikes. Given that Providence has greater altitude differences than Worcester¹, it was quite a surprising observation.

Our day ended with a short commute through Providence, after which we met up with friends and our host for the night.

2.2.0.2 Providence to Orient Point (10.14.2017)

The second day started off from Providence and our goal was initially New Haven. However we quickly altered it to Orient Point in Long Island in order to explore a greater part of the region, as we were going to cross New Haven on our return trip. So we started with our destination being the New London port, from where we would take the ferry across to Long Island.

This day was significantly more punishing on us. It started with a light rain, which soon evolved to pouring rain for the following four to five hours. This meant that we had to be significantly more careful of the street condition, as well as motor

¹This was deduced through our cycling experience, as well as the later look at the respective geographic elements, with Worcester having eleven major hills in an area of 100km² [11] and Providence seven in an area less half the size, measuring 46km² [12].

and pedestrian traffic, that came through our path.

On the bright side the first 20km (12.5 miles) of our trip were conducted on a bike path that was in very good condition. It was covered in asphalt and there were minimal potholes. Unfortunately due to the bad weather conditions pedestrian traffic was minimal at best, as we only noticed a people on or around the path. However given the condition and length of the path it is safe to assume that many people use it, based on our previous experience with bike paths.

After that first section our trip continued for about 23km (14.3 miles) on a six lane avenue. That was probably the most monotonous and unexciting part of the day since we were constantly surrounded by cars, without any attractive scenery around us, being enclosed by relatively bare hills. After that point our route continued until New London on smaller countryside roads. These were very interesting and pleasing, as they were passing straight through the local forests and vehicular traffic was almost non-existent. Unfortunately though the route was prohibitive for most cyclists or pedestrians since it involved great altitude changes with steep inclines and was located far from any facilities.

In the last part of our journey to New London, we had to pass over Gold Star Memorial bridge in order to cross Thames river. The bridge had dedicated pedestrian and cycling paths, which were at slightly different height compared to normal traffic in order to reduce noise and wind currents produced by the passing cars. The condition of it was very good, however it was not very wide, allowing for only one cycling lane. From there, we barely made it in time to catch a ferry across to Orient Point, due to the fact that our schedule was constantly being pushed back by unforeseen circumstances that occurred to us during the day. These included the hills, bad weather, detours taken to enjoy better scenery, and a flat tire.

Our day travel ended about 8 kilometers after we reached Orient Point in Long Island in a remote area. Since we arrived at a late time and the sun had already set, we decided to rest for the night and camped for the first time during the trip. Throughout the day there were not many cyclists or pedestrians whether we were passing through dedicated bike/walking paths or commuting on through the streets, which we attributed to the weather conditions and the relative remoteness of our

route.

2.2.0.3 Orient Point to Bethpage (10.15.2017)

Day three started quite well, with relatively warm weather and no imminent precipitation. Our destination for the day was Bethpage State Park, a total distance of 130km (80 miles). The paths for the day mostly involved two lane streets that were relatively even and with insignificant inclines. Over the course of the day we passed through remote countryside areas and medium density cities. These conditions were encouraging cycling and walking along them, amplified by the existence of small local businesses on the side of the street. The sidewalks too were well maintained and in high use by the locals.

The later part our our trip involved about 15km (9 miles) on a 6 lane avenue. That part, though short, was the most unpleasant of the day, since there was a lot of traffic on the street, which both slowed us down and created an atmosphere littered with emissions. Upon arrival to the Campsite on Bethpage, we noticed that even though the campsite accepted all kinds of campers, we only noticed users with motor operated vehicles, which in our opinion defied the purpose of camping to a great extent.

Overall that day we observed many cyclists and pedestrians in the more rural areas, where surprisingly there existed better facilities than the more densely populated areas.

2.2.0.4 Bethpage to Brooklyn (10.16.2017)

The fourth day was quite short and was the final one before reaching New York City, our trip's destination. In total we cycled 53km (33 miles) and the streets were mostly 4 to 6 lane avenues, without any cycling paths. This can be attributed to the combination of low economic wealth of the regions and the high population density. The main affordable means of transportation for people were public transport which included local bus routes and overground train lines.

Having said that we started noticing significantly more people who were either commuting on the side walks and public transportation or by bicycles on the streets.

Overall the streets had significantly more traffic than previously, however there was no congestion present and the traffic had a constant flow.

This day allowed us to experience the change from a relatively wealthy rural area to a lower economic standard urban area. This transition was also depicted on the people and the reasons they choose to cycle or walk. In the more rural areas people walk or cycle in order to relax and enjoy the surroundings as a recreational activity. On the other hand the residents of the urban area, used a combination of bikes, public transportation and walking as a means of affordable transportation around the city.

2.2.0.5 New York (10.17.2017)

Having spent two consecutive days camping in remote areas, we decided it was for the best to reserve a room for day four and five during our stay in New York to make it more convenient for us. Day five was our big break for the bike tour. The many kilometers that we had done so far though did not stop us on getting on our bikes once again and exploring New York City. From lower Brooklyn to Times Square, and from Times Square to Battery Park, we tried our best during the entire day to experience New York as much as we could from the seats of our bikes. It definitely goes without saying, that it was one of the most pleasant rides. No matter where we went, biking felt like the fastest and safest way for us to travel around New York. A city this big incorporated the proper infrastructure to support any kind of means of transportation in the daily lives and routines of everyone. Even though this infrastructure seemed like a important component in the overall effectiveness of New York city, coming from a country with less then half of that infrastructure, it was a sight to wonder.

The city had few restrictions regarding the means of how you want to transport yourself from point A to point B and that's what made it a unique experience. Small things like that may be taken for granted for the people born and raised in New York City, we consider them a vital factor for the success of a city.

2.2.0.6 Brooklyn to Brett Woods Park (10.18.2017)

After plenty of rest, exploring and food, we were full of energy and decided it was time to start our way back towards Worcester, this time through Connecticut. The weather was in our favor, with the temperature being above 20 degrees Celsius with a clear sky. Thus began our three most difficult days of the bike tour, since the way back was long in distance and the altitude changes were not in our favor. Instead of going through Manhattan, we decided to go through Brooklyn and Queens and then cross the Bronx-Whitestone Bridge. I would definitely consider this bridge crossing the most dangerous part of our journey since it was a high-speed highway for cars only. Despite being inches away from the cars though, we made it across and saved a lot of time and distance towards our journey back home.

From that point on, we biked through Bronx using the bike-ways that were available. Going through small forests, unique landscape and lovely neighbourhoods, the start of our trip back home was most enjoyable.

Towards the last part of the sixth day, in order to arrive to our designated camping site for the night, we had to reach a fairly high-altitude open woods park. As we were getting closer and closer, we could feel the temperature changes. But luckily, after 133 km we made it to our destination for the night and set up camp as quickly as possible in order to warm up. Out of all the camping sites we had been so far, this was the most extreme.

2.2.0.7 Brett Woods Park to Shenipsit Lake (10.19.2017)

Having been woken up early by the sound of dogs running around the open park, we decided it was time to start our seventh day trip, which was by far the longest distance we had covered in a day, for a total of 152km. Facing the fact that we still had a long way from home, we decided to take our time, enjoy the ride and the places we went through and do as many kilometers as we could for the day.

During this trip one of my (Dimitrios) favorite places was West Haven coast. Being a person that has lived most of his life close to the sea, I have a passionate love for the sea. That's why West Haven took me by surprise. It was a quiet and

peaceful town with short buildings and plenty of flora. The sea was crystal clear and the beach was one of the cleanest ones I have seen here in the US. We were so tempted to go swimming in the sea but unfortunately we did not have that luxury. Most of the people that we came across during this part of the trip were of old age, who would mostly walk around the place. The car usage was fairly low. A place like this would definitely be an ideal place to live when retiring.

When we reached New Haven, we took a break in order to replenish our strength and continued on towards Hartford. On this part of the trip we used one of the longest bikepath that would follow a river and go through the woods. We were delighted with the route, since it kept the altitude changes to a minimum while traveling through small hills and natural forestry.

Closing towards the end of our longest day on a bike, we finally made it to our last and most stunning camping site, Shenipsit Lake.

2.2.0.8 Shenipsit Lake to Worcester (10.20.2017)

On the last day of our trip we had less than 100 kilometers(60 miles) to go to return to Worcester. We were really tired and couldn't wait to get home finally after this long trip. We did not make a lot of stops as we were anxious. This trip proved to more challenging than expected. At the same time though the experiences that we gathered throughout were very rewarding and made every bit of the trip worth our efforts.

2.2.0.9 Overall Thoughts

This bike trip was a result of our love for cycling and the will to explore the lower New England in an alternative manner, that would allow us to better understand the locals and find interesting aspects that most travelers would miss, due to moving via a car. We believe that our trip was successful, since it allowed us the chance to observe the local communities from a much closer point of view and get a better understanding of the different regions' inhabitants' habits.

2.3 How Cars Have Impacted Pedestrians

Cars have affected the lives of people all around the world. This section investigates just how much they have changed the world by first looking at their massive increase in popularity in America, and then by analyzing a report done by a French car manufacturer that investigates just how much of a person's life is spent inside of a car.

2.3.1 Brief History of Cars in America and Their Effects on the World

By the early 20th century, cars had entered mass production in the United States, and by 1907, over 47,000 cars had been produced. Not more than 28 years later, the amount of cars produced had increased nearly 90-fold to a staggering 3,971,000. This major increase created roughly 18,000 jobs for car production giant, Ford Motor Company, by 1915, up from 13,623 two years before in 1913. [13] This sudden jolt in the popularity of cars prompted many conservative intellectuals to oppose the new trend. By having more cars in use and creating more roads, the space for pedestrians was massively decreased. It also brought a tremendous increase in the amount of pedestrian deaths caused by car collisions. In contrast, cars have also had a large, positive impact on the social lives of people and the economic status of countries. The car has provided access to remote places worldwide and travel times were cut down tremendously from the days of horse-drawn carriages. Cars also created many jobs directly and indirectly. As of 2009, the U.S. motor vehicle manufacturing industry employed approximately 6.6% of the U.S. manufacturing workforce, or 880,000 workers. [14] Jobs were also created by the new rise in popularity of the fast food industry. With the addition of drive-through restaurants, people flocked to these restaurants for a quick meal while not having to leave their cars.

2.3.2 Citroen Car Survey

In August of 2016, French car manufacturer, Citroen, published a report conducted in cooperation with French marketing analytics company, CSA Research,

entitled "Our Lives Inside Our Cars". [15] This report detailed many statistics about how people use cars, and how they live in them. It demonstrated the pervasiveness of the automobile in European culture but also acted as a rebranding of car culture. While it asked questions such as "How often do we kiss someone, eat a meal, or sing" in our car as an attempt to stylize life in the car as somewhat glamorous, it also illustrated quite clearly that cars are consuming our day to day lives.

The report was commissioned by Citroen as a part of its new promotional campaign for its cars. [16] The report was then translated into a series of short films that emphasize the ways Citroen cars can enhance your "car life". This is even demonstrated in the report itself: "This is why Citroen, a brand imprinted in the heart of millions of motorists, (...) wanted to mark its difference on the subject". [15] Thus, while the report certainly indicates a certain upbeat and optimistic view on the way we interact with cars, there is a clear bias to the reporting. Indeed, the firm which actually conducted the survey, CSA Research, claims, "Our expertise: targeting, segmentations, usage, and attitude studies". [15] They explicitly claim that their ability to target audiences, such as motorists, and conducting attitude studies is their expertise. This may serve to further undermine trust in their reporting, since it was done for explicit purpose, with intended results.

Despite this, the survey they conducted certainly has merit. As a survey of roughly 3500 people, it is of sufficient scale. Conducted in blocks of five hundred from each of the seven European countries chosen, it is also clearly the representative of the continent, without over-representing any one area. That being said, the survey was conducted online and was self administered. Some of the questions are vague or difficult to answer, such as, "Think to yourself that all cars look alike". [15] Questions like these may be difficult for people to recall while other questions might be more closely related to one's daily habits. This may serve to lead those surveyed to over-report memorable moments, things that happen often, or are emotionally charged. With these concerns in mind, the report is not without merit, and contains some interesting statistics.

Alternatives to the style of life outlined in the report remain to be investigated.

Something that this Interactive Qualifying Project (IQP) will be particularly interested in is walking as an alternative to driving. One way to determine the legitimacy of the Citroen report is to ascertain whether the beautiful moments they claim occur within a car also happen while walking on a sidewalk. Similarly, one must determine if the dangers of driving outweigh the risks of walking. Just as Citroen asks how often we "slam on the brakes to avoid an accident", we must also ask how often we "stop just short in the crosswalk to avoid an accident". [15] A more difficult question to answer shall be, "how long do we spend walking for transportation?" Many people walk for fitness as well as for leisure. Differentiating these modalities from one another is a primary concern of this report.

2.4 How Pedestrians are Affected by Urban Planning

2.4.1 Basic Concepts

This section includes both personal opinions gathered through, Ioannis' own experience after living and traveling in multiple cities around the world, and factual information obtained through our research.

Urban planning, though very complex, is founded on some very basic concepts. Through their careful use, we can create a pleasant environment, that promotes walking among its residents, along with the benefits of such activity. Strong pedestrian infrastructure is essential in cities, as it alleviates congestion on the streets and maximizes the usage of area inside of densely populated cities, while promoting healthy habits for its residents.

2.4.1.1 Car Threats and Solutions through Street Planning

Cars can be considered the most immediate active threat to pedestrians [17]. This applies not only to accidents, but also to the emission of carbon dioxide and nitrogen oxides, the highest cause of deaths in urban environments. [18] When not in use, cars occupy valuable space that could be used for any other activities that actively benefit the society. Therefore, any measures that restrict car usage or actively protect pedestrians would significantly increase the "walkability" of an

area.

One suggestion is to lower the speed limits through residential and small commercial areas, thereby promoting a sense of safety. Additionally, by requiring generous sidewalks and closing inner city streets to cars, we can further increase that effect.

2.4.1.2 Building Planning - A pedestrian's dream city

Sidewalks play a very important role in city planning, not only for their main function of allowing pedestrians to commute, but also to remove visual tension, by opening up the sky view within the urban environment and allow for better air circulation. The air quality would be vastly improved [19], due to the larger space allowing greater wind currents. Simultaneously the sight of a pedestrian becomes less crowded, by creating a sense of openness that is visually more pleasing to the eye.

Moreover, by limiting buildings to certain heights, we can increase the effective daylight that reaches the ground level, as well as visibility to the sky, both of which benefit psychological wellness. This opinion was formed mainly during the cycling trip to New York City, where the sun would appear to have set whilst in Manhattan, but upon moving along the coastline, the sun would reappear on the sky and the luminosity created a feeling of euphoria.

2.4.1.3 Recreation Areas

The previous points made in section 2.4.1, if applied, can create an environment great for walking. However, in order to truly achieve this goal, we need to create interwoven cities, where residential areas are mixed in with popular destinations, eliminating the zoning principles of the past. Such locations may include parks, groves, running/walking paths, or even commercial locations, such as markets and restaurants.

People would now have a reason get out and walk to places and the environment would offer a superior experience when walking in contrast to using a car, due to the short distance required to reach those destinations.

2.4.2 Cases From Around the World

2.4.2.1 Barcelona's *Superblocks*

One of the more common ways of increasing the "walkability" of large, modern metropolitan cities is through the use of "Superblocks". [20] These are essentially a set of guidelines similar to the ones above that would significantly improve the quality of life of the residents within and around the cities.

The Superblocks are formed around a group of existing building blocks. Within each Superblock, speed limits are reduced 5-10 miles, sidewalks are widened, and often parts of the street are completely closed off. Additionally, small businesses are offered incentives to move to those regions, further reducing the required transportation someone needs in order to reach their destination.

Barcelona has been facing many issues regarding air pollution in the recent years. [21] Over 95% of the CO₂ emissions are directly related to road transportation activities. As a result, the Spanish government decided to reduce the speed limit of local highways to 80km/h (50mph) to discourage driving.

Additionally, they adopted Superblocks in different regions throughout the city, to decrease traffic use, and also provide a viable alternative that is beneficial to the environment, the health of the citizens. and is visually appealing for tourism. [22]

2.4.2.2 Nearby Boston

By exploring the various neighborhoods of Boston, we observed certain patterns that emerge with regards to the walking habits of the residents. In general, most of the tourist destinations are surrounded by stone-paved roads. This forces the cars to move significantly slower and therefore allows a higher throughput of pedestrians.

Other examples include Chinatown and Bay Village, where clusters of shops form blocks that do not have any roads within and therefore are completely dedicated to pedestrians. [23] Within these areas, there is a sense of security and relaxation, which is the main reason people choose these areas in which to relax during their daily commutes or after-work activities.

Lastly, as we move to the Northern Boston, near Cambridge, we can observe a

more suburban lifestyle, which involves lower vehicular traffic and higher usage of the infrastructure by pedestrians and bicycles. [23] Those activities are also linked to the presence of large number of students, who commute to the various universities in the area. [24]

2.4.3 Walking and Parking Lots

In the United States a quick look in the cities and larger towns reveals that there are multiple parking areas in order to cater the customers that are visiting via cars. Unfortunately this action is in place due to laws that require businesses to provide a minimum area for parking given the size of their business. [25]

2.4.3.1 Cases from the United States

Such an example can be found at Fountain Valley, CA, where the municipal code specifies the minimum number of parking spots required for a business type and size. [25] These laws and codes result in significant space being used for parked cars. It is estimated that 95% of the time private vehicles remain parked. Additionally, over 80% of the time when in use, these cars carry a single passenger while traveling on the road. [26]

In Los Angeles, there are two massive parking lots that are located next to the Dodger Stadium. [26] These lots are in place to accommodate the over 30000 visitors during events, most of whom arrive by car [27]. However, the rest of the time they remain greatly underutilized, occupying space that could be used for other recreational or environmental activities.

2.4.3.2 How Large Institutions Magnify the Problem

Some of the worst offenders of excessively large parking lots are universities, that is partly due to their size and the code regulations similar to the ones described above. However, a significant part is due to the need for parking spots, as many staff and students commute daily by car. After a search between the following universities it is quickly found that only Columbia University is lacking a parking lot due to being located in Manhattan, while Georgia Tech University is the only

other university with a relatively small area dedicated to parking. The percentage areas are the ration of parking area to total building area. This was done due to the discrepancy often created, when universities include public green space in their campuses.

- Worcester Polytechnic Institute — 46.28% (24.4% without the rooftop garage)
- The College of New Jersey — 37.2%
- Texas A&M University — 28.45%
- University of California Los Angeles — 9.49%
- Georgia Tech University — 5.33%
- Northeastern University — 5.29%
- Columbia University — 0%

On the other end of the spectrum, we observe The College of New Jersey, which has a parking area that covers over 1/3 of the total building area at 37.2% . The relative areas mentioned previously have been calculated using an online area calculation tool [28] in combination with the map figures listed in the appendix.

2.5 Walking at WPI

West Street, closed to vehicular traffic in 1995, has become an important pedestrian seam through the campus. Banning cars from the quad and creating the fountain plaza, also encouraged walking outdoors. A walkway through Institute Park that connects the main campus to the Faraday Hall and the Prescott St. buildings of Gateway Park. More recently, WPI has introduced a bike sharing program which greatly promotes students to explore the Worcester area in a cheap and convenient means of transport. The WPI campus is easily accessible by car, however, reaching campus is affected by heavy traffic around 8-9AM, 1-2PM, and 1-6:30PM. Students who commute need to plan accordingly if they have classes scheduled during those hours. There is a lack of university shuttles that should be

made available for all students. The shuttle would help transport students to the campus, from the train and bus stops and pick up students who live off campus in the nearby neighborhoods.

There are parking lots on campus and students who own cars and who like to park on campus are expected to obtain parking permits which cost a whopping 100\$ per ticket; there is a parking necessity brought into the quad and the space for students to walk and play is reduced. Some of the lecture halls are far from the parking lots so it is sometimes a long walk from parking the car to class. The new buildings have elevator access, such as the Gateway buildings which have the elevator right next to the entrance and students need to look for a staircase encouraging less walking which is a call for concern; when the admissions building was planned, there was also a plan for an underground parking lot under the quad. The underground parking lot was not realized, there is now a parking garage with a rooftop softball field. Unfortunately there is no sidewalk for a pedestrian to walk from the quad to FBC, where several educational events take place, or where faculty and staff pick up their children from day care. Most of the students who live off campus, live near the school and they usually rent a house to live together for that year. Since most of these off campus apartments are close by, students usually walk from their rooms to class. An off-campus student usually gets to school at 8, goes to one of the dining halls for breakfast, goes to class or to the library, goes for lunch, then goes to the library, and then walks or drives back home. Just as a back of the envelope computation we can safely conclude that every student walks at least one hour for transport every day, which is as much as Citroen claims that the average European spends in a car.

2.5.1 The Case of WPI

One unique case from the in 2.4.3.2 is WPI, which has utilized the roof of that parking garage as a football field. This results in many benefits, such as maximizing the use of available land, while elevating the field above the thick layers of polluted air that is trapped around the lower levels of buildings.

On the other hand, due to the steadily increasing number of students and fac-

ulty at WPI a need for more parking areas has been generated. In an effort to temporarily cover that need, WPI decided a few years ago, to create a parking lot behind the Higgins House. That lot covers a significant space, that was dedicated to natural landscaping and once created a pleasant environment around the area. Nowadays the temporary parking appears to have become permanent, showing potential lack of hindsight during the planning and construction of the other parking lots that are found across the WPI campus, opposite to the innovations of the Park Avenue garage.

Moreover, there exist a few questionable developments in WPI's campus. Firstly, the Admissions building is placed in a very central position, between the most of the dormitories and the classrooms. As a result, a building that serves practically no functionality to the students everyday life is closer than any of the classrooms or other campus facilities.

More recently WPI has decided to take a different approach and not repeat the mistakes of the past. This can be observed with the Foise Innovation Studio that is placed much close to the residential halls than any of the previous classrooms. Simultaneously the building doubles as a residential hall in the upper three floors, which brings the students in direct access to the in-building classrooms, while they are located much closer to the other academic buildings, than any previously constructed dormitory.

2.6 How Foot Traffic Affects Cities

2.6.1 Brief History of Streetcars

Downtown America has changed drastically over the last century. With that, has come considerable changes to the American pedestrian as well. Electric streetcars and pedestrians commanded transportation in the beginning of the twentieth century. Cities were laid out in such a way that streetcars converged radially around the city center, thus pulling in workers, shoppers, tourists, and others to the city's core. Early streetcars were drawn by horse until 1834 when Thomas Davenport, a blacksmith from Brandon, Vt., U.S., designed a small motor powered by batter-

ies. This invention was first used on a small streetcar on a small section of track. When this was first implemented in London in 1860 by an American, G.F. Train, it marked the first large-scale use of overhead electrical lines to power streetcars. In 1873, the cable-car was invented and put to use in San Fransisco, California by Andrew Hallidie. Seemingly endless cables ran between slots between the rails and ran over steam-driven shafts in the powerhouse. These cars ran more smoothly than electric cars but performed less efficiently, as they could only run at one constant speed. The braking or jamming of one line would hold up every other car on it causing delays and problems for each passenger. As technology progressed and electric streetcars became more sophisticated, they began to replace cable cars around the 1900s while Seattle cable cars lasted until the 1930s. [29]

2.6.1.1 The Case of Winnipeg

When streetcars were first introduced to the city of Winnipeg, it merely ran a short distance along Main Street and was barely used much at all. By 1884, a branch extended the rail westward to a part of the city mostly devoid of any development. Although not much development had happened by this point in time, a significant increase in population and growth of the city occurred spurring many changes for Winnipeg. Extensions to the streetcar were unable to keep up with this speed of change in and around the city, but it was able to respond adequately to it. As the city expanded, the streetcar had to expand with it, focusing mainly on the inner city, where the most amount of population was. In the beginning of its life in the city, the city officials were speculative and concerned about how well the system would actually work and if the benefits would outweigh the risks. As the city developed and places like Elm Park and River Park became more and more popular, the line was extended in terms of length and times of business. When it was first established in the city, it only operated during the summer months. As the city grew, the system began to expand and run year round. This allowed residents and workers throughout the city to travel more effectively as well as bring the population together, however, the mere existence of the streetcar had no guarantee of expanding the city. Only when other attractions and businesses came into play

was the streetcar essential in the shaping of Winnipeg. [30]

2.6.2 Shaping the City

Due to the increase of public transportation, less and less people are using sidewalks as a major form of transportation throughout cities. Buses, subway systems, streetcar systems, etc. are all providing easier and more efficient forms of travel for people living and working in a city. It allows them to get further away faster which, in turn, allows them to go more places within a day than in years past. Although the number of people on sidewalks is declining, it is still a vital part of a healthy and busy city. These benefits can be broken down into 4 categories, says Kent A. Robertson: "traffic management, economic revitalization, environmental improvements, and social benefits". [31]

2.6.2.1 Traffic Management

Robertson [31] suggests that by having a balanced transportation system within a city's core should drastically decrease the amount of traffic due to cars. By expanding the sidewalks, there would be less room for automobiles in a city, thus lowering the amount of traffic within a city. This shift imbalance from mostly cars to mostly pedestrians should also result in more people using mass transit.

2.6.2.2 Economic Revitalization

Street level businesses thrive on pedestrians "window-shopping". As fewer people use sidewalks, it becomes more difficult for these businesses to stay afloat and operational. This is also the case for indoor-oriented shops that are located off of skywalks and atriums. By shifting the balance of downtown to a more pedestrian friendly environment, it encourages people to explore the city thereby walking passed more of these businesses. Another side effect of shifting these balances more towards pedestrians is that it would create a more enticing downtown area. This means that more people would want to travel downtown. Once they are there, stay longer than they normally would have, thus finding more establishments in which to spend their time and money.

2.6.2.3 Environmental Improvements

This increase in "pedestrianization" also leads to a healthier downtown area. By having a larger focus on pedestrians within a city and less of one on automobiles, noise and air pollution start to decrease. For example, in Stroget, Copenhagen, noise levels were cut by 50 percent after automobiles were eliminated. [32] This can also affect the historic relevancy of the downtown area, an argument frequently used in Europe. By lowering the levels of noise and air pollution, buildings are saved and conservation of a city becomes easier. The decrease of air pollution can also free up a skyline so that people can appreciate the structures within a city without their view first being blocked by automobile lights or traffic signals and traffic signs. This, in turn, entices more people to visit the downtown area because it becomes more aesthetically pleasing.

2.6.2.4 Social Benefits

Social interaction is also encouraged by having a more pedestrian-focused downtown. When operating an automobile, one is much more secluded than someone who is walking down the sidewalk. This increases the chance of social interaction can also expose people to a heterogeneous mix of people. This allows pedestrians to encounter people from all sorts of different cultures, racial backgrounds, and economic backgrounds. People of all ages (children, parents with infants, the elderly, the handicapped, etc.) are then subject to more interaction and conversation. A person also typically feels much safer if they are walking down a road full of people rather than walking down it completely alone.

2.6.2.5 Pedestrianization

"Pedestrianization" improves the look and feel of a city drastically. It improves the quality of life for the people living in the city as well as increases revenue and social interaction between the people working, shopping, or just visiting the city. Although there are much better ways to determine the liveliness of a city, one usually determines it by the amount of people walking through the streets. By

having a healthier and more vibrant city, it will attract more and more people, thereby growing and developing the city further.

3 Our Survey: Walking Habits

3.1 Survey and Research Methodology

3.1.1 Introduction

We wanted to further our research on walking by investigating various day to day walking habits, preferences, and activities involved while walking and also the reason behind why people would consider or not consider taking a walking vacation. The survey was produced using the WPI Qualtrics system, we designed thirty five survey questions and obtained IRB approval for distribution.

The survey was opened on January 26th, 2018 and ran for a period of 60 days. The participants of the survey included all WPI students, numbering 5677, out of which only 38 completed the survey, 0.67%. In comparison to the Citroen car report, our 0.67% is a good return rate, as it is using a total of 3508 out of 366,750,602 which equals $9.6 \times 10^{-4}\% = .00096\%$.

3.1.2 Survey Results

Below are all the results from the survey.

Question 1: How far and how long do you walk per week?

- Less than 5 miles
 - Less than 1 hour 27.27%
 - 1-5 hours 63.64%
 - 5-15 hours 9.09%
 - 15-30 hours 0%
- 5 to 15 miles
 - Less than 1 hour 38.10%

- 1-5 hours 47.62%
- 5-15 hours 14.29%
- 15-30 hours 0%
- 15 to 30 miles
 - Less than 1 hour 58.82%
 - 1-5 hours 11.76%
 - 5-15 hours 29.41%
 - 15-30 hours 0%
- More than 30 miles
 - Less than 1 hour 75%
 - 1-5 hours 0%
 - 5-15 hours 8.33%
 - 15-30 hours 16.67%
- Other
 - Less than 1 hour 80.00%
 - 1-5 hours 0%
 - 5-15 hours 20.00%
 - 15-30 hours 0%

Question 2: How far and how long do you walk with someone else per week?

- Less than 5 miles
 - Less than 1 hour 53.57%
 - 1-5 hours 42.86%
 - 5-15 hours 3.57%
 - 15-30 hours 0%

- 5 to 15 miles
 - Less than 1 hour 46.67%
 - 1-5 hours 53.33%
 - 5-15 hours 0%
 - 15-30 hours 0%

- 15 to 30 miles
 - Less than 1 hour 88.89%
 - 1-5 hours 0%
 - 5-15 hours 11.11%
 - 15-30 hours 0%

- More than 30 miles
 - Less than 1 hour 88.89%
 - 1-5 hours 0%
 - 5-15 hours 0%
 - 15-30 hours 11.11%

- Other
 - Less than 1 hour 100%
 - 1-5 hours 0%
 - 5-15 hours 0%
 - 15-30 hours 0%

Question 3: How often do you observe something interesting or surprising while walking?

- A few times a day 5.71%

- A few times a week 40.00%

- A few times a month 17.14%
- Rarely 31.43%
- Other 5.71%

Question 4: How often do you listen to music while walking?

- Always 14.29%
- Most Of the time 8.57%
- About half the time 22.86%
- Sometimes 28.57%
- Never 25.71%

Question 5: How often do you walk to work/school/university?

- Always 2.86%
- Most of the times 11.43%
- About half the time 0%
- Sometimes 20.00%
- Never 65.71%

Question 6: How often do you ask for directions from another person while walking?

- A few times a week 5.88%
- Once a week 2.94%
- Once or twice a month 0%
- Rarely 38.24%
- Never 52.94%

Question 7: How does walking affect your mood?

- Extremely positive 31.43%
- Moderately positive 37.14%
- Slightly positive 8.57%
- Neither positive nor negative 17.14%
- Slightly negative 5.71%
- Moderately negative 0%

Question 8: What do you carry with you when going for a walk?

- Keys 23.36%
- Wallet 22.43%
- Phone 30.84%
- Bag 11.21%
- Water 11.21%
- Other 0.93%

Question 9: Do you use specialized shoes for walking/running/hiking?

- Always 17.14%
- Most of the times 22.86%
- About half the time 8.57%
- Sometimes 28.57%
- Never 22.86%

Question 10: How far do you usually travel for vacation?

- Stay in the same city 8.82%

- 50 to 150 miles 32.35%
- 150 to 300 miles 32.35%
- Different Country 20.59%
- Different Continent 5.88%

Question 11: How often do you bring/rent a vehicle for transportation during vacation?

- Always 14.71%
- Most of the time 17.65%
- About half the time 2.94%
- Sometimes 50.00%
- Never 14.71%

Question 12: Have you considered taking a vacation in your own city?

- Never thought about it 35.29%
- Nothing interests me around here 14.71%
- I have already done it 35.29%
- I have seen everything there is to be seen here 14.71%

Question 13: What type of destinations do you usually visit during vacation?

- Warm climate 18.85%
- Cold climate 7.96%
- Urban 10.62%
- Rural 9.73%
- Historical 10.62%

- Home 6.19%
- Coastal 15.93%
- Mountainous 19.47%
- Other 0.88%

Question 14: How many days per year do you go on vacation? (Open question)

- 10-15 days answered by the majority

Question 15: Do you associate vacation with a distant and/or remote place?

Why?

- Yes 58%
- No 42%
- Majority that answered the why part responded that it was an escape from something that we are familiar to.

Question 16: Do you ever adjust your vacation plans based on your environment impact? Why?

- Yes 33%
- No 77%

Question 19: Which form of transportation do you prefer?

- Walking 16.43%
- Car 48.57%
- Bus 0.00%
- Train/Subway 10.71%
- Bike 24.29%

Question 20: Which are did you grow up in/closest to?

- City 26.67%
- Suburbs 61.76%
- Rural 11.76%

Question 21: Would you rather spent the whole day driving or walking?

- Driving 37.14%
- Walking 62.86%

Question 22: Due to technological advancements, the world is built in a way where walking is no longer needed. Would you still walk to places?

- Yes 82.86%
- No 17.14%

Question 23: Regarding the fitness of a person, do you think walking plays an important role?

- Yes 96.97%
- No 3.03%

Question 24: After a long day at work, would you walk home or drive home?

- Walk home 14.29%
- Drive home 85.71%

Question 25: Do you prefer walking alone or with company?

- Alone 51.43%
- Company 48.57%

Question 26: Do you see yourself walking for entertainment purposes?

- Yes 68.57%

- No 31.43%

Question 27: What would you rather do?

- Explore the whole Europe by foot 62.86%
- Explore the whole Europe by car 37.14%

Question 28: Do you think walking at late hours is safe in your place?

- Yes 42.85%
- Maybe 28.57%
- No 22.86%
- Other 5.71%

Question 29: Would you use walking as a means of transportation in order to save money?

- Yes 65.71%
- No 34.29%

Question 30: Do you believe walking habits will change in the future?

- Yes 37.14%
- Maybe 37.14%
- No 25.71%

Question 31: What means of transportation do you use to go to work/school?

- Car 78.05%
- Bike 9.76%
- Train 12.20%

Question 32: In your personal opinion do you think walking has any benefit apart from physical exercise? Do you think you can learn something new just by taking a walk? (Open question)

- Majority agreed that walking walking has indeed other benefits apart from physical exercise.

Question 33: Do you stay in your office/classroom during your break minutes or go for a walk?

- Stay in office 54.29%
- Go for a walk 45.71%

Question 34: Would you accept to go to work or school one day a week on foot?

- Majority answered no, mostly due to the distance they have to travel.

Question 35: Have you even taken a walking vacation?

- Yes 71.43%
- No 28.57%

Question 46: How often do you walk to go shopping?

- Always 2.86%
- Often 0%
- Sometimes 14.29%
- Rarely 22.86%
- Never 57.14%
- Other 2.86%

Question 47: What kind of items would you shop for when walking?

- Groceries 39.29%

- Office Supplies 17.86%
- Electronics 21.43%
- Other 21.43%

Question 48: How often and for how long you walk after reaching a shopping mall/shopping village etc?

- Always
 - Less than half an hour 36.64%
 - 1-2 hours 36.84%
 - 2-4 hours 21.05%
 - More than 4 hours 5.26%
- Usually
 - Less than half an hour 47.62%
 - 1-2 hours 23.81%
 - 2-4 hours 23.81%
 - More than 4 hours 4.76%
- Sometimes
 - Less than half an hour 43.75%
 - 1-2 hours 18.75%
 - 2-4 hours 18.75%
 - More than 4 hours 18.75%
- Never
 - Less than half an hour 54.55%
 - 1-2 hours 9.09%
 - 2-4 hours 0%

– More than 4 hours 36.36%

Question 49: Do you think walking around or close to your neighborhood is safe?

- Yes 57.14%
- Maybe 31.43%
- No 2.85%
- Other 8.57%

Now that we have seen all the results from all the questions, except question 17 and 18 which we will discuss below, let us begin analyzing all these results and draw conclusions about our respondents.

But first let's understand the respondents, by analyzing question 17, where we asked people where they are from and where they currently live in. These are the results:

- 18 people are from Massachusetts USA where most people still live there
- 2 people are from Cameroon where one lives in Limbe and one in Toronto.
- 1 person is from Nigeria who lives in Stoughton
- 1 from Portugal who lives in Texas
- 1 from Australia who lives in Connecticut
- 1 from Damascus, Syria, and lives in Newport, RI now
- 1 is from Michigan, USA who now lives in Worcester, MA
- 1 is from Richmond who still lives there
- 1 from Alabama, USA who now lives in Illinois
- 3 from Connecticut, where one lives in Worcester and two of them still in Connecticut.

To also further understand the respondents that answered the survey, we shall also look at question 18 where we asked people about their age. These are the results:

- 5 people are under 18
- 10 people between the ages of 18 and 24
- 10 people between the ages of 25 and 34
- 3 people between the ages of 35 and 49
- 7 people between the ages of 50 and 64

Now that we have a small understanding about the age and the location of our targeted audience, let us begin analyzing the results from our survey.

We note that our respondents do not seem to represent the WPI undergraduate student body, our targeted population, but rather a mix of commuting students and employees.

4 Survey Analysis

The most important question is question 19, which asks which “form of transportation do you prefer”. 45.71% prefer the car. This is surprising considering the fact that these same responders would rather spend a day walking than driving around in a car. The car will be preferred by most since it provides speed, convenience and comfort over any other means of transportation. This claim is also supported by question 20 where we observed that over 60% of the people that answered the survey lived in suburbs where public transportation is not as common as a city.

The percentages that Qualtrics returned for question 1 sum to 100% for each of the distance categories, as if all people had a time estimate for each distance window. Indeed, a person could spend 5 hours walking slowly, and additionally waling 2 hours fast and so on. In table 1 we present the raw data in a table, which confirms that indeed the number of responses sum to more than twice the number of respondents.

		N° of responses for Time (hrs)				
		1-5	5-15	15-30	>30	other
N° of responses for Distance (mi)	< 5	6	8	10	9	4
	5-15	14	10	2	0	0
	15-30	2	3	6	1	1
	>30	0	0	2	0	0
	other	0	0	0	0	0

Table 1: Number of responses for question 1, for each corresponding option.

Summing the number responses for the more than 5 hours categories and finding that sum to be equal to the number of respondents, we can safely conclude that people walk about an hour per day consciously, which is approximately equal to the average time a European spends in a car per day according to the Citroen report.

From the first question, where we asked “How far and how long do you walk per week?”, we can observe that most people walk less than 5 miles per week, which is probably just the destination between different building at their respective destinations. The next most common distance was 15-30+ miles weekly in under an hour. This appears to be a group of people who mostly exercise, as their speed indicates. The last point is further strengthened by question 26 where nearly 70% of the surveyed want to walk as a means of recreation.

From question 2, where we ask the same question as 1 but with the addition of doing it with company, we can observe that most people walk very little in the company of others, which can be attributed to the fact that they have busy different schedules that make it difficult to arrange to walk with someone. This result is also supported by question 25, where we asked if people prefer walking alone or with company. The majority answered that they prefer walking alone so it makes sense

that in question 2 the results showed us that people don't spend a lot of time walking in company of others. Even though walking has social benefits, we were surprised to see these results.

Question 3, where we asked how often people observe something interesting while walking, reveals two main groups of people. About 40% who observe interesting things while walking a few times a week and those that rarely do so. We are approaching matters of personal interpretation, but we can potentially attribute this to the conditions during their walks such as listening to music, being in a hurry, thinking of important matters or being in a detached way from their surroundings. This is also strengthened by question 4, which asks how often do you listen to music while walking, where we observe about 50% declaring they rarely or never listen to music while walking.

In questions 5 & 6, where question 5 asks "how often do you walk to work/school/university?" and question 6 asks "how often do you ask for directions while walking?", we can observe that people avoid walking on daily routes whether going to work or shopping. This is mostly due to distance between their residence and those facilities. The only exception as seen in question 47 are people willing to walk for grocery shopping.

In question 7, where we asked how does walking affect someone's mood, we can observe that people really enjoy walking given that over 65% said that their mood is positively affected by walking. At the same time in question 27, a hypothetical question that asks people if they rather explore the whole Europe by foot or by car, we can observe that over 60% would want to explore a new destination such as Europe on foot. The same pattern appears in question 21, which asks "Would you rather spend the whole day driving or walking?", where 60% prefer to walk when given a binary option of walking or driving for a day.

In question 8, where we asked what do people carry with them when they are walking, the majority answered that it was their phone. There isn't much to conclude out of this result, just the fact that people do spend a lot of time on their phones, even when they are just walking.

In question 9, which asked if people used specialized shoes for walking/running/hiking,

the majority answered sometimes. Since people don't spend a lot of time walking due to their busy schedules, it's obvious that they would not put a lot of effort using specialized shoes for this kind of activity.

In question 10, where we asked "how far do you usually travel for vacation?", most people answered that they travel between 50 to 300 miles. From the bike tour component of the IQP, 50 to 300 miles is either a walking or a bike vacation. This result tells us that most people prefer going somewhere else for vacations instead of staying somewhere that they are familiar with, such as their home or surroundings.

In question 14, where we asked people how many days per year they go on vacation, the majority was between 10 to 15 days, which tells us that people in this community have really busy schedules the entire year that allows them to only spend such little time on taking a vacation.

When it comes to the environment, we can observe from question 16, where we asked "Do you ever adjust your vacation plans based on your environmental impact?", that less than a third takes into consideration their environmental impact when planning a vacation. Furthermore, question 15, that asked "Do you associate vacation with a distant and/or remote place?" shows that over 55% associate vacation with a remote destination, as it implies escape, relaxation and going to a different place than where they normally live. This point is strengthened even more in question 13, which asked what type of destinations people visit during vacation, where the vast majority of people travel to warm coastal or mountainous destinations for vacation.

In question 35 we asked if people have ever taken a walking vacation and 71% answered yes. This was a good result since we wanted feedback from people who had some experience in our project subject.

In the open question 32, where we asked if walking is beneficial to a person apart from physical exercise, we got 15 "yes" answers. This was also a positive result since people put more thought into walking and what it can provide to the community and to us personally.

In the hypothetical question 22 we asked people "Due to technological advancements, the world is built in a way where walking is no longer needed. Would you

still walk to places? 29 people answered Yes and 6 people answered No. This results reveals to us that walking is something important to people and that they wouldn't give it up even if we could avoid it completely.

In question 23, where we asked people if they think walking plays an important role in a person's fitness, majority agreed with us. This clearly show that people are aware of the health benefits that walking has to people. However, we were surprised that there were some people that disagreed

In question 24, we asked if people prefer walking or driving home after a long day at home. We were not surprised that the majority preferred the car, since it is faster and less tiring than walking home. In questions 26, we were wondering if people see walking as a means of entertainment. We were happy to see that most people answered yes, which shows us that walking is not fully considered as just a boring activity that humans do naturally.

In terms of safety of walking, we decided to ask people in questions 26 if they think it's safe to walk at late hours in their place. The majority answered Yes, which was good news since it shows us that people are not afraid of walking around their place, even in hours where it might be dangerous. Question 49 also asked a similar question, but without the "late hours" part and we also got the same result, where the majority answered "Yes".

We were also curious if people were aware of the economic benefits that walking has. So we decided to ask that in questions 29. The majority agreed with us, which was really good news to us. Most people that answered our survey were really aware of the benefits that walking has, including saving money. In question 30, we asked people if they think walking habits will change in the far future. The majority was torn between yes and maybe. People think that our walking habits will change somehow, but some of them are not sure how that will happen. This explains the question's results.

In question 31 we wanted to know what means of transportation they use to go to work or school. The majority answered that it was the car. This result makes sense, since in a previous question, people said that the distance they have to travel to get to work or to school is long so they have to use the car in order to be on

time.

In question 33 we asked people if they like to walk during their break in the school or work environment. Most people preferred to stay where they are and not walk. From this result, we can conclude that most people prefer to not tire themselves during their working hours and take a break by relaxing and resting.

In the question 46, where we asked people how often do they walk to go shopping, the majority answered never. This may due to the distances they have to travel or the weight they have to carry, so car can be helpful here. This can be also supported by question 20, where we found out that most people that answered the survey live at the suburbs were its harder to go to shopping malls compared to a city. People however, according to question 48 where we asked how often and for how long they walk when they go for shopping, do spend about half an hour walking around when they are shopping.

In question 20, where we asked in which area people grew up close to, we can observe that an important reason for those habits is the form of the American urban and suburban planning. The strict zoning rules force people to travel longer distances, while suburban areas are more affordable to move to. This combination by itself encourages the habits described in the survey, while it preserves the understanding for the benefits of walking

5 Walk-Away Thoughts

From our survey, we conclude that people are not as aware of walking as they are of driving. Also, people in our suburbs prefer the car to walking for transport, but they walk for exercise. Our observations from vacation experiences confirm that while it is difficult for people to change their walking habits in their daily routine, they are willing to walk during their vacation to explore a new surrounding. We hope that bringing home the examples of the world's most walkable cities will shape our own surroundings to become sustainably walkable and livable.

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Appendices

A Email to WPI Student body, for survey data.

Hi everyone,

We are a group of students doing the Walking Vacation IQP, which explores the health, social, economic and cultural, environmental benefits and trends that surround walking. We would really appreciate if you could fill the following anonymous survey, in order to assist us with our research. The questions are not asking for private information or information that could be associated with the individual completing it.

http://wpi.qualtrics.com/jfe/form/SV_9KzEdeCVxFsVHut

Regards,

Walking Vacation IQP Team

B Survey Raw Data

Q1 - How far and how long do you walk per week?

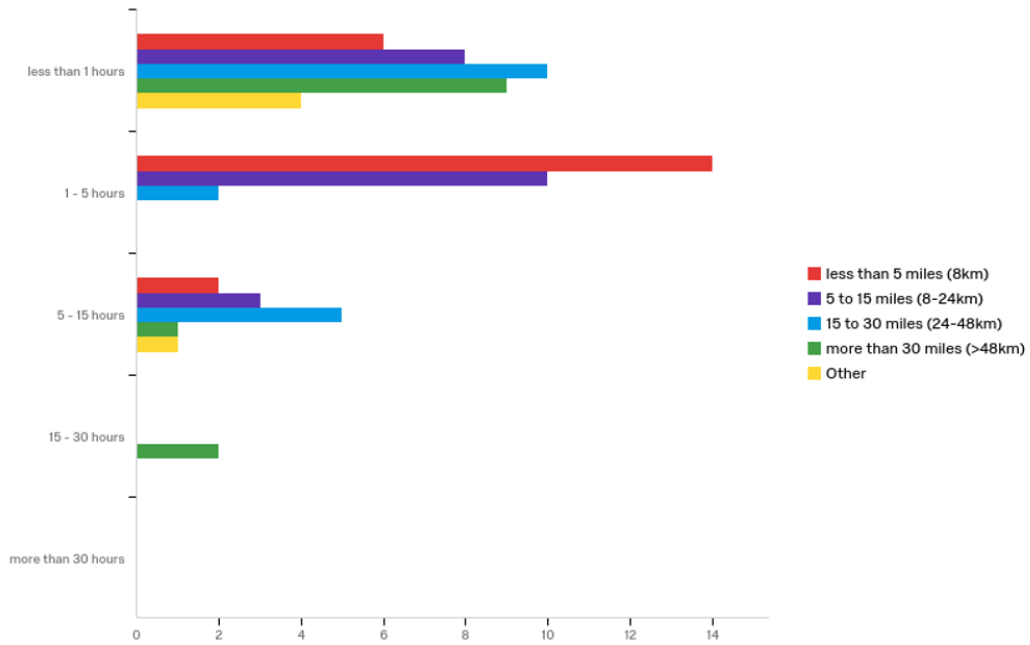


Figure 1: Question 1

Q2 - How far and how long do you walk with someone else per week?

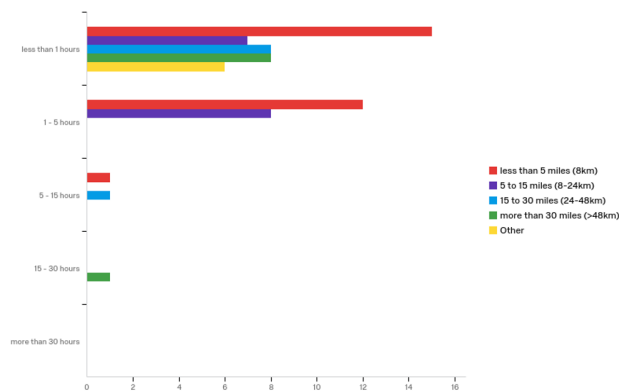


Figure 2: Question 2

Q3 - How often do you observe something interesting or surprising while walking?

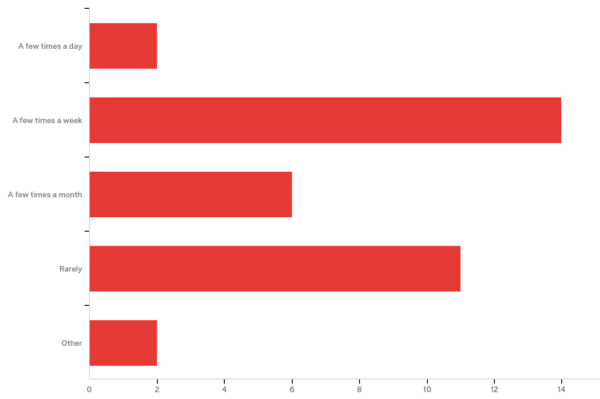


Figure 3: Question 3

Q4 - How often do you listen to music while walking?

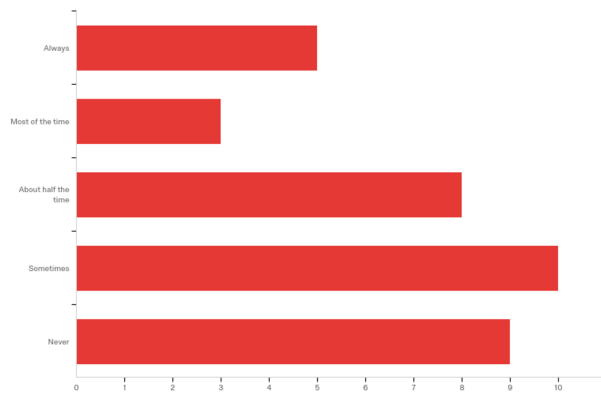


Figure 4: Question 4

Q4 - How often do you listen to music while walking?

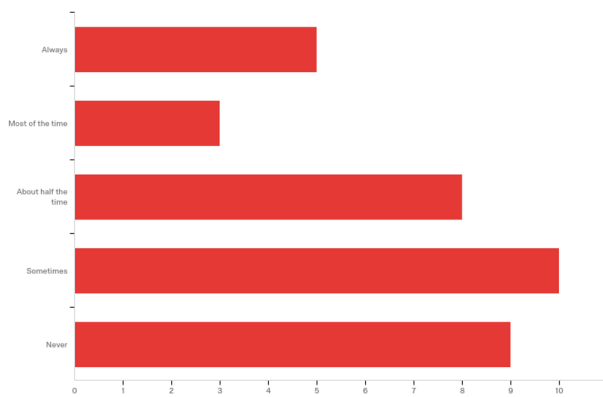


Figure 5: Question 5

Q6 - How often do you ask for directions from another person while walking?

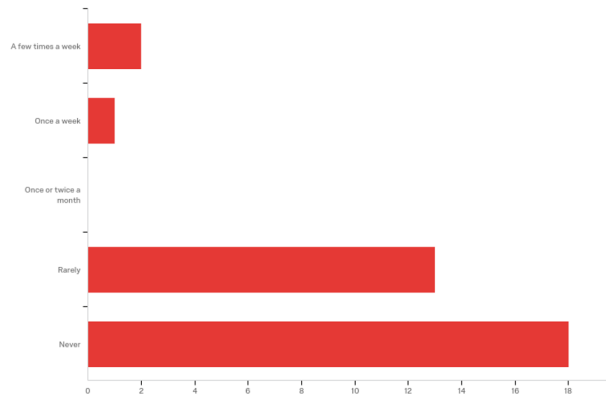


Figure 6: Question 6

Q7 - How does walking affect your mood?

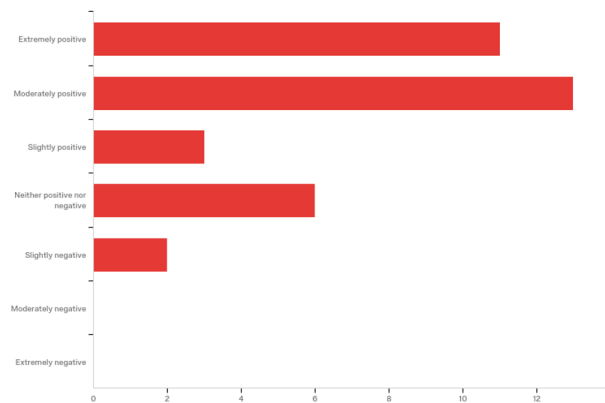


Figure 7: Question 7

Q13 - What type of destinations do usually visit during vacation?

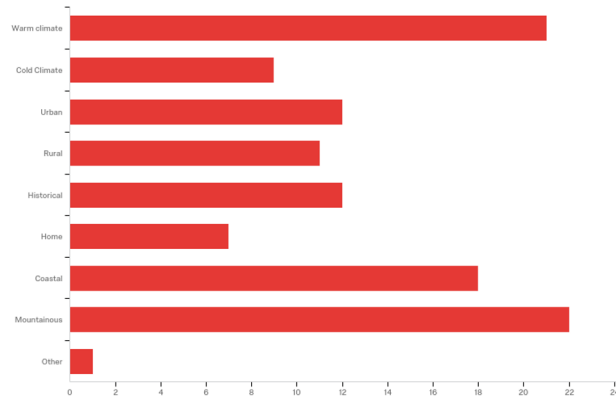


Figure 8: Question 13

Q19 - Which form of transportation do you prefer?

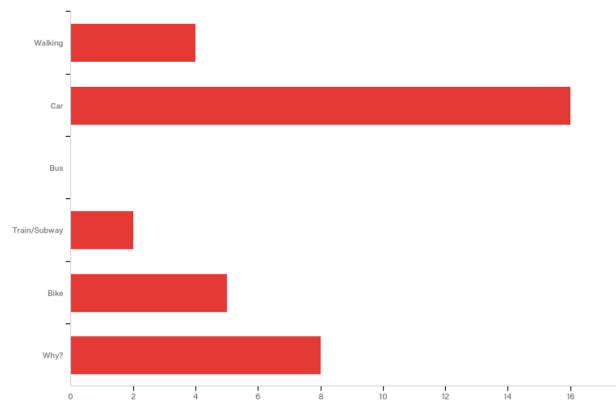


Figure 9: Question 19

Q21 - Would you rather spent the whole day driving or walking?

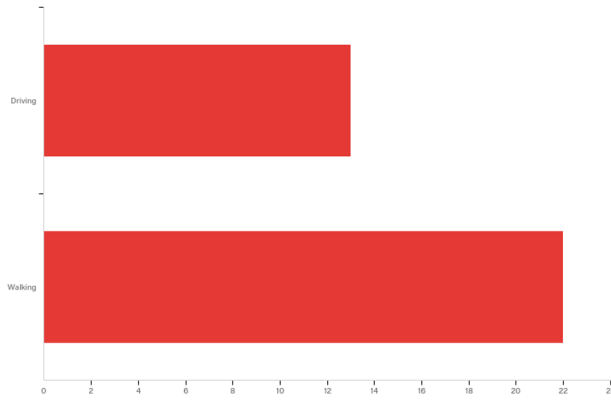


Figure 10: Question 21

Q20 - Which area did you grow up in/closest to?

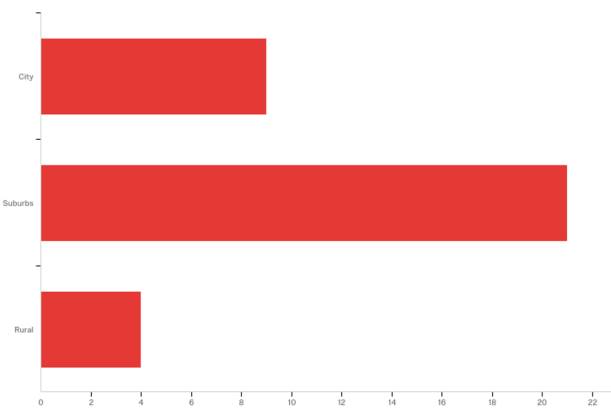


Figure 11: Question 20

Q27 - What would you rather do?

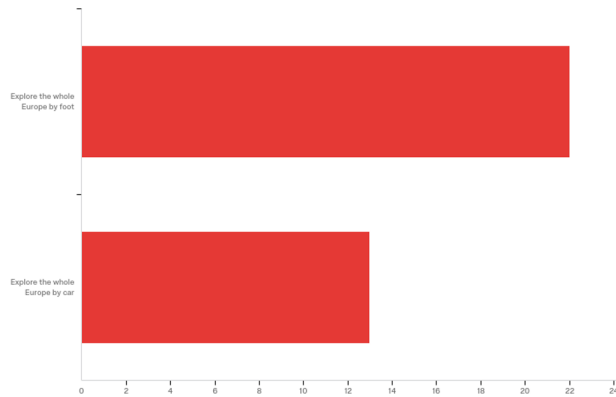


Figure 12: Question 27

Q35 - Have you ever taken a walking vacation? (an excursion, a field trip, a walk on the coast line)?

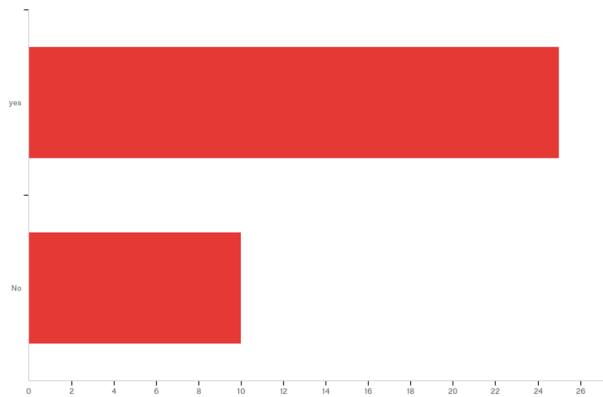


Figure 13: Question 35

Q47 - What kind of items would you shop for when walking?

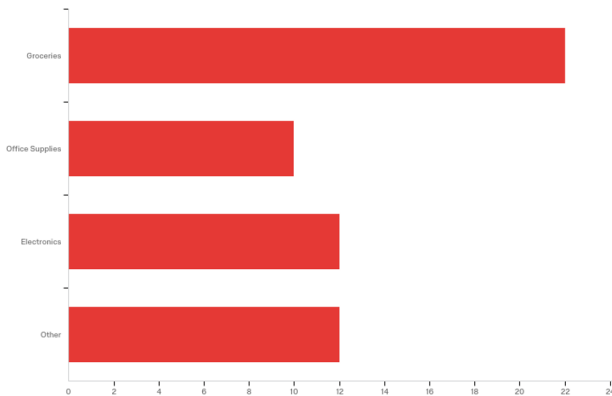


Figure 14: Question 47

C List of Figures

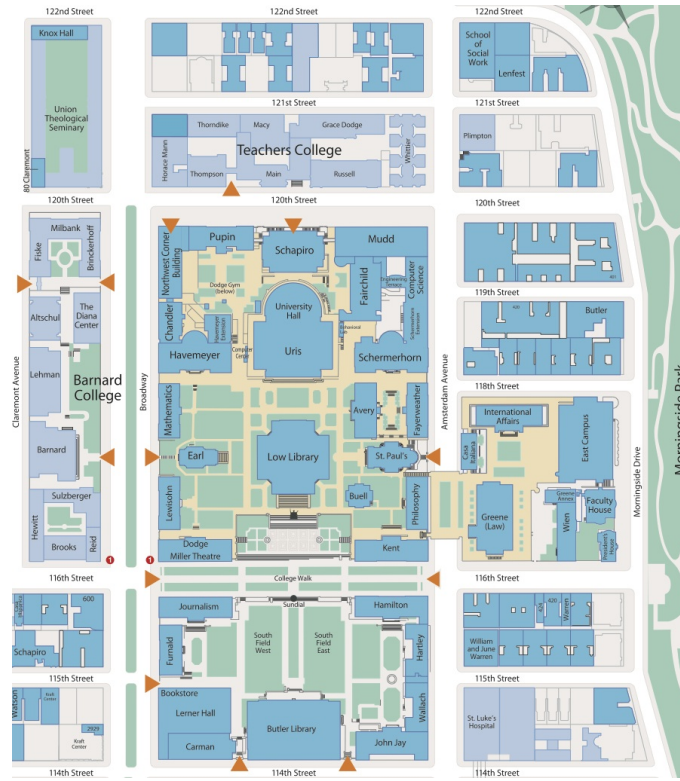


Figure 15: Columbia University Campus Map

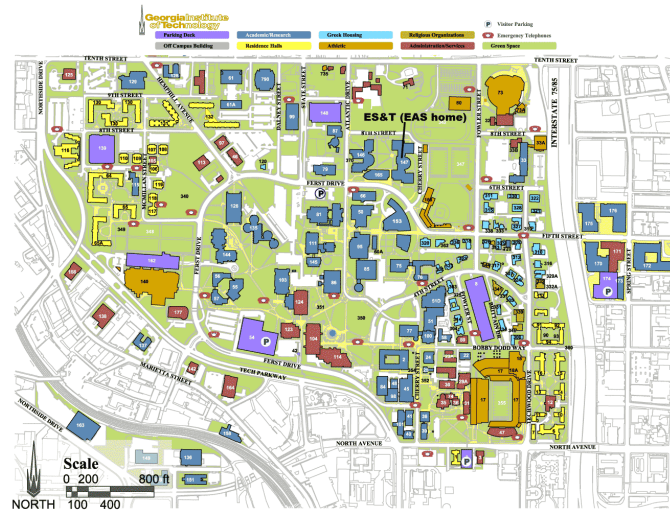


Figure 16: Georgia Tech University Campus Map



Figure 17: Northeastern University Campus Map



Figure 18: The College of New Jersey Campus Map

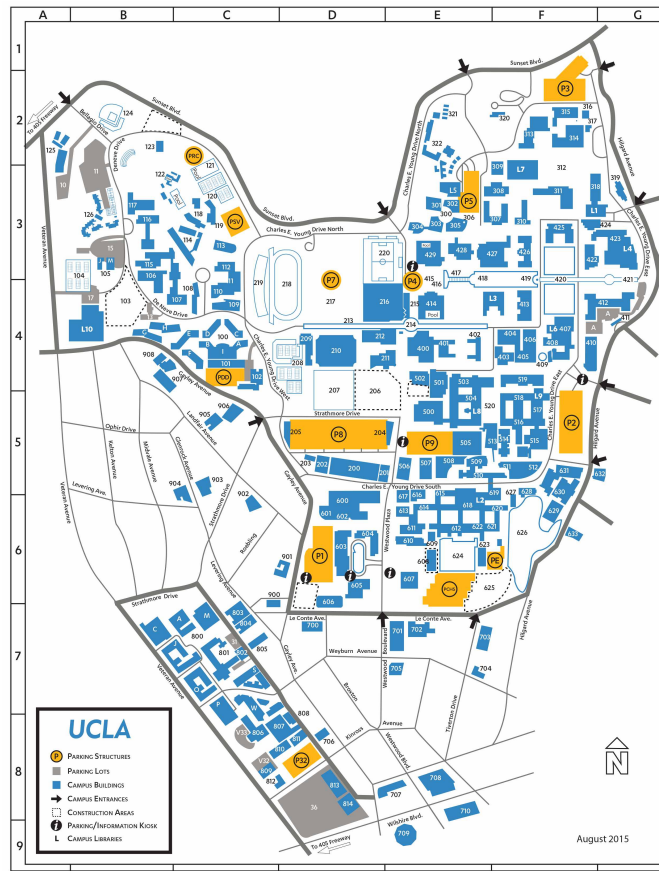


Figure 19: University of California LA Campus Map



Figure 20: Worcester Polytechnic Institute Campus Map

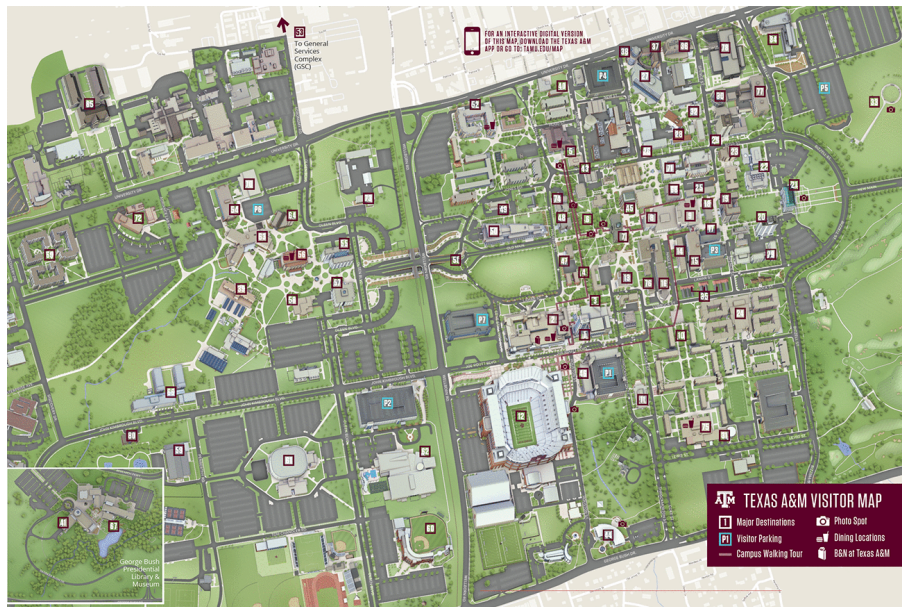


Figure 21: Texas A&M University Campus Map